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The competitiveness of cross-border transportation networks: a case study of the Szczecin–Berlin inland waterway

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Abstract

Transport links are one of the main factors required to develop cross-border cooperation and integration. However, differences in the quality and quantity of transport infrastructure inhibits the development of cross-border cooperation, as exemplified by the cross-border transport network in the northern part of the Polish-German borderlands, namely, the Szczecin–Berlin inland waterway. The existing differences constitute bottlenecks that restrict the use of cross-border transport links to strengthen cross-border cooperation. This article aims to assess the transport function of the Szczecin–Berlin inland waterway and identify the bottlenecks and missing links hindering its potential. The findings will serve as the basis for indicating the types of proposed measures aimed at implementing the proposals made by cargo shippers with respect to cross-border transport links identified during an in-depth interview survey. The types of measures proposed in this article will improve the competitiveness of cross-border transport links by ensuring interoperatibiliy, interconnectivity, and intermodality. However, they will require the effective coordination in policies regarding development of the transport infrastructure in the cross-border area, promotion of its development, and facilitating the cooperation between stakeholders. Measures to be taken in that regard are an important issue in cross-border governance and management.

Introduction

Transport links (their quantity and quality) are one of the main factors contributing to the development of cross-border cooperation and integration (Schnell et al., 1999; Sparrow, 2001), and they should not be perceived as an internally closed system limited to the territory of a single country. In the EU, this idea is reflected by the concept of the Trans-European Transport Networks (TEN-T), which has existed since the 1990s and is based on a holistic approach to transport infrastructure (Kociubiński, 2014, Marshall, 2014). The quality and quantity of cross-border transport infrastructure directly impacts the costs of cross-border trade and exerts a decisive influence on the offerings of cross-border transport services. However, borders can also create bottlenecks in transportation networks (Anderson & Rodrigue, 2017), and the differences between the quality and quantity of transport infrastructure on either side of the border inhibit the development of cross-border cooperation (Malkowska, 2016). This is exemplified by the cross-border transport network in the northern part of the Polish-German borderland, at the Szczecin–Berlin inland waterway. In 2018, the route formally became a constituent of the TEN-T (European Parliament, 2018), which confirmed its significance and opened up new possibilities to obtain investment funds. However, inland shipping via the Szczecin-Berlin inland waterway has steadily declined over the past 10 years. The aim of this article is to assess the transport function of the Szczecin–Berlin inland waterway as a cross-border transport link across the Polish-German borderland, and to identify the bottlenecks and missing links hindering its full potential. The findings will be used to

propose measures aimed at implementing proposals made by cargo shippers with regard to cross-border transport links identified during an in-depth interview survey. Although the article focuses specifically on the northern part of the Polish-German borderland and the Szczecin–Berlin inland waterway, the proposed key actions to improve its competitiveness as a cross-border transport link could also be used for numerous other cross-border inland shipping links across the world. Thus, the results presented in this article provide generalized conclusions.

Literature review

According to Anderson and Rodrigue (Anderson & Rodrigue, 2017), cross-border transportation refers to the activities, infrastructures, and flows of passengers and freight across an international border. From the perspective of the Scandinavian experience, Matthiessen (Matthiessen, 2004) perceives a cross-border transportation system as "a bridge" for promoting cross-border cooperation and governance integration. This particularly includes the development of "binational cities", border-crossing urban areas, or metropolitan regions extending across borders (e.g., Buursink, 2001; Heddebaut, 2001). Button (Button, 2002) identified three main challenges that a transportation system must overcome to promote the development of cross-border cooperation: (1) interoperability to ensure the means of transport can operate with equal efficiency on either side of the border, (2) interconnectivity to enable intermodal connections due to the increasing number, quality, and capacity of infrastructure links and cross-border services, (3) intermodality, which is the ability to shift a cargo unit between different modes of transport at or near the border. Simultaneously meeting the requirements for interoperability and interconnectivity is necessary to obtain intermodality (Reggiani et al., 2000). Failing to meet the requirements connected with interoperability, interconnectivity, and intermodality of cross-border transport links creates major 'bottlenecks' during the development of cross-border cooperation (Nijkamp, 1994) and limits the possibility of cross-border exchange of transport services related to cross-border freight and passenger movement. Moreover, Anderson and Rodrigue (Anderson & Rodrigue, 2017) identified trade imbalances, i.e. unbalanced exports and imports between neighboring countries such as empty cargo flows (frequent empty back hauls), as a bottleneck that transportation operators face when providing cross-border services. In addition, different technical standards between transportation operators and cabotage restrictions in borderland regions separated by a customs border were also considered to be a limiting factor. Fujimura (Fujimura, 2004), based on case studies from the Mekong and Central Asia regions, developed relations concepts between the cross-border transport infrastructure, trade, investments, and development. According to their concept, the interconnected cross-border and national transport infrastructures directly contributed to reducing trading costs which boosted trade. The relations indirectly contributed to an increase in foreign direct investments due to intra-firm vertical integration across borders, followed by intensification of regional trade, and consequently by increased international flows that stimulated economic growth. The author also pointed out that it is necessary to develop cross-border infrastructure and related institutions to maximize economic benefits obtained from national infrastructure. This is due to the natural, cross-border feature of the transport infrastructure in borderlands. From the point of view of cargo shippers and end consumers, the transport infrastructure does not end at the administrative border of a country. Due to these implications, cross-border transport connections constitute a major area of research within multiple cross-border processes (Blatter, 2004). Based on case studies involving the negotiation, development, and management of transport links between Singapore and Johor, Malaysia, Barter (Barter, 2006) noted that the multidimensional character of cross-border processes correlated with the transport system, which requires a multidimensional approach. In this context, cross-border transport connections are viewed as stimulants of economic growth which boost the hidden demand for trade by eliminating bottlenecks in technical facilities and supplementing any missing links in market-related areas. Therefore, they constitute a major part of transboundary governance. Anderson and Rodrigue (Anderson & Rodrigue, 2017) argued that as a part of transboundary governance and management, cross-border transportation can be facilitated, monitored, controlled, and even prevented. The lack of appropriate cross-border governance and cooperation in cross-border transport management can potentially hinder improved cross-border transport networks (Schnell et al., 1999).

The research studies described thus far have mostly focused on railway and road cross-border transport connections. More detailed studies that have addressed inland shipping as a cross-border transport link have been conducted in the context

of its importance in serving the hinterland of seaports (Kotowska, Mańkowska & Pluciński, 2018a). There are no exhaustive studies that address the significance of inland shipping for the development of cross-border cooperation which comprehensively identify the types of measures aimed at improving its competitiveness in cross-border areas, in accordance with proposals specified by Button (Button, 2002). The rationale for conducting in-depth research studies in this regard is further emphasized by noting that inland shipping is one of the most environmentally-friendly transport modes (Frémont & Franc, 2010; Brons & Christidis, 2012; Jaimurzina & Wilmsmeier, 2016), so any actions in support of it are in compliance with sustainable development. It may even prove competitive in terms of time and cost (Konings, Kreutzberger & Maraš, 2013), provided that it can reliably deliver, which will facilitate a modal shift between competitive transport branches (Kotowska, Mańkowska & Pluciński, 2018b). Apart from the environmental and economic aspects, facilitating, monitoring, and controlling the development of inland waterways as cross-border transport links is also related to safety issues, including the need for flood control (Strzelecka, 2014).

Methodology

The main purpose of this research study was to specify the types of measures aimed at improving the competitiveness of inland shipping as a cross-border transport link. Thus, the single-case study method was applied (Yin, 2017) for the Szczecin-Berlin inland waterway as an element of cross-border transport links in the northern section of the Polish-German borderland. This method is widely applied to analyze descriptive problems, where applying quantitative methods is insufficient to explain their significance, conditions, and reasons for their occurrence and development (Grzegorczyk, 2015). The conclusions obtained by applying the single-case study method may be generalized and projected to other cases with similar variables and conditions. In view of the principles of applying this method in research studies, the following research questions were formulated:

1. Which factors hinder the development of the transport function of the Szczecin–Berlin inland waterway, according to cargo shippers?
2. Which measures, apart from those already implemented or planned, should be employed to eliminate existing bottlenecks and provide missing links?
3. What is the role of transboundary governance and management in eliminating these bottlenecks and providing the missing links?

Based on these questions, the following proposal was stated: to improve the competitiveness of the Szczecin–Berlin inland waterway as a cross-border transport link, it is necessary to implement the proposals made by cargo shippers to improve its intermodality, interoperability, and interconnectivity. Implementing this goal requires support in the form of cross-border governance and management.

The research process stages included:

1. Assessment of the current state of knowledge about transport networks in cross-border cooperation, transboundary governance, and management, with a special focus on the challenges that a transport system must overcome to promote cross-border cooperation. Implementation of this stage made it possible to identify the factors that improve the competitiveness of cross-border transport links.
2. Evaluation of the transport function of the Szczecin–Berlin inland waterway by analyzing the volume and structure of freight transport in the cross-border area. Implementation of this stage made it possible to identify the changes in the volume and structure of freight transport.
3. Identification of bottlenecks and missing links in the development of the Szczecin–Berlin inland waterway and specifying their impact on the transport functions of the waterway. Implementation of this stage made it possible to determine the types of measures aimed at improving the intermodality, interoperability, and interconnectivity of the waterway.
4. Indicating the types of measures aimed at improving the competitiveness of the Szczecin–Berlin inland waterway as a link within the cross-border transport connection, including the role of transboundary governance and management in its implementation.

To evaluate the transport function, official statistical data were obtained from the statistical service of Berlin and Brandenburg (AMT für Statistik Berlin-Brandenburg, 2019), which included the volume and structure (in terms of direction, type, and space) of inland shipping to and from the Szczecin seaport. In addition, data was also obtained from the Szczecin and Świnoujście Seaports Authority (Szczecin and Świnoujście Seaports Authority, 2019), which showed the volume and structure of barge transshipments on the quays of Szczecin and Świnoujście seaports. Selected results of the

primary research studies performed in-depth interviews by the author in 2015 over the course of the Oder Waterway project 2015 (Pluciński ed., 2016) were used to identify bottlenecks and missing links. The survey was performed among German cargo shippers based in the Berlin & Brandenburg regions (Lands) along the Szczecin–Berlin inland waterway (44 entities), representatives of public inland ports of Berlin & Brandenburg (6 entities), maritime carriers that handle cargoes from Germany via the Szczecin port (1 entity), sea-land freight carriers running their business in the Szczecin–Świnoujście port complex (13 entities), and the major stevedoring companies in the Szczecin port (5 entities) who have ever handled cargoes transported via this inland waterway. The waterway combines maritime vessels and barge transport as an element of hinterland transport to and from Polish seaports in Szczecin and Świnoujście. Thus, the aim of this study was to identify factors that reduce the competitiveness of the Szczecin–Berlin inland waterway in cross-border (wagon/truck–barge and vice versa), intra-community, and foreign freight transport.

Szczecin–Berlin inland waterway as a cross-border transport link

Characteristics of the transport function of the Szczecin–Berlin inland route

The Szczecin–Berlin inland waterway is part of the E70 international inland waterway governed by the AGN convention and is the only inland waterway in Poland regularly used for freight transport. The route covers the Oder river section from Szczecin to the Hohensaaten lock, the Oder–Havel Canal, and the Havel river, which connects with the inland waterway system of Western Europe (Kotowska, 2011). The Szczecin–Berlin inland waterway is an arm of the Oder Waterway which is the most developed inland waterway in Poland (Woś, 2017). The direct social and economic hinterland of the inland route includes the areas of Berlin and Brandenburg, as well as the Polish provinces of Zachodniopomorskie, Lubuskie, and Wielkopolskie. Indirectly, due to the limitations of inland shipping on the Oder–Spree Canal, the catchment area of the inland waterway also includes the southwestern region of Poland, the southern part of the Berlin region, and the Saxony region in Germany (Mańkowska, 2016). Other areas indirectly covered by the catchment area of the waterway include the German region of Mecklenburg-Vorpommern. Most cargoes transported via this route come from the hinterland of the Szczecin seaport (or are funneled to the hinterland) and are handled by that seaport (Dziechciarz, 2017). On the German side, the infrastructure point of the inland waterway consists of a network of several inland ports, including Schwedt, Eberswalde, Velten, Wustermark, the Berlin inland ports (BEHALA), and the port of Königs Wusterhausen, and Eisenhüttenstadt, located in the southern part of Berlin (on the Oder–Spree Canal). The ports mostly function as trimodal terminals and are equipped with high-quality technical facilities dedicated to barge handling and feature a well-developed network of railway and road connections to major seaports in Western Europe. The public port infrastructure is additionally supplemented by private transshipment facilities such as those of the power plants in Hennigsdorf and Klingenberg or steelworks in Oderberg and Eisenhüttenstadt (Mańkowska, 2011). In terms of serving freight transport, the Szczecin–Berlin inland waterway plays two major functions:

1. Handling the freight in intra-community and foreign (maritime) trade via the Szczecin and Świnoujście seaports by combining maritime vessel and barge transport, which is an element of Polish seaports hinterland transport. The Szczecin and Świnoujście seaports function as major transport nodes.
2. Cargo handling in cross-border trade, wagon/truck–barge and vice versa, transshipments of cargoes directly coming from or heading to the hinterland. In that respect, the Szczecin seaport fulfils acts as an inland port.

Recently, an average of one million tonnes of cargo per year were transshipped to/from barges in the Szczecin and Świnoujście ports, 90% of which occurred via the Szczecin–Berlin route (Figure 1). Since 2017, there has been a noticeable decrease in freight transport volumes. In 2018, only 550 k tonnes of cargoes were transshipped to/from barges, and 80% of this was exports.

The major change responsible for the decrease in the barge transport volume on the Szczecin–Berlin route was the decline in coal exports from Polish mines to the Berlin and Brandenburg region via the Szczecin port. In 2014, the share of coal in total barge transshipments on the Szczecin–Berlin route accounted for 75% (over 600 k tonnes), whereas in 2018 it was only 12% (67.5 k tonnes). The decline in coal transshipment volume was only partially compensated by an increase in transshipment of other bulk cargoes (mainly aggregate, scrap metals, and fertilizers), conventional general cargo (steel

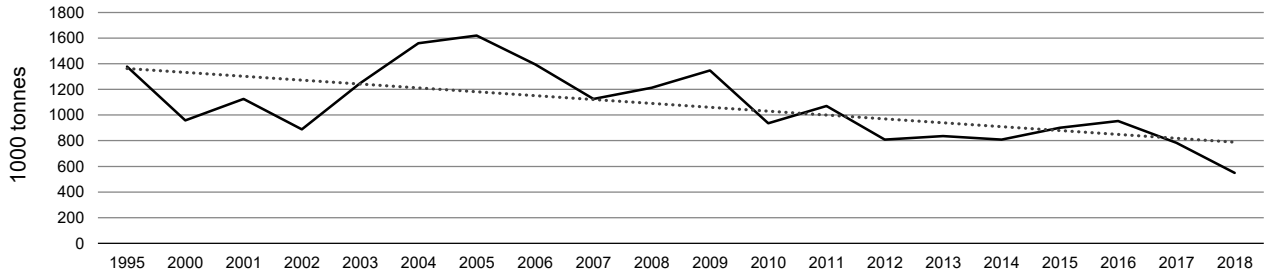

Figure 1. Inland shipping volumes to/from the Szczecin–Świnoujście port complex in 1995–2018 [own study based on: (Szczecin and Świnoujście Seaports Authority, 2019)]

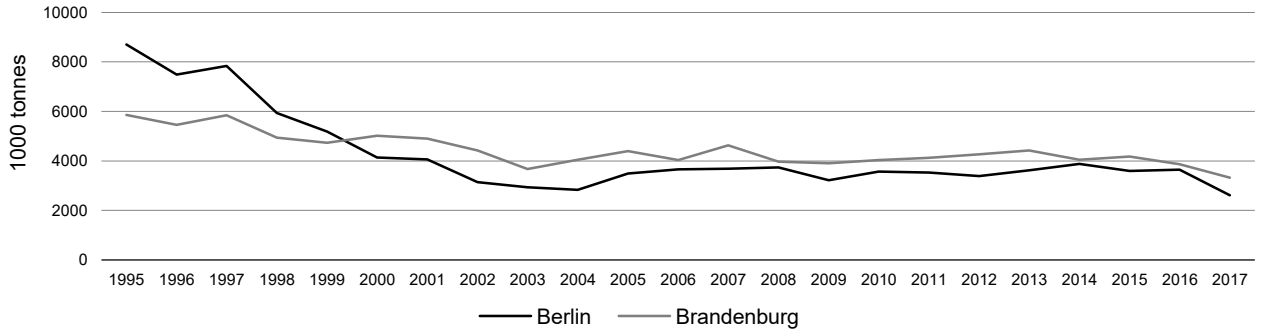

Figure 2. Transshipment volumes in inland ports of Berlin and Brandenburg in 1995–2017 [own study based on: (AMT für Statistik Berlin-Brandenburg, 2019)]

products), ores, and cereals. The general decrease in freight transport volumes along the analyzed route was also reflected in the transshipments in the inland ports of Berlin and Brandenburg. In 2017, ports in the Berlin and Brandenburg region handled ca. 6 m tonnes of cargoes, whereas in the late 1990s, the yearly transshipment volumes were nearly 10 m tonnes. Significantly greater decreases in transshipment volumes were experienced by Berlin ports (Figure 2). In 2017, the Brandenburg ports accounted for as much as 56% of the total transshipment volumes.

Most cargoes were bulk cargoes such as coal, ores, stone, and aggregate, cereals, steel, and steel products, recyclable waste and waste, as well as oversized items (machines, equipment, and structures). There was a recent dramatic decline in coal transshipment volumes (especially lignite), which was as high as – 96% in the Brandenburg ports and –57.5% in the Berlin ports. These declines occurred due to the implementation of Germany's climate policy and consequently because one of the major combined heat and power plants near Berlin switched to natural gas. The largest increases in transshipment volumes occurred in the "recyclable waste and waste" group. The Brandenburg ports also saw increased transshipment volumes of ores, stone, aggregate, metal, and metal products (mainly scrap metal).

In terms of the directional structure of transshipments, imports dominate and accounted for ca. 90% of the transshipment volume in the Berlin ports. In the Brandenburg ports, the directional structure was more balanced, but imports were predominant (60%). In terms of the spatial structure which divides transport into local (within specific region), regional (between specific regions), and cross-border (between different countries), regional haulage dominated the analyzed ports. This was particularly true for the Berlin ports (90% of the transshipments), whereas it accounted for nearly 20% of the total transshipment volume of cross-border transport via the Szczecin–Berlin inland waterway in the Brandenburg ports (Figure 3).

Over the years, cross-border transport routes have gradually become less important in Berlin ports and have decreased from 11% in 2017 to 5% in 2018. However, their share of the transshipment volume of the Brandenburg ports has increased from 16% in 2017 to 20% in 2018.

Cross-border haulage is predominantly imports, particularly for Berlin ports, which can lead to empty cargo flows in one transport direction for inland vessel owners.

With respect to cross-border import routes, the largest share is held by cargoes classified as

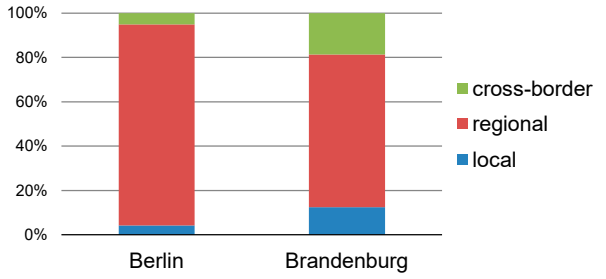

Figure 3. Spatial structure of inland shipping in the regions of Berlin and Brandenburg (data for the period from January to September 2018) [own study based on: (AMT für Statistik Berlin-Brandenburg, 2019)]

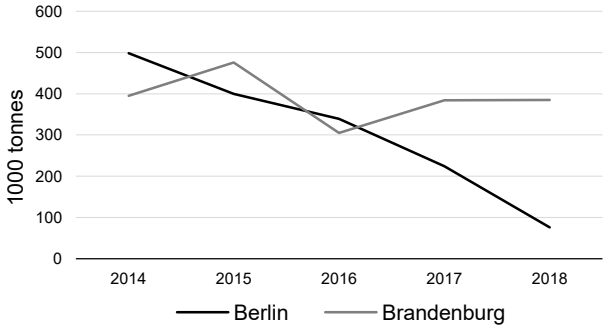

Figure 4. Cross-border freight transport volumes via Berlin and Brandenburg inland waterways in 2014–2018 [own study based on: (AMT für Statistik Berlin-Brandenburg, 2019)

"recyclable waste and waste" (Brandenburg ports), coal and building raw materials such as stone, aggregate, sand, and gravel (Berlin ports). As for the cross-border export routes from the Brandenburg ports, recent years have seen an increase in transshipments of cereals, metal products, and derivative products (pigiron, steel, and ferroalloys).

Bottlenecks and missing links in the development of the Szczecin–Berlin inland waterway

The results of in-depth interviews conducted in 2015 among the stakeholders made allowed bottlenecks and missing links to be identified which hindered the development of the Szczecin–Berlin inland waterway. The factors were divided into infrastructural and market-related ones (Table 1). In the opinion of interviewed stakeholders, the factors undermine the rationale for changing the transport chains determined by the entities and involving German or Dutch ports with their own transshipment terminals. According to the surveyed entities (especially the forwarders), the low competitiveness of combined maritime and inland waterway transport chains which include the Szczecin–Berlin inland waterway are heavily affected by the policy of German authorities that promote their home ports. In the opinion of the cargo shippers, the major bottleneck of the Szczecin–Berlin inland waterway is the technical parameters of the linear infrastructure, as well as the infrastructure of other transport modes (railway) that cross the route, which do not meet the requirements of international inland waterway class standards in terms of maximum draught or vertical clearances. These include the railway bascule bridge across the Regalica river (Eastern Oder), the boat lift in Niederfinow, and the Oder–Havel waterway.

Due to the insufficient vertical clearance and the failure rate of the moveable span, the railway bascule bridge across the Regalica river hinders ice control activities in winter time (icebreaking taken up by both German and Polish services), and it constrains inland shipping in the Szczecin Water Node. The boat lift in Niederfinow constrains the capacity of the Szczecin–Berlin navigation route (Semenov & Sęk, 2015). It can handle smaller vessels (max 9.5 m wide and 84 m long), whereas most vessels currently operated are 110 m in length. Currently, only Europaschiff class vessels can be navigated on the Havel–Oder waterway, with the maximum draught of up to 2.00 m, which makes the route section an

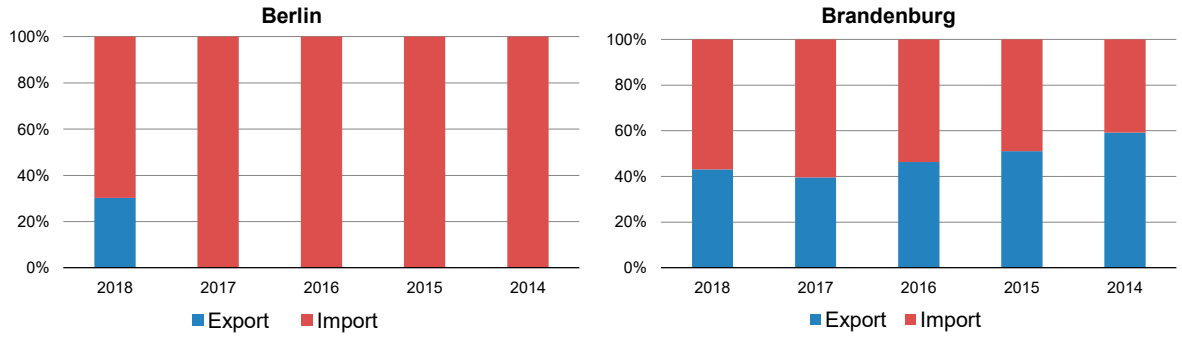

Figure 5. Directional structure of cross-border freight transport to/from the ports of Berlin and Brandenburg [own study based on: (AMT für Statistik Berlin-Brandenburg, 2019; https://www.statistik-berlin-brandenburg.de/; 08.03.2019)]

Table 1. Bottlenecks and missing links in development of the transport function of the Szczecin–Berlin inland waterway, according to the stakeholders

s/n	Factor	Effect
	Infrastructural	
1.	Limited technical parameters of the old, still functioning boat lift in Niederfinow and too low vertical clearances under railway bridges on the Polish side	No possibility of operating larger barge combinations
2.	Unsatisfactory condition of the technical facilities in the port of Szczecin and the infra- and suprastructure dedicated to barge handling	– Lack of dedicated barge terminals – Lack of transshipment facilities with considerable lifting capacity necessary to handle heavy cargoes
3.	Low quality waterside access to the port in Szczecin (insufficient depth parameters of the Szczecin–Świnoujście fairway)	– Impossible to handle larger vessels
4.	Lack of deepwater container terminal in the Szczecin–Świnoujście port complex	Lack of direct transoceanic connections, which imposes the necessity of container transshipment on intercontinental routes
	Market-related	
5.	Scarcely developed network of regular feeder connections in Short Sea Shipping	– Impossible to transport on export routes important for the Berlin and Brandenburg region (e.g., Great Britain) – Convincing the cargo shippers of the narrow specialization of the seaports in Szczecin and Świnoujście in handling cargoes heading to Eastern Europe
6.	Limited attractiveness of the services offered by the Szczecin–Świnoujście port complex compared to German and Dutch ports, in terms of service costs and time	Worse location, higher cargo handling cost, and longer handling time compared to German ports and other North Sea ports
7.	Highly competitive prices of regular, direct railway connections between Berlin/Brandenburg and German ports	Significant tariff discounts applied by railway operators, even up to 92%, considerably decrease the competitiveness of the combined maritime and inland waterway transport chains that include the Szczecin–Berlin inland waterway.

Table 2. Characteristics and outcomes of investment projects regarding the Szczecin–Berlin inland waterway [own study based on: (PGWWP, 2019; BMVI, 2019b)]

Investment	Effect	Responsible entity	Scheduled completion
Railway bridge construction in 733.7 km of the Regalica river along with accompanying infrastructure	– Will enable ice control activities in winter time – Will enable regular inland shipping, including carriage of 2 layers of containers, as the new structure will be elevated to ca. 6.2 m above the level of so called High Navigable Water	Administrator of the waterway infrastructure: "Polish Waters" National Water Management Authority, Regional Board for Water Management in Szczecin	2020 Planning phase
Construction of a new boat lift in Niederfinow	– Will enable handling of large vessels with mechanical drives, so called GMS (Großmotorschiff), with a draught of up to 2.8 m, including vessels carrying containers with a capacity of up to 104 TEU – Will enable handling larger (longer) vessels such as river cruisers – Will increase the route capacity via shortening the time of lockage process – Will enable separation of the freight traffic from the local tourist traffic via maintaining the old boat lift in operation	Administrator of the waterway infrastructure: Wasser- und Schifffahrtsverwaltung Eberswalde	2019 Final phase of implementation
Upgrading the Havel–Oder Waterway (HOW) between Schwedt and Friedrichsthal for the purposes of handling large freight vessels with mechanical drives and draught of up to 2.80 m, with limitations with regard to ships passing one another	– Will enable improvement of navigation quality on the route via upgrading the navigation conditions to the technical parameters of the new boat lift in Niederfinow (waterway class V) – Assumes an increase in freight volumes up to 1.3 m tonnes in 2030	Administrator of the waterway infrastructure: Wasser- und Schifffahrtsverwaltung Eberswalde	2026 Planning phase

inland waterway only regionally important. Inland shipping constraints predominantly include the section of the route between 10.4 km (Henningsdorf) and 134.96 km (Schwedt). On both the German and Polish sides of the route, there are investment projects underway or being designed, which are aimed to eliminate said bottlenecks. These include the modification of an existing railway bridge and the construction of a new one across the Regalica river, the construction of a new boat lift in Niederfinow, and upgrading the Oder–Havel inland waterway. As part of the Federal Plan for Transport Infrastructure 2030 (BMVI, 2019a), the Oder–Havel inland waterway was classified as C category, which means is an element of the federal core network (Kernnetz) with a high priority for development. The details of the investment projects are given in Table 2.

Implementing the scheduled measures aimed to improve the infrastructure will make it possible to achieve the parameters of international waterway category of Va/Vb over the entire route section. However, the identified bottlenecks and missing links, of both infrastructural and market-related nature, remain unresolved.

Types of measures to improve the competitiveness of the Szczecin–Berlin inland waterway as a link in cross-border transport connections

According to the surveyed entities, the Szczecin–Berlin inland waterway shows considerable growth potential for serving cross-border, intra-community, and foreign trade. This includes acting as a link in the combined maritime and inland waterway transport chains, in terms of already-existing cargoes (bulk and conventional general cargoes), as well as cargoes for which the demand will develop in the future, such as oversized cargoes and general containerized cargoes carried by barges from the Berlin & Brandenburg region and then by shipping from the Szczecin port. The precondition is to create a competitive offering of transport services in terms of service cost, time, and quality to meet the challenges of intermodality, interoperability, and interconnectivity. The proposed types of measures aimed at accomplishing this goal are shown in Figure 6.

The measures require support from entities and institutions engaged in the development of cross-border cooperation in the Polish-German borderland. It is necessary to coordinate cross-border governance and management activities, particularly in planning inland waterway infrastructure, its promotion, and supporting cooperation between stakeholders. The cooperation has been institutionalized as the Polish-German Intergovernmental Committee for Regional and Frontier Cooperation. The body responsible for the development of transport connections is the Committee for Land Management, which is a discussion panel composed of representatives of ministries responsible for the transport infrastructure in Poland and Germany, as well as representatives of regional authorities in the Polish provinces of Zachodniopomorskie, Lubuskie, Wielkopolskie, and Dolnośląskie, and the German federal states of Berlin & Brandenburg, Mecklenburg-Vorpommern, and Saxony.

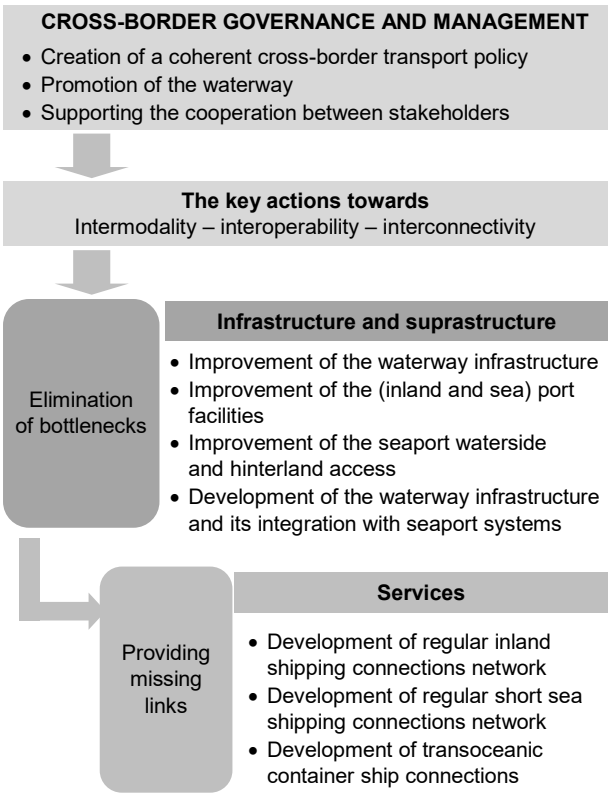

Figure 6. Key actions improving the competitiveness of the Szczecin–Berlin inland waterway

The Oder Partnership, initiated in 2006, is one of the instruments applied in cooperation as a concept of frontier cooperation as an informal cooperation network of the above mentioned four Polish regions and four federal states in the eastern part of Germany. The initiative may be a vital instrument in terms of enhancing the infrastructural connections between the regions on both sides of the Oder and the Lusatian Neisse rivers along the Polish-German border. In terms of spatial planning and development of infrastructural connections, the vision was described in the document developed in 2014 by the Committee, titled "The Shared Concept of the Future 2030" (KGP, 2016). The document does not contain

formal decisions on spatial planning, but rather presents spatial planning recommendations approved by both sides and addressed to competent bodies, institutions, and decision-makers. Improvement of transport connections is one of the five fundamental areas of development specified in the document, and the vision for 2030 presented therein assumes, among other things, that "... inland waterways in the Polish-German area of interrelations should be used far more intensively for the purposes of freight transport and tourism". The Szczecin–Berlin inland waterway has been identified as a "significant cross-border offer", and actions aimed at supporting its development are included in the immediate objective *II.4 Enabling the Inland Navigation*: *Jointly made efforts to enhance the role of inland navigation in the Polish-German area of interrelations, in order to ensure freight transport that is possibly the least harmful for the environment and the most economical, with better use of the developing infrastructure, with a particular focus on the aspect of economic efficiency, environmental protection and flood control.* The concept implementation is facilitated by financial support in the form of competitive procedures for the implementation of cross-border projects, aimed at working out solutions to the challenges described in the Concept. The tool may be used to intensify cross-border cooperation between various stakeholders interested in developing the inland waterway, i.e. business entities, local self-government units, associations, organizations, chambers of commerce, and universities. In view of including the Szczecin–Berlin inland waterway in the TEN-T Core Network, an important tool for financing the joint projects aimed at eliminating the bottlenecks are EU funds. In the area of cross-border infrastructural projects, support is offered under Multi-Annual Work Programmes to support TEN-T projects in EU Member States (European Commission, 2014). At the regional level, the Polish-German cooperation program INTERREG VA are of major importance. The Mecklenburg-Vorpommern-Brandenburg – Poland programme is underway in the analyzed frontier area, and one of its main objectives is the promotion of sustainable transport and the elimination of capacity deficiencies in major infrastructural networks. The issue of promoting the development of the Szczecin–Berlin inland waterway is also addressed on the local level by associations and other forms of cooperation, including, among others, the German "Association for Promoting the Oder–Havel River Area" and the Polish "Association for Cross-border Cluster Berlin-Szczecin-Baltic Waterway".

Cross-border governance and management support is necessary to coherently implement infrastructural and market-related measures. The precondition for increasing the volume of inland shipping is achieving the parameters of the international waterway category of Va/Vb over the entire route. This will make it possible to meet the conditions necessary to make this transport mode competitive (reliability of delivery) according to cargo shippers (Kotowska, Mańkowska & Pluciński, 2018b). Apart from the measures already underway or scheduled (Table 2), bottlenecks particularly exist in the area of technical facilities for barge handling in the Szczecin–Świnoujście port complex. A significant constraint is the lack of dedicated barge terminals. Barges are handled at the same wharves as maritime vessels, and in when a port becomes congested, the maritime ships have priority in cargo handling. Providing the Szczecin–Świnoujście port complex with dedicated barge transshipment terminals or berths will increase its competitiveness compared with Western European ports. Infrastructure development dedicated to barge handling should be accompanied by upgrading the port suprastructure, in particular to handle heavy cargoes whose share in the structure of inland shipping has steadily grown. The lack of transshipment facilities with considerable lifting capacity constitutes a considerable constraint reported by cargo shippers, i.e. business entities operating in the scrap metal processing industry which plays a major role in the structure of the economy of the analyzed frontier area. A precondition for increased importance of the inland waterway in combined maritime and inland waterway transport chains is improving the waterside access to the Szczecin port. The project consisting of dredging the Szczecin–Świnoujście fairway to a depth of 12.5 m is already underway. Improving the depth parameters of the fairway will make it possible to handle larger ships, and thus increase the network of connections between the port and the foreland. An attractive Short Sea Shipping (SSS) network covering Great Britain, Norway, Finland, and other Baltic countries will contribute to intensified freight transport on the Szczecin–Berlin inland waterway. The Szczecin–Świnoujście port complex may be more competitive in terms of prices and time due to its geographic location, which would provide the rationale for establishing regular barge connections. To increase the share of the route in container transport, it will be necessary to develop transoceanic container ship connections in the future, which means the planned construction of a deepwater container terminal in Świnoujście. To increase the

freight volume on the Szczecin–Berlin inland waterway, it is also necessary to manage their security and efficiency using modern IT solutions which integrate and facilitate the management of combined maritime and inland waterway transport chains, which has become standard for inland waterways in Western Europe (Durajczyk, 2011; Kaup, 2014; Kaup & Filina-Dawidowicz, 2015), particularly in routes linking major European seaports with their hinterland (Kotowska, Mańkowska & Pluciński, 2018a). The solutions will serve cargo shippers, barge operators, terminal operators, and port authorities, port administration, inland waterway administrators, and other stakeholders. Consequently, implementing such solutions may increase the competitiveness of inland shipping in intermodal transport systems. In the EU, it is obligatory to implement ICT systems to improve navigation security (RIS, River Information Services) on EU inland waterways of class IV or higher (Directive, 2005). In Poland, the obligation to implement the RIS system was imposed on a portion (ca. 100 km) of the waterways in the lower part of the Oder river from Ognica to Szczecin, meeting waterway class Vb parameters (Woś, 2011). The Oder–Havel waterway has an information system called ELWIS (Elektronischen Wasserstraßen- und Information Service). In the cross-border context, it will challenging to integrate already-existing systems with the systems aimed at improving the effectiveness and quality of transport processes, as well as with the systems already functioning in seaports and inland ports, such as VTMS, PCS, and CCS (Durajczyk, 2011; Kaup & Filina-Dawidowicz, 2015).

If the Szczecin–Berlin inland waterway can meet the challenges of intermodality, interoperability, and interconnectivity, it can become a competitive transport option for both existing and new cargoes in cross-border, intra-community, and foreign trade. Competitive transport services offering may compensate for the decline in coal transport volumes and improve the trade structure balance. Apart from bulk cargoes that traditionally gravitate to inland shipping, an increased demand for inland shipping may be expected for conventional general cargoes such as steel semi-products, paper and cellulose, granite, project cargoes, and future containerized general cargoes.

Conclusions

The studies and analyses described in this article have confirmed that cross-border transport connections play a vital role not only in serving cross-border trade, but also intra-community and foreign trade, via the systems of connections with major international transport nodes. The Szczecin–Berlin inland waterway is a transport connection linking the EU regions lacking formal customs borders. The study shows that even in integrated areas with a high level of trade liberalization, which have been covered by a common policy focused on the development of cross-border transport connections, there are still significant differences in terms of quality and quantity of the transport infrastructure. Such differences constitute bottlenecks restricting the possibility of using cross-border transport links to strengthen cross-border cooperation. Due to their existence, it is impossible to provide a competitive offering of transport services, since it requires supplementing market-related missing links. The differences are often the consequence of implementing diverse priorities in national plans for transport infrastructure development, which do not sufficiently account for its integration in the cross-border area. The types of measures proposed in this article are aimed at improving the competitiveness of cross-border transport links via fulfilling the requirements of interoperatibiliy, interconnectivity and intermodality. These measures require effective coordination in the policy regarding the development of the transport infrastructure in cross-border areas, promotion of their development, and facilitating the cooperation between the stakeholders. Measures to be taken in that regard should be viewed as an important issue in cross-border governance and management.

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