A 2.1 - IWT Bottlenecks and Potentials in the BSR
Final Report

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Marcus Engler
ISL

This document represents the intermediate Report of the EMMA Activity 2.1. It describes a collection of bottlenecks, some ideas how to overcome and probable positive effects in the countries of participating organisations.

A bottleneck is described as an existing permanent obstacle for inland navigation in the partner countries. Since the inputs towards this report are researched and elaborated by the EMMA partners, some readers might miss individual bottlenecks. However the project did not aim at covering the entirety of all possible bottlenecks, but at covering everything of relevance regarding projects requirements. The requirements for this activity are set to cover all parts of all countries except for Germany: Since a coverage of the project is the Baltic Sea Region (BSR), Germany is analysed by its north eastern part: From the River Weser via the river Elbe up to the river Oder at the German-Polish Border. The named rivers run more or less in a north/south direction, in order to cover the region, all waterways between the Weser and the Oder more or less connecting these fairways in an east/west direction, are part of the research.

The research was done using a questionnaire in a table format was created, containing 28 data fields with open and multiple choice questions. This document covers the outcome of the questionnaire with accompanying information about the countries characteristics to set a context. Please find the complete questionnaire with hints but without answers in the annex of this document.

A total of 39 bottlenecks were collected in the countries Finland, named parts of Germany, Lithuania, Poland and Sweden. The number per country is very different: The most information was collected in the parts of Germany – since Germany has already a well-developed IWT system with a long tradition and history. Second highest number of bottlenecks (eleven) were identified in Poland with a rather low use of IWT, Sweden reported four bottlenecks, Finland two and Lithuania one. These different amounts can be observed when reading through the individual country information: for Sweden, Finland and Lithuania each bottleneck is describes whereas for Poland and Germany a summary is given.

The terms “Inland navigation” or “inland water transport” (IWT) is used throughout this document also with respect to lake sea navigation. The sequence of countries in this report is according to alphabetical order.

Contrary to the description of EMMA Activity 2.1, costs regarding the overcome of bottlenecks are not included in this report. The research unveiled a range of cost from none to multi-million Euro investments for infrastructural enhancements. But these figures show just a part of the truth: anticipated costs would be given, but these figures might be completely different to real cost (e.g. cost initially expected and actual cost for the new airport in Berlin, BER) and furthermore, administration and lobby cost are not determinable. Since this project is also about such aspects, absolute or relative cost would distort the reality and might impeach credibility of this project.

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1 FINLAND

Finland is a country with about 16,200 km coastal routes and inland waterways, of which about 4,000 km are used commercially. The most important fairway is the Lake Saimaa area with a length of about 772 km and 1,200 vessels calling per year.

1.1 Bottlenecks

1.1.1 The Saimaa Canal

Both bottlenecks in Finland described below are connected with the Saimaa Canal. This canal was opened in 1856 and connects Lake Saimaa with the Gulf of Finland. It connects many lakes and was always of strong interest for the Finnish forest industry. The canal is located on Finnish and Russian territory. The dimensions of the Saimaa canal defines its own vessel sizes separate from the UN ECE Blue book, this type is called Saimax[1].

The canal currently contains eight locks. By enlarging all locks by 12 meters in length would benefit the traffic in Saimaa inland waterway by increasing the vessel fleet from approximately 30 to 90 and thus increased efficiency and reliability of this IWT. This is seen as cost at a medium range.

Another political issue is the possibility to increase the water level in the Saimaa Canal by 10 cm. This measure together with a solution to stabilise the dams in the Canal is technically possible but requires a permission of The Water Court. These measures would enhance cost efficiency and reliability of this waterway at a relatively low cost.

Figure 1.1 to the right shows a map[2] of Finland with the approximate location of the Saimaa Canal between the Gulf of Finland as part of the Baltic Sea and Lake Vänern.

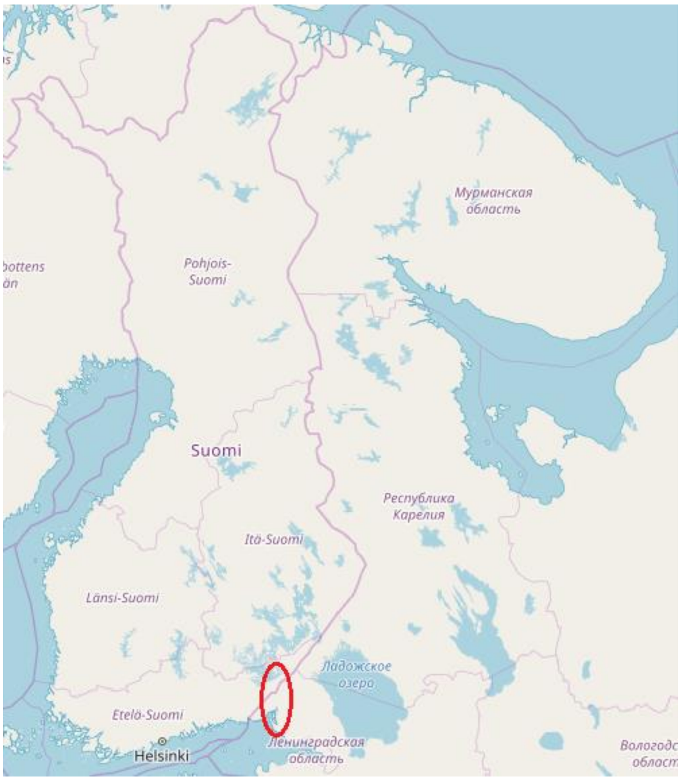

Figure 1.1 Map of Finland

[1] https://www.liikennevirasto.fi/web/en/waterways/canals-and-bridges/the-saimaa-canal/navigation-in-the-saimaa-canal-and-lake-saimaa
[2] Based on https://www.openstreetmap.org/

1.2 Assessment of effects on elimination of bottlenecks

Lengthening the locks by 12 meters (cost estimation 50 million €[3]) and increasing the water level by 10 cm in Saimaa Canal (cost estimation 5 million €[4]) would enable larger vessels entering Saimaa deep water fairways and would speed up the modernization of the fleet visiting in Saimaa inland waterways. Increasing the water level in Saimaa Canal area would also enable current vessel fleet to have approximately 50 to 100 tons more cargo per vessel and give an instant competetiveness boost for this transport mode.

Extending the locks would enable new vessel size able to enter to Saimaa deep water fairway, resulting in a new vessel type and improved vessel dimension: a length of 93.6 meters, a width of 12.6 meters and a draft of 4.45 meters. Cargo intake would then be approximately 3,100 tons per vessel. These new dimensions would allow up to 550 tons more cargo a single vessel might carry compared to the current Saimax fleet[5]. These technical development actions would then significantly increase the competetiveness of the waterway transportation against all other transport modes and would also bring positive effects for the development, volume growth and therefore speed up the renewal of the old Saimax fleet.

These development plans reduce significantly the problems caused by the winter and icy conditions and therefore help the Finnish transport agency plan to have 11 months of sailing period trough the Saimaa Canal and an all year around traffic in Saimaa deep water fairways.

Calculation of the effects of these technical improvements for the Canal area would result modernization of Saimax fleet and therefore allow 550 tons increase for each new type of vessel compared to the current Saimax fleet. The increase of capacity might be calculated by number of vessels that have sailed trough the Saimaa Canal in recent years (counting approximately 1,100 vessel journeys per year) as follows: 715,000 tons increase for Saimaa cargo traffic. In addition, these improvements would contribute to the goal announced by the Finnish Traffic Agency[6] for prolonging the operational season at the Saimaa Canal for up to 330 days per year and all year around traffic inside inland waterways in Saimaa. The extension of two more months of the traffic season would then result 768,000 tons more cargo.

With these planned and ongoing development actions and calculations of the growth potential for traffic volumes from inland waterway cargo traffic in Finland is about 1.5 million tons per season. This means that volumes may be more then twice as they are now. In the future the forest industry companies e.g. UPM and StoraEnso and several other production plants and industries e.g. Yara and Kemira are planning to have several investments to increase to production capacity around Lake Saimaa area.[7] Because of these development actions transport volumes will in any case increase around the Lake Saimaa area significantly in the future.

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[3] https://yle.fi/uutiset/osasto/news/locks_in_busy_50-year-old_saimaa_canal_in_need_of_an_upgrade/10349278
[4] http://en.portnews.ru/news/263354/
[5] Saimaa Lake area cargo traffic executive summary 15 11 2016 (Brave alliance/Finnish Transport agency, confidential)
[6] https://julkaisut.liikennevirasto.fi/pdf5/mkl_2008-6_saimaan_sisavesiliikenteen.pdf
[7] https://www.keskisuomi.fi/filebank/25347-Nakokulmia_maakuntauudistukseen_ja_tienpitoon_-_Nietola_Metsateollisuus_ry.pdf
https://www.kemira.com/company/media/newsroom/releases/kemira-expands-production-capacity-at-its-chlor-alkali-site-in-joutseno-finland/
https://docs.wixstatic.com/ugd/9247af_947c0d4bcf5e4db7a4f43995a96d9d96.pdf

One more project that can also affect to cargo volumes positively is a planned new pulp mill (Finnpulp[8]) in North Savonia that would result in 0.5 to 1 million cubic meters more round wood transported in waterways compared to today. Also, an equal amout of pulp of 60 vessels per year would then be most cost efficient to transport trough the Saimaa Canal to customers in Europe where this transport mode is seen most suitable.

1.3 Positive twist to regions from infrastructure investment in Saimaa Canal

Selected infrastructure developments would be a signal for shipping companies, investors and other stakeholders to invest in a modernised fleet that also meets the new ballast water regulations and energy efficiency rules[9].

New vessels and a modern fleet which are technically more advanced sailing in the BSR region therefore would reduce the risk for vessel break down that may cause problems if it happens in very narrow routes in Lake Saimaa[10] area that is also been used as a fresh water source.

For shipping companies, it would give a better economy from reduced fuel consuption per transported ton and by using new type of alternative fuels. New build vessels and more modern fleet has assumable also lower insurance costs because of the age of the vessel and higher risk for accidents eventually rises the insurance costs.

Lengthening the traffic season from less than 300 days to 330 days and more will also be a great improvement and will help to keep inland waterway as a part in supply chain all year round. This development comes from the fact that new build vessels and current BSR fleet has better ability to operate during winter time and they have better ice classes. Modern BSR fleet with larger and newer vessels have also wider operational range, this would give the possibility to transport goods from/to Saimaa competitively longer distances and to find new possible counter ports and markets for products imported and exported trough Eastern Finland. These effects then would give signs for growth in these rural areas and give positive signals for smaller ports and operators there to invest for infratructure and equipments to gain better competetive edge.

By gaining a better competetive edge all stakeholders involved in these supply chains and industry that are located in the sphere of influence of Saimaa Inland waterways will benefit from these infrastructure developments and furthermore it will increase the attractiveness to set up a new businesses and to locate in the area. Eventually it will have great economical effects and affect the employment rate in these rural areas.

For the prevention and cutting down CO_2 emissions caused be transportation it will give one effective and cheap solution to meet the new CO_2 emission reduction targets. It will also speed up the needed modal shift from road transport to other transport modes (e.g. inland waterways and railways). This has been proven to reduce the cost from transport that is caused for the society in sosio economical way, so it then eventually saves tax payers money and health[11].

[8] http://www.finnpulp.fi/johto.html
[9] http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Technical-and-Operational-Measures.aspx
[10] http://www.theseus.fi/bitstream/handle/10024/123508/URNISBN9789523440074.pdf?sequence=1&isAllowed=y
[11] https://docs.wixstatic.com/ugd/9247af_c4962cb477794e49a46d3b44e9149482.pdf

2 GERMANY

Germany has a large amount of navigable inland waterways and more inland ports than any other EU country. The German inland waterway network is used today to a great extent by industry.

The bottleneck collection from Germany brought up 19 different obstacles to Inland Waterway Transport in affected part of Germany, basically from the river Weser to the east, involving river Elbe and Oder and the connecting waterways; whereas the river Peene rather a solitary waterway. The river Weser is connected to the river Elbe via the Mittelland Canal. The river Elbe is connected to the river Oder via several waterways creating a network of waterways instead of rather unconnected waterways as described in the other countries in this document. Since the river Oder is also named in the polish section (see below) the issues of this particular river can be seen as cross border issues. The range of bottlenecks found includes lock restrictions (4), length and width restrictions (3), clearance height (5) and draught restrictions (4). Three general obstacles are also observed: from an IWT shipper's and associations' point of view, the Port of Hamburg misses mooring areas for inland waterway vessels. Another issue reported is the limited availability of River Information Services (RIS) since parts of rivers under maritime regulations (e.g. river Elbe from Port of Hamburg downstream) are covered by systems which are restricted or only available commercially, whereas inland waterways are free of charge. The third issue is located at the Scharnebeck twin ship list at the Elbe Lateral Canal. The lift operates 24 hours a day but if for certain operations additional pusher tugs are needed, waiting times up to 16 hours may apply since the tug operator work only 8 hours a day.

2.1 Bottlenecks

2.1.1 River Weser and the Mittelland Canal

The river and the canal connect Germany's second largest seaport with the river Elbe, where downstream Germany's largest seaport is located, as well as and der Western German canal system. This route might be used as an alternative for container transport instead of using the North Sea avoiding the issue of very large vessels on the river Elbe between the port and the open sea. Currently this route on the river suffers from length and width restrictions from the lock in Bremen Hemelingen for about 150km upstream to be realised at medium expenses. The canal named allows a one level container transport only which might be done consuming very high cost.

2.1.2 Rivers Elbe and Saale, Elbe-Lübeck Canal, Elbe Lateral Canal and Elbe-Havel-Canal

The river Elbe and the rivers and canals might be seen as the most frequented inland waterway in the centre in northern Germany. Connections are made to the west (e.g. Weser), to the open sea in the north (North Sea, Baltic Sea) and to the east (e.g. Oder).

The most issues in this report are concerned with the river Elbe and adjacent river and canals. The Elbe itself suffers currently at some parts from draught restrictions (e.g. between Mühlberg and the mouth of Saale for about 170 km, to be refurbished at medium cost) but also multiple times from height restrictions caused by low bridges (e.g. road bridges Roßlau and Schönebeck which might be replaced using a rather low amount of money). Another part of the river Elbe between Dömitz and Hitzacker would consume a medium amount of money to erect groynes at 12 km length.

The river Saale has also draught restrictions between Calbe and Halle/Trotha also consuming a medium amount of money to solve this bottleneck.

The Elbe-Lübeck Canal connects the Elbe south-east of Hamburg at Lauenburg with the Baltic Sea. The whole canal has a maximum allowed draught of 2.00 meters and a minimum height under bridges of 4.40 meters restricting cargo transport, the most cargo transport limiting factor are six locks which may be used from Vessels up to 80 meters. These locks will be reneved at high cost. At the Elbe Lateral Canal, running from the Mittelland Canal to the Elbe at Artlenburg, the Scharnebeck twin ship lift at km 106.16 lifts vessels about 38 meters vertically. The usable length is 100 m, convoys might be decoupled and lifted separately but vessels of AGN class VIb might operate the canal but are unable to be lifted. This bottleneck might be eliminated at medium cost. An issue with convoys is the needed towage company operates 8 hours a day whereas the ship lift operates 24 hours a day. More to the south, the Elbe-Havel-Canal links the Elbe at Magdeburg with the river Havel near Berlin. The lock Wusterwitz is currently being expanded with a second lock, but occurred construction defects delay the opening from initially 2014 to some undetermined instant in the future consuming additionally another medium amount of money.

Two further issues regarding the Elbe at the port of Hamburg and the river between Hamburg and the north sea were named. The German River Information System is usable at no cost for inland navigation by everyone, whereas the same system to be used at the leg between Hamburg and the North Sea is chargeable. Some political will is needed to allow inland navigation vessels to use the RIS completely for free. Inland navigation vessels also suffer in many combined inland and sea ports from preferred deep sea vessels, resulting in missing mooring and resting areas in the port of Hamburg, for example. Few cost is needed to erect further areas.

2.1.3 River Oder and the Spree-Oder-Waterway and the Havel-Oder-Waterway

From Berlin eastward towards the river Oder the Havel-Oder-Waterway (HOW) is the connection in a north-eastern direction towards Sczeczin (PL) with the Oder-Havel-Canal (OHK) as part of it. Another canal, the Spree-Oder-Waterway (SOW) connects Berlin with the Oder in a south-eastern direction at Eisenhüttenstadt (DE). The HOW and the OHK suffer currently from length and width restrictions at most parts of the canals which might be solved using a medium amount of money. The Niederfinow Boat Lift at OHK km 76.24 to 76.40 is seen as a bottlenech for vessels larger than 80 m in length since a vessel turning point is 4 km upstream, a medium amount of money would eliminate this bottleneck. At the SOW the double lock Fürstenwalde allows vessels with a length of max. 67 meters to pass, allowing AGN Vessel class III to use the whole canal, whereas to and from the boat lift AGN class IV is usable. This bottleneck might be eliminated at high cost. The river Oder suffers on the German bank from outdated regulating structures (groins), resulting in sedimentary deposition in the fairway thus reducing the draught. Additionally the missing regulatory function may lead to ice shifting and ice congestion. Refurbishment might consume a medium amount of money.

2.1.4 River Peene

This river in the north-eastern part of Germany has a navigable length of about 96 km. Several parts have currently a draft restriction between 1.30 meters and 1.90 meters due to insufficient maintenance. This bottleneck might be eliminated at rather low cost.

Figure 2.1 to the right shows a map[12] of Germany with approximate locations of the river Weser and the Mittelland Canal in the north centre part of Germany (red), the rivers Elbe and Saale and adjacent canals more to the east (green) and the river Oder and adjacent canals to the east (blue). The river Peene is located near the Baltic Sea in the north-eastern part of Germany (orange). The connection between the green and the blue selections (mainly Elbe – Oder) is located in and around Berlin, without bottlenecks reported.

Figure 2.1 Map of Germany

2.2 Assessment of effects on elimination of bottlenecks

In Germany various studies published by different organisations do exist which concentrate on separated river stretches and the elimination of bottlenecks on same. A potential analyses for the entire German IWT system does not exist. As such the presented figures should be carefully taken into consideration and should provide a rough potential only, which needs to be further analysed. The figures presented next page are collected from different sources and were published in recent years:

[12] Based on https://www.openstreetmap.org/

Inland Waterway	Potential	Source
Elbe Lateral Canal	15-19 m ts (Base year data 2014)	Ergänzungsgutachten zum Ausbau des Elbe-Seitenkanals (ESK), Hanseatic Transport Consultancy (HTC), 8th June 2015.[13]
River Saale	LUB Consulting: 2 m ts (Base year data 2012) PLANCO: 0.23 – 0.56 m ts (Base year data 2011)	Argumentationspapier zum Saale-Seitenkanal auf Basis der aktualisierten gesamtwirtschaftlichen Bewertung 2012, LUB Consulting GmbH[14], August 2012. Aktualisierung des Gutachtens zur Gesamtwirtschaftlichen Bewertung des Ausbaus der unteren Saale, PLANCO Consulting, 2012.[15]
River Elbe	0.27 m TEU linked to hinterland transport of the port of Hamburg (Base year data 2011)	Analyse des Ladungspotenzials der Binnenschifffahrt im Hinterlandverkehr des Hafens Hamburg (2011/2012), Hamburg Port Authority[16] and Port of Hamburg Marketing, 2011/2012.
Berlin Region, Spree-Oder-Wasserstrasse	3.3 – 4.5 m ts	Tischvorlage, Treffen mit PSts Enak Ferlemann, WEITBLICK e.V. 26.04.2016[17]
Elbe-Lübeck-Canal	2 – 3 m ts.	Hanseatic Transport Consultancy (HTC)[18], 2013.

List 2.1 German IWT potential

Figure 2.2 German IWT potential

[13] https://www.besk-niedersachsen.de/files/03_esk-ergaenzungsgutachten_2015_langfassung.pdf
[14] https://www.lub-consulting.de/
[15] http://www.planco.de/index.php?id=108
[16] https://www.hafen-hamburg.de/de/firma/hpa-hamburg-port-authority-aoer-hamburg---7893
[17] http://www.weitblick-verkehr.de/fileadmin/user_upload/Downloads/Anlagen_nach_Zahlen_sortiert/Anlage_3_-TV_Ferlemann_26.04.2016.pdf
[18] http://www.htc-consultancy.de/

2.3 Positive twist to regions from infrastructure investment in Germany

Transport policies and linked investments are too often focused on road and rail transport in the Baltic Sea Region. Benefits of inland navigation in respect of external costs for society have not been considered sufficiently. Thus, missing links and bottlenecks limit the overall efficiency of inland navigation and river-sea shipping in the Baltic Sea Region. Because of this, there are areas where these modes can only compete in a limited way with the dominating rail and road transport modes. Investments in waterways offer the advantage to serve other purposes besides shipping (transport) as well, like leisure activities and white fleet business. This increases the social return on investments and should be considered when planning for more investments.

One example regarding the socio-economic benefits of inland navigation is the river Elbe. A recent study identified a direct employment impact of 6,600 employees and an indirect employment impact of 5,300 employees that benefit from services acquired in order to carry out inland navigation transport. Another 2,500 jobs are created from investments therefrom. Lastly, there is the induced employment impact of 2,000 jobs. This brings the count to 16,400 employees on a regional level, generated from inland navigation along the river Elbe.[19]

Especially private investments are particularly hindered by lack of maintenance and rehabilitation as well as regeneration measures in river basins and infrastructure, which result in unstable navigational conditions. This uncertainty in economic viable inland navigation also causes the absence of modernisation and innovation in the fleet. Investments are undertaken by the private sector only if a return on investment is foreseen. To put it in a nutshell: The unclear future of navigational possibilities in some areas and river stretches in Germany hinders private investments and the uptake of IWT as part of transport solutions.

Benefits can be clearly seen in less noise emissions, the reduction of carbon footprint and de-stressing road and rail infrastructure.

[19] http://www.gesamtkonzept-elbe.bund.de/Webs/GkElbe/DE/Informationen/Studien/Elbschifffahrtsstudie.pdf?__blob=publicationFile&v=3, p. 54

3 LITHUANIA

This country has rather short navigable inland waterways and a few inland ports. Rail and road transport play a greater role for the industry than IWT.

3.1 Bottlenecks at the River Nemunas

The bottleneck observed in Lithuania is located on the river Nemunas. The river has a total length of 914 km, the obstacle described is located between Klaipeda and Kaunas, at a length of 275 km. One general issue is ice: the river is closed from end of November until end of March. A more complex issue is length, draft and width restrictions. The draft between Jurbarkas and Kaunas may fall down to 1.1 meters only. This obstacle might be solved by increasing the depth by use of dams or dredging, but the Lithuanian Environmental Law does not allow this measure which might consume a medium amount of money.

Figure 3.1 to the right shows a map[20] of Lithuania with the approximate location of the river Nemunas between Klaipeda and Kaunas to the right.

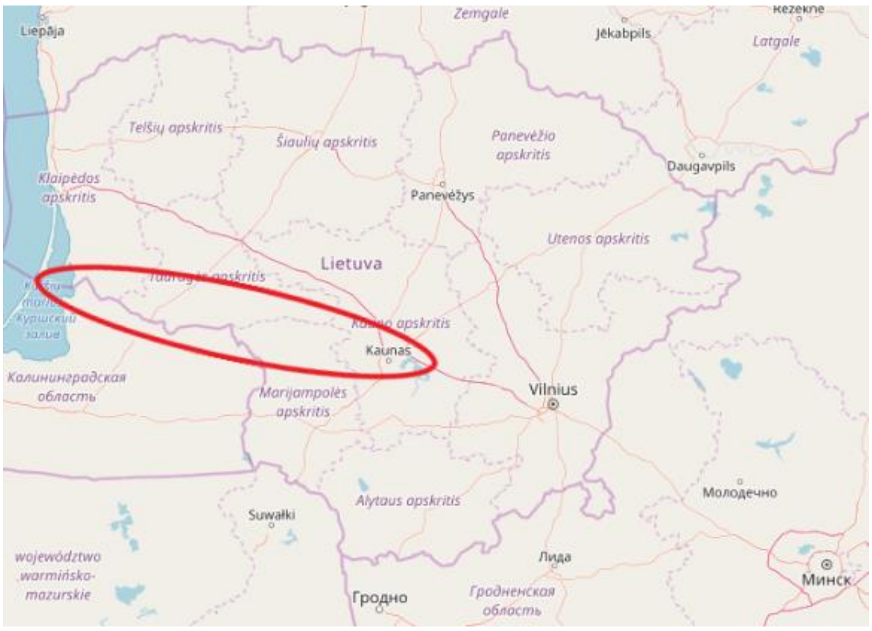

Figure 3.1 Map of Lithuania

[20] Based on https://www.openstreetmap.org/

3.2 Curonian lagoon and river Nemunas

In 1997 the Republic of Lithuania signed the European Agreement on Main Inland Waterways of International importance (named AGN agreement[21]). The defined Lithuanian inland waterways are the river Nemunas and the Curonian lagoon, allowing vessels to travel from Kaunas to Klaipeda using the inland waterway of international importance E41 with a length of 291.2 km. The waterway is devided into sections with different specifications according to TRANS / SC.3 / 144 of the United Nations Economic Commision[22] to maintained by the waterway authority.

The dimensions of the section between Klaipeda to Jurbarkas is set as follows: The maximum length of a vessel is 100.0 meters, the beam is 10.0 meters and the vessel draft ist 1.3 meters maximum whereas the waterway has a depth of 1.5 meters.

The dimensions of the section between Jurbarkas to Kaunas is set as follows: The maximum length of a vessel is 100.0 meters, the beam is 10.0 meters and the vessel draft ist 1.0 meters maximum whereas the waterway has a depth of 1.2 meters.

Figure 3.2 shows a map[23] of the Curonian lagoon with a section of the E-41 of 65.3 km. It starts at the Klaipeda state seaport[24] (northernmost circle) and ends in Rusne at the mouth of the river Atmata. Included in this map is also the branch to Nida. The fairway along this section is marked by luminous buoys as navigational signs.

This part of the E-41 has following security dimension: A depth of 1.5 meters minimum, a minimum width of 50.0 meters and a turning radius of 500.0 meters.

In this section the inland waters passenger port of Nida is located with a border inspection post[25] to the Russian Federation. The Russian Federation islocated in the south of this map.

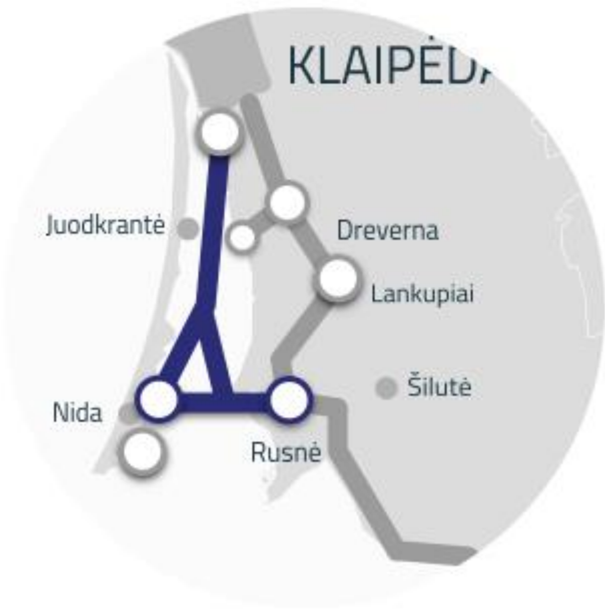

Figure 3.2 The mouth of the river Atmata - Klaipeda state seaport

[21] https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XI-D-5&chapter=11&clang=_en
[22] https://www.unece.org/trans/main/sc3/sc3res.html
[23] Source: http://vvkd.lt/en/vidaus-vandenu-keliai
[24] http://www.portofklaipeda.lt/en
[25] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.88997

Figure 3.3 shows a map[26] of the location of the mouth of river Atmata at Rusne with 126 km of the E-41 to Jurbakas. The fairway along a part of of 113 km from Smalininkai to Atmata mouth is marked by luminous buoys as navigational signs whereas a section of 13 km from Smalininkai to Jurbarkas is marked out by non-luminous boys.

The river Nemunas between Rusne to Smalininkai is for about 100 km the border between the Russion Federation and Lithuania. This implies another noteworthy obstacle: the right side of the fairway (located in the Republic of Lithuania) is marked by luminous buoys , whereas the left side of the fairway (located in the Russian Federation) is marked by non-luminous buoys. Users of the inland water navigating at nighttime must be very attentive.

Figure 3.3 The mouth of the river Atmata - Jurbarkas

This part of the E-41 has following security dimension: A depth of 1.5 meters minimum, a minimum width of 40.0 meters and a turning radius of 350.0 meters.
The port of Jurbarkas, the port of Rusne, the port of inland waters located in Uostadvaris are part of this section.

Figure 3.4 shows a map[27] of 88.3 km of the E-41 between Jurbakas and Kaunas. The fairway from Kaunas to Kulautuva (20.5 km) is marked by luminous buoys whereas the part from km Kulautuva to Jurbarkas marked by non-luminous buoys

This part of the E-41 has following security dimension: A depth of 1.2meters minimum, a minimum width of 30.0 meters and a turning radius of 250.0 meters.
In this section the Kaunas winter port, the Marvele wharf and the Kaunas passenger pier are located.

Figure 3.4 Jurbarkas - Kaunas

[26] Source: http://vvkd.lt/en/vidaus-vandenu-keliai
[27] Source: http://vvkd.lt/en/vidaus-vandenu-keliai

4 POLAND

Poland has an inland waterway network of 3,655 km of which 214 km were navigable using international standards in 2015. Due to the current quality of fairways and enhancable navigable parameters 0.4% of all freight is transported on waterways. The identified eleven bottlenecks are concerned with the two largest rivers in Poland: Vistula and Oder. These two rivers are connected via the river Brda, the river Wartha and river Notec and the 24.7 km Bydgoszcz Canal. This connection is usable since end of the 18th century.

The range of bottlenecks are mainly length and width restrictions of vessels (4), as well as draught (3) and clearance height (1) restrictions. These bottlenecks apply to the natural waterways, whereas lock restriction (1) and insufficient maintenance (2) was named at manmade canals.

4.1 Bottlenecks

4.1.1 Rivers Vistula, Brda and Lower Notec and the Bydgoszcz Canal

The bottlenecks reported for these rivers and canal are all close to the city of Bydgoszcz. Vessels on the river Vistula suffer from draft restrictions, whereas 3.1 km apart of the mouth of the river Breda flowing into the Vistula, the clearance height is restricted by the Most Portowy (the Harbour Bridge) which is the lowest bridge on the channelized Brda river. Additionally the canal suffers from the aging Okole Lock[28] (build 1910 - 1914, opened 1914, currently closed due to breakdown 08 July 2016). Each of these bottleneck might be overcome by investing a low amount of money. The need to ensure transit depth at the canalised section between the Bydgoszcz Canal and the Lower Notec River additional dredging and cutting off water plants is required at medium cost to ensure needed transit depth.

4.1.2 River Oder

The river Oder suffers from length and width restrictions at many parts of the river: a reach of 75 km between the mouth of the river Lusatian Neisse to the mouth of the river Warta (an important part of the Polish-German cross border IWT), another reach of 60 km from the mouth of the Warta to Oder Havel Channel and 37.5 km between Widuchowa and Szczecin. All three Bottlenecks might be eleminated at medium cost. Furthermore a reach of 37 km between the Oder Havel Channel and Widuchowa might be eliminated al low cost.

Draft restrictions are named twice and apply for some hundred kilometres: from the lock in Brzeg Dolny to the mouth of the Lusatian Neisse, where also many narrow curves and low bridges hinder transportation. The second draft restriction applies at the barrage of Malczyce (currently under construction), where even small boats hook in stones and tree trunks lying on the bottom of the river. Both bottlenecks named might be overcome at low cost.

[28] http://visitbydgoszcz.pl/en/places/116-zabytki-hydrotechniki/578-sluza-okole

Another issue is the improper use and lack of maintenance of the Gliwice Canal[29] with a reduced depth to 1.80 m. The usable length of the locks is a single barge or a set of one barge and towboat. A complete rebuilt might be done at rather high cost.

Figure 4.1 to the right shows a map[30] of Poland with the approximate locations of the river Oder in the western part of Poland and the river Vistula and Brda in the centre of the country.

Figure 4.1 Map of Poland

4.2 Assessment of effects on elimination of bottlenecks

The state of waterways in Poland, in recent decades, has deteriorated significantly, and inland navigation plays a marginal role in the country's transport system. At present, Poland has 3655 km of waterways, of which about 92% is exploited, and 94% of these roads meet the criteria of classes I-III (of regional significance), while only 6% have a min. IV - international - navigable class. Three International Waterways run through Poland, namely E-30, E-40 and E-70, connecting Western and Eastern Europe, as well as the Baltic Sea with the Mediterranean and the Black Sea. In recent years, several analyzes have been developed regarding the possibility of using inland water transport and the size of projected cargo streams on individual waterways, while at present the Ministry of Maritime Economy and Inland Navigation[31] prepares an analysis of the inland waterway transport sector in the scope resulting from the modernization of the Oder Waterway and the Vistula River Waterway, which will accurately determine the transport potential of Polish rivers.

[29] http://www.european-waterways.eu/e/info/poland/kanal_gliwice_gleiwitzer_kanal.php
[30] Based on https://www.openstreetmap.org/
[31] https://www.gov.pl/web/gospodarkamorska

Inland Waterway	Potential	Source
Dolna Wisła	Uniwersytet Gdański 7-12 mln ton (Dane roku bazowego 2017) Projekt InWapo (Interreg Central Europe) 7-10 mln ton (Dane roku bazowego 2014)	K. Wojewódzka-Król, R. Rolbiecki, Społeczno-ekonomiczne skutki zagospodarowania dolnej Wisły, Gdańsk 2017.[32] Studium Techniczno-Ekonomiczno-Środowiskowe rewitalizacji i przywrócenia żeglowności Dolnej Wisły na odcinku Warszawa-Gdańsk, Gdynia 2014.[33]
Połączenie Odra-Wisła (Warta, Noteć, Kanał Bydgoski, Brda)	Porozumienie MDW E70 (województwa lubuskie, wielkopolskie, kujawsko-pomorskie, pomorskie i warmińsko-mazurskie) ok. 4 mln ton (Dane roku bazowego 2011)	Analiza popytu na przewozy ładunków i pasażerów Drogą Wodną E70 (dla przedsięwzięcia: Rewitalizacja śródlądowej drogi wodnej relacji wschód-zachód obejmującej drogi wodne: Odra, Warta, Noteć, Kanał Bydgoski, Wisła, Nogat, Szkarpawa oraz Zalew Wiślany (planowana droga wodna E-70 na terenie Polski), Sopot 2011.[34]
Oder	1970-1980: trasport from the Gliwice channel to Świnoujście at a level of up to 10 ml tonnes. In the long-term perspective, an increase in transport is estimated E-30 waterway to 25 million tons.	III International Maritime Congress –debate „Odra szlakiem rozwoju" Krzysztof Woś, Założenia do programu rozwoju polskich śródlądowych dróg wodnych. Warszawa 9.02.2016[35]
Oder	The team under the guidance of prof. Michał Pluciński 20 million tons (Data base year 2016)	Resolution No. 79 of the Council of Ministers of June 14, 2016 regarding the adoption of "Assumptions for plans for the development of inland waterways in Poland for 2016-2020 with a view to 2030"[36]

List 4.1 Polish IWT potentials

[32] https://issuu.com/energasa/docs/spo__eczno-ekonomiczne_skutki_zagos
[33] https://docplayer.pl/4015174-Opracowanie-studium-techniczno-ekonomiczno-srodowiskowego-rewitalizacji-i-przywrocenia-zeglownosci-dolnej-wisly-na-odcinku-warszawa-gdansk.html
[34] http://obserwuj.lubuskie.pl/uploads/documentsearch/id44/1.4.%20MDW%20E70%20-%20Analiza%20popytu%20na%20przewozy_76678.pdf
[35] https://mgm.gov.pl/wp-content/uploads/2016/02/Zalozenia_do_Programu_rozwoju_polskich_srodladowych_drog_wodnych.pdf
[36] https://mgm.gov.pl/wp-content/uploads/2017/11/assumptions-for-the-development-plans-of-inland-waterways-in-poland-for-2016-2020-with-2030-perspective.pdf

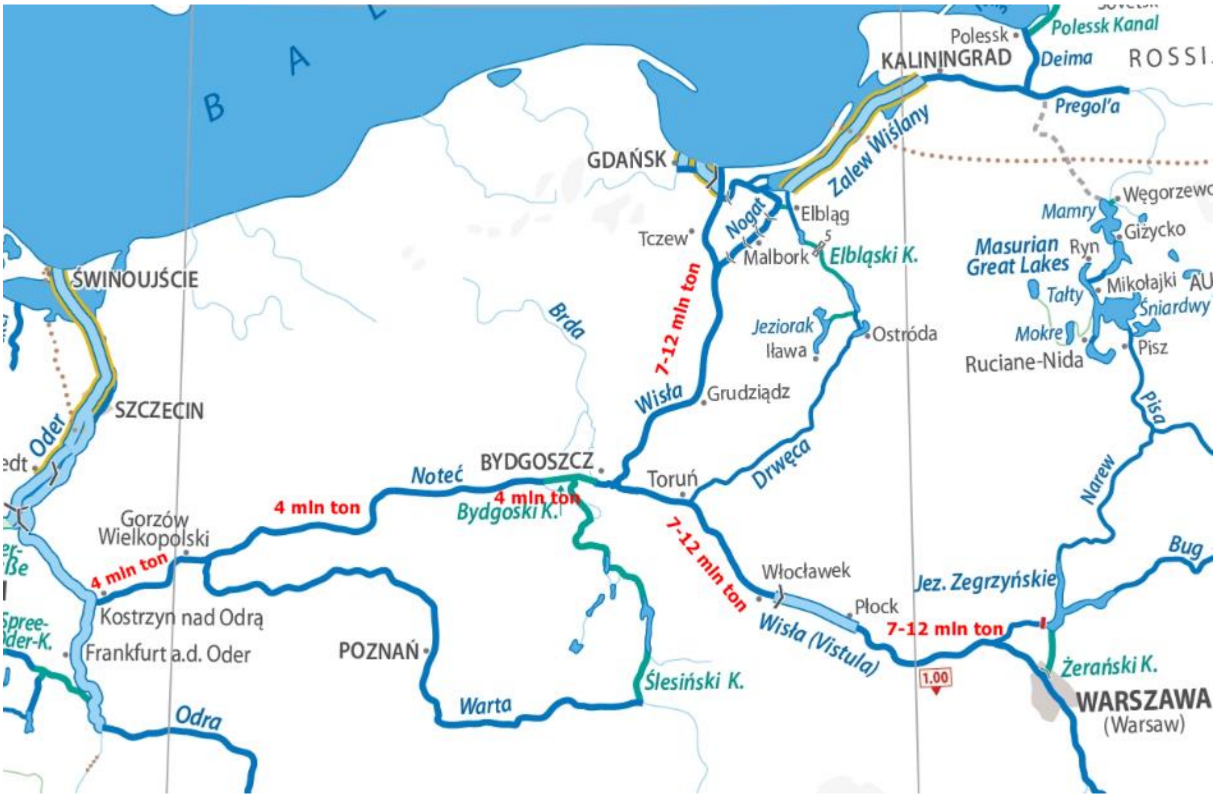

Figure 4.2 Map of potentials in Poland

4.3 Positive twist to regions from infrastructure investment in Poland

The country's transport policy and related investment focus mainly on road and rail transport, while the advantages of inland water transport are still not well recognized. Lack of investments in the maintenance of water routes caused the disappearance of inland waterway in the freight services of the country. For this reason, the efficiency and advantages of inland transport have been severely limited and cannot compete with other modes of transport today.

In recent years, along with the reform of water management, there has been a positive return in terms of the perception of river revitalization and the development of strategic documents in this area has started. As a result, many projects related to inland navigation and economic use of the potential of Polish rivers have been initiated.

The scope of investment tasks on the Odra Waterway in the short term includes the preparation of feasibility studies, functional and utility projects, strategic environmental impact assessments, including hydrological analysis for the implementation of long-term projects. It is planned to adapt the Odra Waterway to Va class parameters and the implementation of a harmonized river information system (RIS) on all waterways of international importance. Detailed information can be found in Resolution

No. 79 of the Council of Ministers of June 14, 2016 regarding the adoption of "Assumptions for plans for the development of inland waterways in Poland for 2016 - 2020 with a prospect until 2030".[37]

One of the examples of the socio-economic benefits of launching inland waterway transport is the Vistula River, and more precisely its lower section from Warsaw to Gdańsk. Previous research in this area shows great benefits from the comprehensive development of this section, which will not only allow regular - economically justified inland transport, but also bring tangible benefits in the field of flood protection, hydropower, drainage, communication links and tourism development.

More detailed - the latest data will be provided together with the currently developed by the Gdansk Seaport Authority - "Feasibility study for comprehensive development of international waterways: E-40 for the Vistula River on the section from Gdańsk to Warsaw, E-40 from Warsaw to the Polish-Belarus border (Brześć) and E-70 on the section from Vistula to the Vistula Lagoon (Elbląg) with the completion planned for 2020.[38]

It should be noted that the current policy of the Government of the Republic of Poland and the bottom-up activities of many environments, including local government units are conducive to activities for the development of inland transport and allow to assume that in the near future it will return to the transport map of Poland.

The most prominent international inland waterway in Poland is the E-30 within which the Odra river is located. In connection with this, the Polish government initiated the development of the Odra Waterway development program[39]. After the modernization, the Odra river will ultimately have the fourth navigability class. The investments carried out also in the reconstruction of weirs, locks and regulatory buildings will improve the conditions for development.

[37] https://mgm.gov.pl/wp-content/uploads/2017/11/assumptions-for-the-development-plans-of-inland-waterways-in-poland-for-2016-2020-with-2030-perspective.pdf
[38] http://www.e40restoration.eu/download/Buklet_EN.pdf
[39] https://www.am.szczecin.pl/en/4621-samorzady-nadodrzanskie-wspolnie-dla-uzeglownienia-odry-2

5 SWEDEN

In Sweden an IWW regulation was established in 2014. Previously all areas were seen as open sea technically fully equipped (e.g. AIS[40], ECDIS[41], VTS[42]) and operated by the Maritime Administration[43]. Sweden has a few navigable inland waterways, one of them is the Göta alv between Gothenburg and Lake Värnern.

5.1 Bottlenecks

5.1.1 The River Göta alv

In the Gothenburg area industry and cargo and passenger traffic by road, rail and vessel meet. Bridges over the river are partly lift- or turn-bridges. Since there are conflicts between river traffic and passing train and roadways, earlier RIS-pilot (GOTRIS[44]) showed a need for traffic synchronization between different modes. The new bridge over Göta Älv in the centre of Göteborg has legal prerequisites to be followed by some sort of traffic management system addressing insufficient River Information System applications. When this bottleneck with a low cost range is overcome, better usage of the river infrastructure, less waiting time for vessels at bridges (openings), lower emissions, better energy efficiency, less waiting time for public transport is expected in general and an increased efficiency and reliability of IWT in particular.

Figure 5.1 to the right shows a map[45] of Sweden with the river Göta alv and the Trollhätte Canal.

Another issue is the new bridge in the centre of Gothenburg across the river. The bridge Hisingsbron replaces in a few years time today´s bridge Göta älv-bron. The new bridge will be lower than the currently used bridge, the maximum clearance height will be reduced from 18.3 meters to 13.0 meters. This means the new bridge has to be opened every time a cargo vessel passes Gothenburg to and from the ports in Göta river and Lake Vänern. Different to all other bottlenecks in this document described, is this an upcoming bottleneck, it cannot be changed since the Gothenburg government already concluded to build the new bridge some

Figure 5.1 Map of Sweden

[40] https://www.marinetraffic.com/
[41] https://www.marineinsight.com/marine-navigation/what-is-electronic-chart-display-and-information-system-ecdis/
[42] https://www.logisticsglossary.com/term/vts/
[43] http://www.sjofartsverket.se/en/
[44] http://gotris.se/
[45] Based on https://www.openstreetmap.org/

time ago and construction works are already in progress. Cost to overcome this upcoming inland waterway navigation bottleneck are currently undeterminable. The idea to overcome this bottleneck is a commitment by the City of Gothenburg to accept one cargo vessel passage per hour or a maximum of eighteen passages each day the year around. The same applies to the nearby railway bridge Marieholmsbron. The traffic effects of reducing the height of the new bridge will probably be longer waiting times and a larger uncertainty for both railway- road and river-traffic.

The river Göta and the Trollhätte Canal is currently equipped with six locks between Göteborg and Lake Vänern. All locks used today have been built about 120 years ago. 2030 is said to be the end of use for the locks despite constant maintenance with costs rise each year. If locks are not rebuild at medium cost and opened before a closedown of current locks, passenger and cargo traffic will come to a standstill and cargo is moved using road or rail instead.

5.1.2 Missing classification to enlarge IWT and compulsory pilotage

Legal obstacles currently prevents to create more inland waterways in order to enlarge inland waterway transportation. In order to turn unused waterways into navigable waterways, a classification is needed. In Sweden in the two lakes of Mälaren and Vänern and the river from the high bridge at the entrance to Gothenburg up to Lake Vänern are navigable. Further study, especially regarding wave height, will be needed by Swedish Transport Agency[46], and probably limited sea surveying plus some additional fairway marking by SMA. Cost cannot be determined at the moment, rather an ongoing study is needed, taking potential needs of the industry into account.

Pilotage in Sweden is regulated by the Swedish Transport Agency and mainly based on vessels size and cargo carried. Pilotage is compulsory for vessels equal to or larger than following dimensions:

- Göta River: length 60.0 m width 9.0 m draught 4.0 m
- Lake Vänern: length 70.0 m
- Lake Mälaren: length 70.0 m width14.0 m draught 4.5 m

It is possible to apply for individual pilot exemption at high fees. For example, one pilot exemption on Göta River and Lake Vänern could cost between 7,000 and 10,000 Euro[47].

In order to facilitate the traffic on inlands waterways, the pilot dues in these two areas have up to now been reduced. On Göta river/Lake Vänern the dues are reduced by 65 percent and on Lake Mälaren by 32 percent. However, the Swedish Maritime Administration has decided on a new model for pilot- and fairway dues which will result in higher costs for inland waterways. As an example, calculations show that the total costs for shipping on Lake Vänern will increase by as much as 57 – 87 percent.[48] The new model came into force the 01 of January 2018.

[46] https://transportstyrelsen.se/en/About-us/
[47] Source: Avatar Logistics
[48] Analys av utvecklingspotentialen för inland- och kustsjöfart i Sverige, Swedish Maritime Administration 2016

5.2 Assessment of effects on elimination of bottlenecks

5.2.1 The River Göta alv

The situation in Sweden at the Göta alv and the Trollhätte Canal is different than in other countries since bottlenecks are upcoming restrictions compared to today's IWT situation. A desired effect would be to maintain today's transport system and numbers of transports on the river but this is not realistic.

This situation is caused by two obstacles: the newbuild bridge in Gothenburg and the ageing locks as described above.

On the other hand, investments in new locks would enable inland waterways to handle a predicted growth of cargo volumes in Sweden. Forecasts indicates a growth of as much as 50 percent up to 2030, from today´s just over 110 billion ton kilometers up to around 160 billion ton kilometers. The ability to handle such a huge growth assumes that a larger part is transported by sea.

The upcoming obstacles in Gothenburg could be overcome and the situation might even be enhanced by introducing a Rail-Traffic-Management System the traffic would most likely run even more efficient than it does today.

5.2.2 Enlarging IWW-areas and abolishing pilotage

The traffic effects of enlarging the IWW-areas have been tested in different scenarios in the Samgods-modell[49]. The results indicates that the positive effects on the transport system as a whole would be very limited. According to the results, larger IWW-areas in Sweden would increase IWW:s share of the total transport work in between 0.01 and 0.04 percent of the total share. Even if the increase could give positive effects on the road network in congested areas, the goods volumes are still very limited. But the future growing demand for transports might change the picture.

The traffic effects of abolishing the compulsory pilotage on the inlands waterway areas (or eliminate the public pilot dues) have also been tried in the Samgods modell. Although the tests in Samgods are based on a 100 percent reduction of the fairway dues, they also indicate the effects of reduced costs for pilotage. The results indicate the following:

- With today´s IWW-areas: the share of the total transport work increases from 0.07 percent to 0.10 percent.
- With extended IWW-areas according to above: the share of the total transport work increase from 0.08 percent to 0.11 percent.

[49] https://www.vti.se/en/Publications/Publication/representation-of-the-swedish-transport-and-logist_1034226

6 CONCLUSIONS

The bottlenecks collected show a great variety, the most bottlenecks refer to infrastructural issues. Since Finland, Lithuania and Sweden are isolated countries without EMMA Partners in neighbouring countries, these countries are separated. The two countries Germany and Poland are neighbours with the river Oder as part of the international border. After many years of separation, the situation got better and led to a use of the river for cross-border cargo transport, also manifested in a regulation between Poland and Germany about common enhancement waterways in the German-Polish border region[50].

6.1 Vessel Classes

Different vessel classes hinder often the efficient use of inland waterways. The countries, in which the EMMA partners did the research, multiple classes are existent. Please refer to annex A, Section 8.2 for the classes used. The different vessel sizes and interrelated different sizes needed for mooring areas, locks, draft, and clearance height create difficulties to continuous vessel use if vessels are also able to navigate in the Baltic Sea. A common classification and mandatory implementation within a foreseeable future might provide continuous cargo transport throughout the countries. Less unprofitable procedures might be avoided.

6.2 Border Rivers

The river Oder is partly the border between Germany and Poland with the political boundary right in the centre. This relict of the new border between Germany and Poland resulting from WW2 includes that each state is responsible for the individual river bank. Bottlenecks can be minimised with co-operation more effectively than by each individual state alone. Basic requirements might be same vessel classes and same bank structures and installation e.g. to avoid complicated or double signposting.

6.3 Maintenance Works

Many waterways described in this research suffer from missing maintenance works, e.g. dredging to maintain depth to allow vessels a guaranteed draft. This leads to less cargo transported upon each vessel and rising cost per unit.

6.4 Infrastructure

A lot of parts of the infrastructure is aging or quite old (e.g. SE: Trollhätte Locks: 120 years, PL: Okole Lock: 105 years). The vessel sizes and the cargo volume 100 years ago were quite different to todays or predicted cargo volume in times of globalisation. Such infrastructural bottlenecks prevent effective

[50] http://www.thb.info/rubriken/single-view/news/bilateraler-vertrag-zum-oder-ausbau.html German

cargo flow. Planning of new infrastructure should not be made on today's numbers and vessel sizes, but on expectations of the future.

6.5 Cost

The collected bottlenecks show a great variety of cost. A few obstacles might be overcome probably at no cost but needs some political will and acceptance of the need by politicans and sometimes also stakeholders. Twelve bottlenecks might be overcome by investing a rather low amount of money and fifteen bottlenecks might be overcome by investing a medium amount of money. Three handicaps would consume a high amount of money, one is at very high cost and at two further ones cost are undeterminable.

6.6 Elemination of Bottlenecks anmd positive Twists summary

The elemination of existing bottleneck is possible at various cost. But removing on e bottleneck in a high frequented stretch of a river or canal does often not really help for IWT in general. Refurbishment of a lock to in order to let more or larger vessels pass at a given time might be useless if the congestion at the next curve is not eliminated.Instead of focussing on single assessments it is more helpful to support a whole stretch of a river or canal with a focus of corridores cross countries. In order to reach this, many Authorities with different duties should work together instead of having only advantages regarding own assignments in mind. In addition potential private inverstmens have to be taken into account in order to support local businesses. Such private investments are often also positive regarding raising local employment since inverstors seek for a return on investment in a limited time span. Taking all these factors into account, a comprehensive plan with many details to enhance IWT is seen to be necessary.

7 ANNEX A: THE IWT BOTTLENECK QUESTIONNAIRE

Template for analysis of main IWW infrastructure bottlenecks

Template version as of: 2016.07.313final

Definition to identify applicable "bottlenecks" within the EMMA project:
a) A bottlneck on (a stretch of) a waterway and or canal exist, if it does not meet the proposed characteristics of its classification according to UNECE AGN Blue Book.
and, or:
b) the elemination of a bottleneck would result in more competitive inland waterway transport on the actual classified waterway and or canal.

Bottleneck Unique identification in EMMA	*E.g. DE-001* *(Pls use two digits country abbreviation and three digit serial number)*
Inland waterway's official name	*E.g. river's or canal's name, preferable in english lanuage*
Identification of river's or canal's section effected by bottleneck (River kilometer / GPS-coordinates)	*From – to (if applicable)*
Type of bottleneck	
Substantial bottleneck which needs to be lifted.	*Could apply e.g. for a lock located at the entry or exit point of a waterway or canal. If the lock is to small and will not be replaced by modern one, all other defined measures on bottleneck eleminations on the same waterway or canal would have no effect.* *This is a substantial bottleneck which you should describe here. Otherwise please fill in "no".*
Description of bottleneck	*Description of the bottleneck including possible realisation barriers or supporting issues like (non-) compliance of a section with CEMT-class standards, legal obstacles or political opposition,*
If applicable: Known restrictions	*Bottleneck applies to vessel dimensions/classes, draught, congestion, ...*
If applicable: Known closures	*May apply to Locks: Operating Hours, closure due to weather conditions (low water, ice, ...)*
UNECE AGN Blue Book (actual status of IWW)	
Status of bottleneck elemination	
Part of TEN-T corridor	*Core or comprehensive TEN-T network + name of corridor*
Part of national transport plan	*ID number and priority*
IWW Supervised by Public Authority Name	*E.g. river autority*
Operated by	*E.g. lock operator*
Existing RIS Name, hosted by	*Please include name of the system available and by whome it is hosted if applicable. Otherwise fill in "No RIS"*
Stakeholders responsible for bottleneck elemination	*Please fill in who is in charge for the infrastructure the bottleneck is linekd to.*
Date of editing	*Date of editing, e.g. June, 16, 2016*
Editor	*Who submitted this bottleneck information, e.g.* *Marcus Engler* *ISL - Institute of Shipping Economics and Logistics* *Universitätsallee 11-13, 28359 Bremen / Germany* *Phone: +49(0) 4 21/2 20 96-25* *Email: engler@isl.org*

How to overcome / good practice example	*Is there already an idea or a (good practice) example existent, which is applliccable to the issues as given above.* *Maybe attach a link to the solution if already published.*
Cost estimation for elemination	*Preferably official figures from existing studies or national investment plans. If no figures exist please fill in "not available".*
If applicable: duration between closure and re-open	*E.g. please indicate if closing of the waterway for IWT applies during the elemination of the bottleneck (periode of time: from - to)*
If applicable: extra limitations during elemination	*E.g. please indicate if specific limitations apply to IWT during the elemination of the bottlenech like smaller vessels might only pass construction site*
Assumed positive effects on inland waterway transport according to existing studies	*Please fill in estimated additional transport volume by IWT, estimated additional handling capacity in locks or similar information from official studies (incl. source of information).*
Economic feasibility / Cost - benefit ratio	*Preferably integrate existing cost-benefit ratio for described bottleneck and quote the source of information. If such information is not available please anticipate economic feasibility maybe by a rough calculation, which has priority over"no information on cost-benefit*
Existing project for bottleneck elemination	*Please describe the existing project incl. source of information, should a project for the bottleneck elemination exist. Otherwise please fill in*
Expected effect after bottleneck elemination for the river or canal	
Date of editing	*Date of editing, e.g. June, 16, 2016*
Editor	*Who submitted this bottleneck information, e.g.* *Marcus Engler* *ISL - Institute of Shipping Economics and Logistics* *Universitätsallee 11-13, 28359 Bremen / Germany* *Phone: +49(0) 4 21/2 20 96-25* *Email: engler@isl.org*

Figure 7.1 The Questionnaire used for EMMA Bottleneck Collection

The first part of the questionnaire starts with an EMMA-identification since official identification of rivers, canals or single stretches in each single country is different. After that, the official name, sometimes using the national and the englisch name, is given, and the section where the bottleneck is located is named. A type of bottleneck is asked for as a multiple choice question, please find possible answers in sections below. This is followed by a text as description as well as currently known restrictions and closures due to the bottleneck. Then the actual status of the river or canal is asked for, referring to the UNECE AGN Blue Book[51] vessel classes. Since not all countries surveiled by the EMMA partners did already sign into the UNECE AGN, this supposed to be another multiple choice but became became an open question during the survey. Next multiple choice question is the status of bottleneck elimination, followed by the open question about if the waterway is already part of a TEN-T[52]-corridor. Next part is the supervising and operation authority or company. Then the information if a river information system (RIS) is already in place and the information which stakeholders are probably responsible for the elimination of the bottleneck.

The second part is mainly about ideas how to overcome this particular bottleneck, estimated cost for elimination, maybe extra limitations when construction work is performed, assumed effects, a rough estimated cost-benefit ratio, an existing project and the expected effect for the measure.

Both parts also contain the date of editing and name and contact information of the editor.

7.1 Type of Bottleneck

The multiple choice question Type of Bottleneck allowed following answers:

1. Draught restrictions
2. Length and width restrictions
3. Clearance height restrictions (e.g. low bridge heights)
4. Lock restrictions
5. Insufficient maintenance measures
6. Insufficient River Information System applications
7. Soft measure not infrastructure related (e.g. restrictions in lock operating hours)
8. Reliability (e.g. ice restrictions)
9. other (pls explain in bottleneck description)

[51] https://www.unece.org/trans/main/sc3/bluebook_database.html
[52] https://ec.europa.eu/transport/themes/infrastructure_en

7.2 Vessel Classification

Initially the European Agreement on Main Inland Waterways of International Importance[53] (AGN)-Classes was used for classification of vessels in the questionnaire, but the results show that additional classification on the rivers and canals are used today.

7.2.1 UNECE Blue Book / AGN

The multiple choice question Vessel Classes copied the classes of the AGN Blue book, the allowed classes were Class I up to Class VIc. However, this applies to countries which signed the agreement (Finland, Germany, and Lithuania)[54].

7.2.2 Poland

Poland assessed the AGN on 17 March 2017, but also use a classification of vessel based on (Polish) Regulation of Council of Ministers as of 07 May 2002 on classification of IWW. Classes are divided into classes of regional importance (class Ia, Ib, II and III) and international importance (class IV, Va and Vb).[55]

7.2.3 Finland

Finland signed the AGN on 23 Jun 1997, but in this country an own class for the Saimaa-Canal (Saimax) exists. Dimensions are max. Length of 82.5 m, a width of 12.6meters and a draft of 4.35meters in the canal.[56]

7.2.4 Sweden

This country uses for the transport of cargo between Gothenburg and Lake Vänern the Vänermax-Class. These vessels have a maximum length of 89 m, a maximum width of 13.4meters and a draft of 5.4 m.[57]

7.3 Status of bottleneck elimination

Another multiple choice question was about this status of the bottleneck described. Following answers were possible:

1. Not on a wide political agenda
2. On political agenda but realisation not planned yet
3. Realisation not yet started
4. In building procedure
5. Legal obstacles

[53] https://www.unece.org/fileadmin/DAM/trans/conventn/agn.pdf
[54] https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XI-D-5&chapter=11&clang=_en
[55] https://www.czasopismologistyka.pl/artykuly-naukowe/send/319-artykuly-na-plycie-cd-6/5521-artykul
[56] https://www.liikennevirasto.fi/web/en/data
[57] http://www.sjofartsverket.se/pages/47582/fritidsthnkanal2014.pdf

7.4 Expected Effect

The forth multiple choice question was about the expected effect after bottleneck elimination for the river or canal with the following choice:

1. Increased efficiency of IWT
2. Increased reliability of IWT
3. Increased efficiency and reliability of IWT
4. Upgrade of the AGN class (whole waterway)