Inland water transport in the Baltic Sea Region (BSR) Transportation System

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Abstract
The inland waterway transport (IWT) has high potential to serve transportation needs in the Baltic Sea Region (BSR) under some conditions (e.g. improving waterway infrastructure, increasing the size of vessels. Confounding factors may be on the one hand the growing transport needs on the other restrictions on competitive modes of transport. Inland Transport could gain a better competitive position against other modes of transport, particularly in the junction area with roads and sea ports handling facilities.

Features of IWT are mainly low environmental nuisance, energy consumption and labour intensive, a smaller number of accidents on inland waterways and also costs effectiveness. This effectiveness however depends on some conditions which are not so easy to be met. The attractiveness of a form of transport depends not only on costs but also on possibilities of satisfying needs of transport users in terms of quality of transport services. The IWT is relatively cheap but at the same time slow, unreliable what seems the most important obstacle for its greater development. IWT needs some volume to be costs effective (scale effect) but not so big like in case of rail transport. The sufficient volume probably exists and the bigger problem is quality of services which could be improved first of all by infrastructure investments. Very important factor of quality is the integration of logistics chains, the part of which are the inland waterways but it is hard to obtain a satisfactory level of integration without infrastructure improvements.

Inland navigation in the Baltic Sea Region has the potential in specialised markets. These include: container traffic, river-sea transport, transport of new cars by ship, scrap, coal, biomass as an energy feedstock, loco traffic of inland ports as commercial sites, dangerous goods.

Traditionally, inland shipping has specialised in the transport of bulk goods, but in recent decades is also entered in the segment of high-value freight and containers. Thus the success of containerisation is a chance for inland waterway transport development particularly in the service of sea ports’ hinterlands.

The importance of inland shipping varies however by category of cargo and a region. The role of IWT in individual countries is varied. Baltic Sea Region includes the maritime borders of the following countries: Germany, Denmark, Sweden, Finland, Russia, Estonia, Latvia, Lithuania, and Poland. All the inland waterways in those countries are passing through the areas of economic importance but it seems that Inland waterways play most important role in an area of the southern and eastern Baltic. Inland waterway branch has a relatively weak position due to small market share but the potential exists at least in countries like Poland, Czech Republic, Germany and in chosen transport connections and market segments.

Another area in which inland navigation could shows its advantages is tourism and recreation especially in Baltic Sea Region. The tourism and leisure industry is expected to grow in the BSR and inland transport can play important role in this development.
There are some interesting projects, innovative solutions, initiatives and practical implementations of IWT utilization. These are solutions in the field of communication, forms of crew training, and technology. The most important projects and programmes in that field are PLATINA, NAIADES, INLATRANS, ELWIS-Notices to Skippers = ELWIS-Abo, KLIWAS. The examples of effective practices are: paper rolls transport on Finnish lakes, Keitele Canal, constructions of innovative vessels, Calculator for combined transport with CO2 emissions - IMTIS Software, The LEHNKERING fleet equipped with flow meters in the fuel system, DIPCITY: Waste transport (Liège, Brussels, Paris, Lille), Airbus transport with Ro-Ro motor barge (Bordeaux), Beer boat (Utrecht).

IWT can help achieve EU’s transport policy goals like the reduction of emissions of transport and increasing efficiency of transport. On the other hand it is transport policy and its measures which are the most important factor of increasing attractiveness of inland navigation. Transport policy, due to many regulations on the market concerning internalisation of external costs, will make it necessary to conduct economical calculations, which include on the same level economical and social costs and benefits.

In the context of the growth of freight transport and advantages of this form of transport countries in the Baltic Sea Region cannot afford to neglect the development of the inland navigation. Urgently there is a need for a strong impetus to initiate the development of this branch of transport in developing its long-term political considerations.
Introduction
The essay describes the present possible future role of the inland navigation the transportation system of the Baltic Sea Region. The goal is to present what is the current state of inland transport in relation to infrastructure and services and also to propose some actions needed in order to integrate the inland waterway transport into the BSR’s transportation system and to help to achieve EU’s transport policy.

It has been worked out as a part of international project: TransBaltic ‘Towards an integrated transport system in the Baltic Sea, Work Package 3. The goal of the TransBaltic Project is to develop a plan of Transport System in the Baltic Sea region.

As stated in the TransBaltic documents:

“The dynamic economic interactions between the Baltic Sea countries and regions, coupled with the fast growing EU trade exchange with other global players (e.g. USA, Russia, the Far East and India), provide a good prospect for transforming the BSR into a transport gateway area, serving both domestic and intercontinental flows”.¹

The overall objective of the TransBaltic project is “to provide incentives for the creation of a comprehensive multimodal transport system in the BSR on a regional level, by means of joint transport development measures and jointly implemented business concepts”.

TransBaltic sets the following specific objectives:

- development of a support basis for decision making for regional and national investments in transport corridors across the BSR by means of corridor-scaled pan-Baltic traffic forecasts and scenarios;

- to demonstrate a showcase for national-regional level cooperation in transport development by contributing to pan-Baltic harmonisation actions as launched by the national transport ministries through a priority list of investments in infrastructure, logistics and transport capacity, which will aim at resolving the most pending pan-Baltic connectivity and interoperability problems from a sustainable regional development perspective;

- creating a regional preparedness plan with defining the actions needed to enhance the gateway function of the BSR in serving the increasing intercontinental transport flows, based on the shared vision and an optimum development scenario (foresight method);

- to contribute to the implementation of EU transport and cohesion policies by means of the regional level solutions stemming from business concepts implemented by individual transport corridor projects and generalised at the BSR level;

¹ From: “PROJECT IDEA IN A NUTSHELL”
• to provide an umbrella framework and create synergies between individual transnational transport projects and pan-Baltic transport development concepts by stimulating debates and agreeing on necessary horizontal activity in shaping an integrated transport system in the BSR,

• to implement particular business concepts with the participation of private stakeholders for speeding up necessary co-modal investments and amendments in legislation and administrative procedures of the BSR countries

TransBaltic addresses the key challenge for the BSR accessibility - to accelerate development of a comprehensive multimodal transport system across the area - in twofold context:

• in relation to the internal connectivity of the BSR

• in association with the external connectivity of the BSR

The goal of the project can also be described as a plan or a strategy of developing a Transportation – Logistics System of The Baltic Sea Region. This plan concerns transportation problems in different aspects - from political to organisational ones. It corresponds with the UE Transport policy and also other policies in which a specific European attitude can be seen - “Sustainable Development” which means pursuit of economical development together with the concern for social and ecological problems. Inland transport fits ideally this philosophy.

The title of WP3 is “The BSR as a transport gateway area”. In detail this Work Package includes the following tasks:

• inventory of existing BSR concepts, master plans and strategies;

• analysis of the current distribution of intermodal transport flows (maritime, road and rail) in the BSR transport corridors;

• a vision of the intermodal transport system in the BSR (2030 census) and the most desirable development scenario;

• traffic forecasts for BSR transport corridors 2020 and 2030 according to the selected scenarios for intermodal transport flows and infrastructure development (applied transport model compatible to the one applied in DG TREN investigations);

• preparation and impact assessment of a regional preparedness plan with measures necessary to enhance the gateway function of the BSR in serving the increasing intercontinental transport flows

The development of Inland transport could be a very important factor in attaining the EU’s objectives, policies, plans and concepts like for Co-modality and “Green Corridors”

Co-modality is a new concept in the EU Policy. It grew out from the previous policy direction - intermodality. It seems that presently in the EU it is coming to the conclusion
that it is quite difficult to take goods from road to other modes of transport and limit dramatically the share of the road transport. The new attitude is characterised by cooperation of transport modes that means optimal allotment of tasks between them. It focus also on efficiency of transport operations that is a good way to increase attractiveness of environmental transportation solutions and at the same time to reduce negative impact on environment of road transport. Transporting goods by rivers may seem the ideal way to reaching the goals of the EU’s transport policy - high efficiency, especially in terms of costs, and low external costs.

Co-modality approach can be seen (and is even mentioned) in another new and important concept of “Green Corridors”.

“Green Corridors” are defined as:

“European concept denoting long-distance freight transport corridors where advanced technology and co-modality are used to achieve energy efficiency and reduce environmental impact [...] Green Corridors support the EU’s agenda towards decarbonising transport while emphasising the need for efficient logistics”. ²

They are priority transportation corridors for the development of environmentally friendly modes of transport, well-placed to implement the technical and technological improvements in order to simultaneously achieve optimum economic and ecological efficiency.

As stated in The EU’s freight transport agenda: “Rail and waterborne transport modes will be essential components of these green corridors”. ³

One of the most important tasks in realisation of the “Green Corridors” concept is the selection of transport corridors for greening. This is one of the tasks of the “SuperGreen” research project⁴. The selection process is in progress and perhaps it is a good time to define the role of inland navigation in the “Green Corridors” in general and also to choose concrete transport corridors in which inland transport could contribute to the “greening” of transport.

On the other hand Inland Water(way) Transport (IWT) has certain disadvantages which are very important drawbacks in modern economy and logistics systems. The conducted researches should give answers to the question - what could be the role of inland waterway transport in the global transportation system. Can it be the part of an integrated logistic supply chains? If so, under what conditions?

It seems that IWT can be an important element of the EU’s transportation system and could contribute to the realisation of TransBaltic goals, in particular the creation of a comprehensive multimodal transport system in the BSR.

³ The EU’s freight transport agenda (2007): Boosting the efficiency, integration and sustainability of freight transport in Europe
However in order to find out what can be the role of this form of transport in the whole system it has to be investigated which transport connections can be served, who can be the user of such form of transport, what kind of commodities can be transported by rivers etc.

The IWT is already used for special purposes and can be an alternative to road transport. Special attention should be paid to integration aspects because integration is a very important factor that denominates the efficiency of transport processes.

The data used for this report have been collected from various sources: TransBaltic, Public statistics data and information from business practice as well as own research work.
1. Characteristics of the Inland Water Transport

1.1. The importance of inland shipping in the port hinterland traffic

The IWT sector has high potential to serve transportation needs in selected market segments and the ability to participate in the integrated transport chains, in particular, sea-river transport chain serving the needs of back-ports. The conditions which may help predispose IWT to fulfil the transport function in these areas result from:

1. restrictions on road transport infrastructure, congestion and the growing threats to security in this mode of transport, the lack of suitable road connections with seaports and inadequate adjustment of rolling stock and the cars for container transport on one hand and

2. the increase in size of vessels and thereby increasing the demand for transportation of large quantities of cargo at one time

Features of demonstrating the attractiveness of IWT are mainly low environmental nuisance, energy consumption and labour intensive. It is also emphasised, especially in the context of transport of dangerous goods, a smaller number of accidents on inland waterways.

River ports are the determinants of the availability of IWT. They fulfil the function of transport, logistics, industrial, urban and regional development.

The Baltic Sea Region is an area of high intensity development of maritime transport. This is due to geographical location, favourable geopolitical conditions and its economic potential. The importance of the transportation system for the development of the countries in the region is huge. Maritime transport is an effective link of the region with the layout of the global economy and is a key factor in creating economic and social cohesion in the Baltic Sea Region as well as integrating it into the internal and external dimensions (EU, Europe, the global economy).

Presented in Brussels on 28 March 2011, the White Paper for the transport sector, outlines the main directions of development of transport policy. The White Paper challenges the reduction of emissions of transport in 2020 by 20% compared with 2008 and by 60% compared to 1990.

For inland waterways it creates opportunities and allows gaining a better competitive position against other modes of transport, particularly in the junction area with roads and sea ports handling facilities. For freight transport it is expected to move 30% by 2030 (and more than 50% by 2050) of cargo flows on distances of over 300km from road to the rail and IWT. To realise this concept the European Committee plan to develop infrastructure of these modes. In this context, prospects for inland navigation are very positive. In this situation, countries in the Baltic Sea Region cannot afford to neglect the development of the inland navigation. Urgently there is a need for a strong impetus to initiate the development of this branch of transport in developing its long-term political considerations.
IWT plays the complementary role of maritime transport. Due to its mass character and low cost of transportation is an attractive partner serving ports hinterland traffic. The average share of inland waterway to handle the largest sea ports in Western Europe is estimated at the level of 43%.

The importance of inland shipping in the port hinterland traffic varies by category of cargo and seaport region. In the hinterland transport of Dutch and Belgian ports (West ports) the inland navigation is much faster compared to other modes of transport than in the hinterland of the German seaports. Their share of modal split in the hinterland of the German seaports is just over 7%, in the hinterland of the western ports, however about 55%5.

Inland navigation in the Baltic Sea Region has the potential in specialised markets. These include (See table 1):

- Container traffic
- River-sea transport
- Continental container transport
- Transport of new cars by ship
- Scrap
- Coal
- Biomass as an energy feedstock
- Loco traffic of inland ports as commercial sites
- Dangerous Goods

### Table 1

<table>
<thead>
<tr>
<th>Container traffic</th>
<th>The development of containerisation, the limitations of existing infrastructure in the hinterland of ports, promotion of the use of river vessels to relieve the roads and thereby reduce the external costs of transport. In order to achieve above results the maintenance of waterways is required and also the needs of navigation in the construction and modernization of facilities engineering ought to be taken into account. Port is a transportation hub, in which the transportation lines of different modes of transport are meeting. Proper management of ports and creation of space for the development of shipping in the container transport system is an opportunity for its revival in the Baltic Sea area.</th>
</tr>
</thead>
<tbody>
<tr>
<td>River-sea transport</td>
<td>Compared with the pure transport by sea and inland waterway, it has a cost advantage of 10 - 30%. Also thanks to the smaller number of loading and unloading operations the risk of damages decreases.</td>
</tr>
</tbody>
</table>

5 Verkehrswirtschaftlicher und ökologischer Vergleich der Verkehrsträger Straße, Schiene und Wasserstraße, Planco Consulting GmbH, Bundesanstalt für Gewässerkunde, 2007, s.84.
The market share of the river-sea navigation in Western Europe is under 10%. In Russia and Ukraine, however, sea-river vessels transport is around a third of the cargo volume of typical inland waterway transport. Currently, the Russian waterways are disabled to foreign flags. The opening of the waterway system for the international sea-river traffic through an international second register is currently under discussion. As a result, new potential for the Western European inland navigation would arise.

There is a trade off here - utilisation of such ships allow avoiding transhipments (costs, time consuming) but their capacity is lower than solely sea ships, so probably the costs of transport could be relatively higher. From the other point of view using bigger ships is more effective on longer distances. The most important factor is costs and time of transhipment which on shorter distances stand for a considerable share of the total time and costs. So may be this kind of waterborne transport, where ships can travel frequently with relatively smaller quantities of commodities, is in the BSR region economically justified.

Short Sea Shipping (SSS) also is very important in EU’s transport policy. The Commission introduced measures that apply to various levels - to the Member States, maritime industries and ports and port authorities. The proposed measures aim to improve information on the offers of the internal maritime traffic, increase of the networking and the reorganisation of administrative procedures.

| Heavy haulage | Heavy haulage next to the bulk cargo are, from the technical point of view, the type of goods that gravitate towards inland water transport. In comparison to road transport, inland water transport has features like:
|              | - Collision free transport route;
|              | - No congestion caused by transporting spacial cargo;
|              | - Higher safety of carriage;
|              | - No damages in infrastructure and its surroundings (broken trees, bridges, power lines);
|              | - No limits and loads to other traffic members.
|              | High spacial factor of inland waterways ships offer better load usage, reaching up to 100%. It’s one of the causes of gravitation of heavy haulage goods towards inland waterway transport. |

| Transport of new cars by ship | Advantages of inland waterway transport, in comparison to road transport, which is used to carry new passenger cars, are: no road fees, unlimited working time, higher safety of transport and less damages. Ford car factory and Mercedes car parts in Germany - Carry 80% of their production via inland waterways. One of the advantages, which decided to build a car factory in Poland, General Motors was the access to the Gliwice Canal, and the prospect of the river transports to the West and South of Europe. |

| Scrap | Scrap metal is very often used as a production raw material. It is acquired from three sources - as the used metal elements, as the waste during metal production and as the raw material from demolition. The biggest receivers are steel works, from which biggest part of is situated by the rivers because of the big water demand. Inland waterways, according to their big role in spatial planning, demonstrate |
| **Coal** | Along the Oder River, there are numerous plants that produce energy with the use of Silesian coal, and there is a possibility that they could benefit from cheap water transport. The Coal Holding sells also coal to power plants in Berlin and is interested in running both the Gliwice Canal and the improvement of the River Oder. The current state of hydrologic Oder Waterway prevent from using the inland ports. Holding claims the investments will contribute towards the revitalization of Oder Waterway. |
| **Biomass as an energy feedstock** | New market potential for inland waterway transport can arise in biomass transport segment. This kind of production is supported by EU and will potentially grow. This market is developing, but there are no existing freight flows. It is also hard to predict if biomass production will be competitive industry branch. Nevertheless transport policy concerning inland waterway transport should be in the nearly future connected to bio energy development, so that it could extract the benefits from new market segment development. |
| **Dangerous Goods** | Inland waterway transport, as the safest mode of transport plays big role in the transportation of hazardous goods. In Germany 15% of goods that are transported with the use of inland waterways are hazardous goods, from which 80% are liquid products. Boats/ barges in comparison to other transportation vehicles, characterise itself with lower level of shockproof and vibrations. |
| **Paper rolls** | In the lake district in Eastern Finland, paper production is an important economic activity. Paper rolls are produced for both domestic and - more important - for international markets. In the past, paper was exported by road and rail to e.g. Russia and Western Europe. For the last few years, waterway transport has been used as the main mode of exporting paper rolls in Eastern Finland. Sea-river vessels of companies such as Wagenborg Shipping are sailing up the lakes and the Finnish/Russian Saimaa Canal, which connects lake Saimaa to the Baltic sea through the Gulf of Finland and which has a capacity of up to 2,500 tonnes. The sea-river vessels can cross the Baltic sea to Szczecin in Poland and navigate to Berlin, or even to the Netherlands and the Ruhr area in western Germany. Currently around 100,000 tonnes of paper per year are being transported by waterways. Also, a plant producing paper in Shwedt in West Germany has a port for transport of paper by water. Unfortunately, because of inadequate state of the waterway the whole production is transported by lorries. |


### 1.2. The problem of cost-effectiveness of inland navigation

The inland navigations stands for one of the most ecological forms of transport. What’s more and more important, from the point of view of real possibility of using water...
transport, it is also costs effectiveness. This effectiveness however depends on some conditions which are very often not so easy to be met. But even when they are met there is no certainty that this form of transport will be utilised by shippers. The attractiveness of a form of transport depends not only on costs but also on possibilities of satisfying needs of transport users in terms of quality of transport services.

The challenges of modern economies make shippers to demand from their transport and logistics operators high level of service – quick reaction, reliability, safety, complexity, additional services. An interesting question arises here - could the IWT be an element of logistic supply chain or is it suitable only for traditional transport solutions? What solutions should be adopted in order to achieve that? From the other point of view logistics offers some interesting solutions that probably could be applied to increase efficiency of IWT (logistical integration of processes).

The IWT is relatively cheap but at the same time slow, unreliable. So the question arises here - for what purposes the waterborne transport can be used.

Let’s compare the three modes of transport on the example of one of the transport relations: Wroclaw - Szczecin.

Currently, a lorry’s driving time from Szczecin to Wroclaw is over 5 h (500 km). In the case of rail transport routes, one can use: E - 59 or CE - 59 but in both cases, in some sections of the routes speed is 40 - 80 km per hour, which means that a train can travel about 8 h. The improvement of infrastructure parameters and the increase of speed up to 160 km/h would reduce that time to 3,5 h. However, this should not include the time for loading, delivery, and preparation for transportation by rail carrier. In the case of IWT - the journey by a barge in this case could take a week. On the other hand, infrastructure investments are likely to affect the time handling at intermediate points (stations, ports) and thus contribute to improving the quality of services. So the massive modes of transport can compete on:

- low price with a longer period of delivery or delivery comparable time
- better quality service at comparable or higher prices
- lower price and good quality services

The last option in the case of rail transport is difficult to accomplish, but theoretically possible - the investments made have an impact not only on travel time but also costs. Shorter travel time, for example, could mean better use of existing rolling stocks. But it will be difficult for the IWT to compete with the two other modes of transport even if waterways infrastructure was improved. On some transport connections IWT can offer comparable or better service because of the state of land infrastructure or congestions on roads. But such a situation happens very seldom. For this reason, the first option will be considered.

Some customers prefer higher quality of services than the lower costs of transportation, especially if the difference in prices of transport services is not high.
Rates for renting a road set of the highest possible capacity in Poland - a lorry with trailer 13.6 m (34 pallets, 24 - 29 tonnes of payload net) could amount up to EUR 1 per km (approx. 4 PLN), but the price is often lower. Road transport is more competitive than rail. Cost-effectiveness of rail transport is increased if for example a railway carrier offer an appropriate discount. PKP Cargo’s services in the present situation became competitive on the Polish market only at discounts of 70%. Rail effectively reduces the rate for customers who can declare large consignments for carriage to be transported on a regular basis.

In the case of IWT, operating costs vary depending on e.g. depth, but studies have shown that on the Oder River it is from 6.48 to 7.06 EUR/1000 tkm.

In table 2 there are examples of the cost of transporting goods in the three modes of transport in the year 2005 in relation Szczecin - Wroclaw.

It is very difficult to obtain proper and suitable data from the point of view of this expertise data concerning costs of inland transport operations. For example one of the authors estimate level of costs for the case of transporting 1 million tonnes of coal to power plants in Opole:

Table 2

<table>
<thead>
<tr>
<th>Mode of transport</th>
<th>Distance [km]</th>
<th>Transport rate [PLN/tonne]</th>
<th>Transport rate [EUR/tonne]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inland waterway</td>
<td>960</td>
<td>9,7</td>
<td>2,43</td>
</tr>
<tr>
<td>Rail</td>
<td>750</td>
<td>20,37</td>
<td>5,09</td>
</tr>
<tr>
<td>Road</td>
<td>750</td>
<td>23,5</td>
<td>5,88</td>
</tr>
</tbody>
</table>

Source: Own author's research

Assumptions

Total voyage circular time including the time for unloading - 51,6 h
The average time of exploitation in the navigation season - 250 days (4000 h)
Number of barges in one set - 2
Number of employed sets - 13,6
Average amount of cargo transported per year by a set - 73 470 t

The Total cost, thousand. PLN] (EUR)

The cost of annual depreciation of the fleet - 666 (166,5)
The cost of current repairs and periodic per-year operation - 2 040 (510)
The annual costs of external services (leased fleet) - 7 500 (1875)
General expenses (insurance, for loading and unloading) - 2 450 (612,5)
Total Annual Costs - 12 656 (3164)
Unit transportation cost - 12,656 PLN/t (3,164 EUR/t)
Unit cost of transport work - 0,1205 PLN/tkm (0,030125 EUR/tkm)

These data provide interesting information but are not very suitable for conducting simulation. That's why the author used data from own analysis and expertises conducted for transportation and manufacturing sector in Poland. The data used for simulations for different modes of transport are in the table 3.

Table 3

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>50 000</td>
<td>50 000</td>
<td>0,50</td>
<td></td>
</tr>
<tr>
<td>Intermodal rail</td>
<td>776 000</td>
<td>11 765</td>
<td>70 000</td>
<td>13,25</td>
</tr>
<tr>
<td>Waterborne</td>
<td>50 000</td>
<td>22 500</td>
<td>110 000</td>
<td>10,75</td>
</tr>
</tbody>
</table>

Source: Own author's research

Below there are results of simulations of the cost-effectiveness of the use of inland waterways for the connection - Szczecin - Gliwice. The following data and assumptions have been adopted:

- Distance (waterway) - 679 km
- a set of two barges has been used
- capacity of 1 barge - 500 ton
- the speed of the barges - 4 km/h
- Number of operating days per year - 250
- Time of stopovers and loading in two directions - 5 h
- Fuel consumption - 1000 l/100km
- Fuel price - 2,6PLN/l (0,65 EUR/l)

It also assumed that in road transport 24 tonnes net lorries will be used and in rail - trains with 20 wagons 60 tonnes each and 1 day and 3 days respectively of journey time.

With these assumptions, journey time in inland navigation is 20 days in both directions. To have employment for at least one set of barges the volume of 30 000 tonnes of cargo annually should be available.

Tables 5 and 6 and Graphs 1 and 2 show simulation results for different volumes of cargo flows. In table 2 there are number of vehicles in different modes of transport which are needed to transport different volumes of cargo what is the base for further costs calculations.

Up to 10 thousand tonnes per year in one way road transport is the cheapest and inland slightly more expensive. In the range 50 - 100 thousand tonnes IWT is the cheapest. From 100 thousand tonnes rail starts to be the most competitive what can be explained by high fixed costs and thus greater impact of “scale effects” and bigger capacity of a train. In inland navigation the costs concerns mainly of barges operation and not like in rail transport where fixed costs of infrastructure are the big share of total costs. That’s why, at above mentioned big volumes of cargo, rail becomes more competitive thanks to the ability of utilizing its capacity.

We can also use another methods and other data. For example some authors calculate costs of a journey on Oder River on above analysed transport connection in following way: total costs 23 980 PLN (5 995 EUR) and unit costs: 25,4 PLN/tonne (6,35 EUR/tonne). The price for hiring a lorry could amount to 2 000 PLN (500 EUR) what gives about 85 PLN/tonne (21,25 EUR/tonne). If beneficial agreement was signed with PKP Cargo the price per one tonne could be 65 PLN (16,25 EUR).

<table>
<thead>
<tr>
<th>Weight of cargo per year in one way [thous. tonnes]</th>
<th>Mode of transport</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of lorries</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 4

Number of vehicles to carry different volumes of cargo
### Table 5

**Effect of weight load on the costs of various modes of transport**

<table>
<thead>
<tr>
<th>Weight of cargo per year in one way [thous. tonnes]</th>
<th>Mode of transport</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Road [PLN]</td>
<td>Rail [PLN]</td>
</tr>
<tr>
<td>10</td>
<td>451 148</td>
<td>1 362 290</td>
</tr>
<tr>
<td>100</td>
<td>2 057 739</td>
<td>2 332 415</td>
</tr>
<tr>
<td>200</td>
<td>4 115 477</td>
<td>3 458 455</td>
</tr>
</tbody>
</table>

*Source: Own calculations based on data collected by the author*
Table 6
Change of unit costs of transport in relation the cargo volume

<table>
<thead>
<tr>
<th>Weight of cargo per year in one way [thous. tonnes]</th>
<th>Mode of transport</th>
<th></th>
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<tr>
<td></td>
<td>Road [PLN/tkm]</td>
<td>[EUR/tkm]</td>
<td>Rail [PLN/tkm]</td>
<td>[EUR/tkm]</td>
<td>Inland [PLN/tkm]</td>
</tr>
<tr>
<td>10</td>
<td>0.176</td>
<td>0.044</td>
<td>0.532</td>
<td>0.133</td>
<td>0.200</td>
</tr>
<tr>
<td>100</td>
<td>0.161</td>
<td>0.040</td>
<td>0.182</td>
<td>0.046</td>
<td>0.132</td>
</tr>
<tr>
<td>200</td>
<td>0.161</td>
<td>0.040</td>
<td>0.135</td>
<td>0.034</td>
<td>0.124</td>
</tr>
<tr>
<td>300</td>
<td>0.161</td>
<td>0.040</td>
<td>0.119</td>
<td>0.030</td>
<td>0.122</td>
</tr>
<tr>
<td>400</td>
<td>0.161</td>
<td>0.040</td>
<td>0.112</td>
<td>0.028</td>
<td>0.120</td>
</tr>
<tr>
<td>500</td>
<td>0.161</td>
<td>0.040</td>
<td>0.107</td>
<td>0.027</td>
<td>0.119</td>
</tr>
</tbody>
</table>

Source: Own calculations based on data collected by the author
1.3. **Strategy of utilization of inland transport**

It seems that one of the most beneficial and feasible strategies is to use the IWT:

- for transporting commodities which are not time sensitive
- in hinterland connections to seaports.

Cooperation between sea transport and IWT probably creates a chance for IWT to carry containerised cargo for two reasons:

- a large portion of commodities are being transported by sea in containers, so goods in ports are already prepared for multimodal transport;
- in case of deliveries from the Far East, the sea journey leg time is very long anyway (30 days or longer\(^7\)) and a few additional days which the goods spend on barges shouldn’t make big difference for the users.

It is also notable if it can be integrated with the dry ports concept. The volume of loads that are consolidated at dry ports could be sufficient to obtain economies of scale, which is so important in bulk modes of transport like waterway transport. On the other hand however inland navigation may offer poorer service in terms of time of delivery than rail transport.

\(^7\) Presently due to global crisis and high transportation costs carriers reduce the operating speed of ships.
The activities which should be dealt with in order to increase share of inland transport in the service of sea ports are:

- Transhipments - reloading infrastructure and suprastructure, management of transhipment operations;
- Cooperation between inland water transport and sea transport
- Administration and legal framework

Barges are used not only in transportation of commodities like raw materials but also finished goods (e.g. unitised cargo). The river transport is without a doubt a very cheap mode of transport, but at the same time slow, unreliable and with poor accessibility. Some quality parameters could be improved, but anyway it seems that growth opportunity of inland navigation depends on customers who prefer low price to high quality of services. In case of high value goods it seems that only big companies could be interested in transporting goods by rivers because they have sufficient volumes of goods which could be sent regularly, and the demand for which could be perhaps more easily predicted than in the case of smaller companies.
2. Inland Navigation in the BSR

2.1. General characteristics of inland navigation in the Baltic region

Baltic Sea Region includes the maritime borders of the following countries: Germany, Denmark, Sweden, Finland, Russia, Estonia, Latvia, Lithuania, and Poland. All the inland waterways in those countries are passing through the areas of economic importance.

Inland waterways play most important role in an area of the southern and eastern Baltic. This is due to several reasons. First of all Scandinavian countries are islands or peninsula what makes the reason that there is not so big need to use the waterways, and just SSS. Secondly, Scandinavia is characterized by low population density. One of the main shortcomings of inland transport in the Baltic Sea basin is the lack of year-round operational capacity resulting from the freezing of freshwater canals.

Table 7

Inland infrastructure in the Baltic countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Total length of navigable waterways/canals of international importance</th>
<th>Major inland waterways (rivers and canals)</th>
<th>Major ports on inland waterways</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>7,467 km (Rhine River carries most goods; Main-Danube Canal links North Sea and Black Sea) (2010)</td>
<td>Rhine, Elbe, Main, Weser, Danube, Midland Canal, Main-Donau Canal, Dortmund-Emms Canal</td>
<td>River/sea ports: Hamburg, Bremen/Bremerhaven; River ports: Duisburg, Koln, Mannheim</td>
</tr>
<tr>
<td>Lithuania</td>
<td>441 km (navigable year round) (2007)</td>
<td>Nemunas</td>
<td>River/sea port: Klaipėda (Curonian lagoon); River ports: Kaunas, Jurbarkas</td>
</tr>
<tr>
<td>Latvia</td>
<td>300 km (navigable year round) (2010)</td>
<td>Daugava</td>
<td>River ports: Daugavpils, Riga</td>
</tr>
<tr>
<td>Estonia</td>
<td>335 km (320 km are navigable year round) (2010)</td>
<td>Rivers of Estonia are short and mostly have small discharge. Only 10</td>
<td>River ports: Narva</td>
</tr>
<tr>
<td>Country</td>
<td>Length (km) (Year)</td>
<td>Details</td>
<td>River/sea ports</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
<td>---------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Sweden</td>
<td>2,052 (2010)</td>
<td>Vanern (Wanern Lake) Trollhättan Canal Göta River</td>
<td>Karlstad Mariestad Göteborg (Gothenburg)</td>
</tr>
<tr>
<td>Finland</td>
<td>7,842 (includes Saimaa Canal system of 3,577 km; southern part leased from Russia; water transport is used frequently in the summer and is widely replaced with sledges on the ice in winter; there are 187,888 lakes in Finland that cover 31,500 km (2010))</td>
<td>Saimaa Canal Saimaa Deepwater Channels</td>
<td>Lappeenranta, Imatra, Joensuu, Varkaus, Joutseno, Kuopio</td>
</tr>
<tr>
<td>Russia</td>
<td>102,000 (including 48,000 km with guaranteed depth; the 72,000 km system in European Russia links Baltic Sea, White Sea, Caspian Sea, Sea of Azov, and Black Sea) (2009)</td>
<td>Wolżanski Water System Newa River</td>
<td>Moscow Rybiński St. Petersburg</td>
</tr>
</tbody>
</table>


### 2.2. Characteristics of the potential of inland waterway transport in the BSR countries

**Sweden**

Sweden's inland waterways system comprises two separate commercial routes serving the hinterlands of the ports of Stockholm and Gothenburg respectively, and a number of smaller canals (see Fig. 1 and 2). Mostly interconnected, they were built to serve the country's industrial and agricultural development, but since the last barges ceased operating in the 1950s (or earlier), these canals have all become important tourist assets, used by passenger vessels and private boats, as well as some hire boats, during the four-month season (mid-May to mid-September)8

Sweden has three important channels leading to the hinterland. Channel Trollhätte in Gothenburg and Södertälje canal south of Stockholm combined with each other via connecting the lakes Wanern and Vetter Baltic with the North Sea. They allow passage of vessels with a capacity of over 3000 t. River-sea vessels are there just as often seen as the classic coastal motor vessels. There are also a number of locks that are in very good condition, despite the adverse winter weather conditions in Scandinavia. Göta Canal at

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Norrköping attract more traffic and cruise ships. Tourism has the region’s major economic importance\(^9\).

The Göta Canal together with the Trollhätte Canal forms a continuous waterway through Sweden from coast to coast. The Trollhätte Canal and the Göta Canal form a route across Sweden from the North Sea to the Baltic, passing through two major lakes. Trips are available on passenger ships or self-skippered boats that can be rented. A coastal passage continues north to Stockholm. Six other canals are connected to inland lakes\(^10\).

Göta Canal due to the large number of locks (58) and the need to cross about 90 meters difference in height is not competitive, even for rail transport not to mention the road transport. Trollhättan channel, which connects the lake Wanern lying on the height 44 meters from the Kattegat, has acceptable dipping to 5.4 width to 13.2 m and length 88m. Immersion and annual turnover of 3.5 million tonnes improves the competitiveness against other means of transport.


\(^10\) www.eurocanals.com
Figure 1. Sweden’s inland waterways

Source: http://www.worldcanals.com
Finland

In Finland, there is one channel connecting the eastern part of the Gulf of Finland with the whole system of Finnish lakes. Transport Parameters are: dipping 4.35 width 12.6, 82.5 depth. These parameters are similar to Swedish ones and allow the entrance of vehicles with the capacity of 2500DWT. Turnover oscillates around 2 million tonnes per year.

Finland has a total of around 19,500 kilometres of public, charted fairways marked by more than 33,000 maritime aids to navigation (lighthouses, buoys, signs, leading beacons, etc.). The Finnish Transport Agency is responsible for around 25,000 of these. In addition to the Saimaa canal, which connects the Saimaa watercourse to the sea, the waterway network includes 31 other lock canals.
Fairway maintenance services take account of the navigation needs of merchant shipping and other waterborne traffic. Their operations focus on maintenance of the fairway network.

The costs of fairway maintenance and ice breaking related to coastal merchant shipping are covered by fairway dues.

Finnish ports play an important role in Finnish business. Almost 90% of Finland's foreign trade passes through Finnish ports. In this sense, Finland could be compared to an island, as the ports located on its approximately 1,000 kilometres of coast, operate as nodes in the commercial transport links of goods and passengers to and from foreign countries. Most Finnish ports are kept open to serve shipping all year long, in spite of the winter.

Finland offers a region of hundreds of interconnected lakes along the border with Russia, accessible from the Baltic Sea via the 40-km Saimaa canal (located in the land leased from Russia.) River-sea vessels are now available without hindrance, even in winter, thanks to latest-generation icebreakers. Saimaa Canal partly runs through Russia to Vyborg, which creates uncertainty for future investment in maintenance and expansion.

The Finnish waterways are made up of four main networks of lakes and connecting navigations, totalling 6150km. Finland possess 8,000 kilometres of inland waterways. Finland’s most important canal is the 43-kilometres long Saimaa Canal, which connects Lake Saimaa to the Gulf of Finland.

The Saimaa Canal is 42.9 km long - 23.3 km situated on the Finnish and 19.6 km on the Russian side of the border.

Domestic and foreign traffic (incl. transit) and timber floating through the Saimaa Canal in the year 2010 was 1 659 956 t.

Passenger traffic through the Saimaa Canal in 2010 was 45 946 passenger and increased compared to 2009 by over 5 000 passengers.
Fig. 3. Important Finnish waterways

Fig. 4. Waterways in Finland

Source: http://www.eurocanals.com/Waterways/finlandwaterways.html

Fig. 5. Production plants locations in Finland
Russia

The navigable waterways in the European part of the Russian Federation cover a total of 72,000 km, of which 18,000 km are canals or canalised rivers and 10,000 km are channels in natural lakes. This network provides routes across the continent linking five seas: the Baltic Sea, White Sea, Caspian Sea, Sea of Azov and the Black Sea. Inland shipping accounts for approximately 3% of domestic freight movements in Russia measured in tonne-km. Freight is handled by 14 state-owned shipping companies reporting directly to the
Ministry of Transport\textsuperscript{11}. Development of the vast potential for cruising in private boats is handicapped by the stringent regulations, and in particular by the obligation to take on board a professional pilot.

Neva provide, at least during the summer, efficient connection between Russian inland waterways and Baltic sea, but on it only movement of vessels with Russian crew is allowed. Neva route is dominated by river-sea vessels with capacity over 4 000 tons. During the winter (from October to May) movement on this route is suspended. This inland waterway network has 6500 km of length, but many locks, especially in the further section, require major maintenance works to be carried out due to the damages caused by driving off the ice. In St. St. Petersburg, there are no significant handling operations between sea and river vessels\textsuperscript{12}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{waterways_in_russia.png}
\caption{Waterways in Russia}
\end{figure}

\textit{Source:} \url{http://www.worldcanals.com}

\section*{Lithuania}

\begin{flushleft}
\textsuperscript{11} \url{www.worldcanals.com} \\
\textsuperscript{12} Hautau H., Pawellek G., Schönkecht A.: Binnenschifffahrt im Ostseeraum: Ungenutze Potenziale. Internationales Verkehrswesen. - 2006, nr 11, s. 549-552. \url{www.gbk.net.pl}
\end{flushleft}
The Nemunas River is navigable and used for commercial shipping between Kaunas and the Baltic seaport of Klaipeda, reached through a channel in the Kuronian Bay. East of Kaunas, about 204 km from Klaipeda, a hydropower dam with no lock prevents the development of inland shipping upstream. The river would otherwise be potentially navigable a further 200 km through to Grodno in Belarus. The Nemunas is accessible from the Polish waterway network through the Wislanian Bay, which becomes the Kaliningrad Bay in the Russian Federation, leading to the Pregel. Canals link the Pregel to the Kuronian Bay. The channel is marked by navigation markers between Kaunas and the mouth of the river and by navigation lights on the Kuronian Bay. There is little barge traffic on the river, mainly timber and construction materials.

Inland shipping is limited here mainly because of the low level of water. As a consequence of this state Klaipeda - the largest ice-free port - has no efficient water connection with the rest of the country. From the Baltic to Kaunas water depth is 1.2-1.5m, what allows only for transport of small quantities of goods.

Fig. 8. Waterways in Lithuania

Source: http://www.worldcanals.com

Latvia

There is now no commercial inland navigation in Latvia. The first 10 km from the Baltic is the entrance for deep-sea vessels to the port of Riga. Historically, the Daugava was navigable as part of the Berezina route to the Danube, but three hydropower plants and

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13 www.worldcanals.com
dams (with locks never completed) prevent the development of inland navigation on the upper Daugava River. There is also an old canal to the north of Riga, linking the Daugava to the Gauja, built around 1900. It was only used for rafting timber and is now derelict. However, it does have what is probably the world's longest lock, one mile in length.

The project of a Daugava-Dniepr link is being promoted by many economic and political stake holders in Latvia, Belarus and Ukraine

![Fig. 9. Waterways in Latvia](http://www.worldcanals.com)

Estonia

Inland waterways are potentially of great value to Estonia, but navigation is handicapped by the hydropower scheme with a dam of 8 m high on the river Narva just upstream of the town of the same name. The port of Narva, 20 km inland from the Gulf of Finland, has recently been made accessible to ships drawing up to 3-4 m, under an agreement between the Estonian and St Petersburg (Russian) waterway authorities. A lock adjacent to the Narva power plant would open up navigation through to Lake Peijpus, where a freight terminal has been built at Storoziets, and the Russian town of Pskov, but there do not appear to be any immediate plans for implementation of this project. The river Emajõgi is navigable for trip boats and other craft drawing up to 1.9m from Lake Peijpus to the country's second city, Tartu.

There are 101 ports in Estonia, 31 of them involved in merchant shipping (freight and passenger transport). All the freight ports in Estonia are open for foreign vessels. The
biggest turnover of international freight and passenger transport is taken by Vanasadam (the Old City Harbour), Muuga Harbour, Paljassaare Harbour and Paldiski South Harbour, receiving vessels with a draught of 9 - 16.9 m. All of these belong to the state-owned trading company Port of Tallinn Ltd., and are open for navigation all year round. Additional ports are part-municipal, part-private. Port of Kunda, the municipal North Port of Paldiski and the part-municipal, part-private Port of Pärnu (60% private and 40% city of Pärnu), have the largest turnovers of international goods. The official length of waterways on sea totals 1,640 km while the total length of inland waterways totals to 520 km, 320 km of which are navigable and marked with navigation signs. There are six ferry ports: Kuivastu, Virtsu, Heltermaa, Rohuküla, Sviby and Soru. The larger ports have provided the conditions necessary for receiving large ships. Both state, municipal and private ports are represented in Estonia.

Fig. 10. Waterways in Estonia

Source: http://www.worldcanals.com

Poland

The network of Polish waterways, comprising navigable canals and canalised or free-flowing rivers, as well as a number of interconnected lakes, is nearly 3650 km long. Waterways of international importance (classes IV and V) represent only 1.9 and 3.0 % of this length respectively. Most waterways (59%) are Class I, for a carrying capacity limited to 180 tonnes at a loading depth of 1.4m. In view of these restrictions, waterborne traffic accounts for less than 1% of all inland freight movements in Poland. The main commercial
waterways are the Oder, the Vistula and the Vistula-Oder waterway. The rivers Bug and Wieprz are no longer navigated to any significant extent. The most important waterways for tourism are the Augustów and Warmia (or Elblanski) Canals. The Slesinski Canal is also potentially of great interest, joining the Warta at its upstream limit of navigation to the Bydgoszcz Canal.\(^\text{17}\).

Poland offers ten waterways totalling over 3,500 kilometres. The best recreational cruising is the forested lakes region in the north-eastern corner of the country. The Elblag and Augustow canals of this region are accessible via rivers from Germany or the Baltic Sea.\(^\text{18}\).

Inland waterway transport is mainly carried out on the Oder and Vistula, which are linked by Bydgoszcz Canal. Barges used on this route are considerably smaller than in Germany and the Scandinavian (up to 800 t). Tests showed that lower part of Odra river (75 km from Baltic sea towards north of Berlin and Schwedt) can be available for smaller river-sea vessels with capacity up to 1 400 tons, however railway bridge in Szczecin is a bottleneck on this route and it requires modernization.\(^\text{19}\).

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**Fig. 11. Waterways in Poland**

*Source:* [http://www.worldcanals.com](http://www.worldcanals.com)

\(^\text{17}\) Ibidem  
\(^\text{18}\) www.eurocanals.com  
Oder River also has changing depth parameters and as a border situated river it has significant transportation function. Lower river up to Odra - Havela canal (150 km from the sea) has a difference in river levels on the German side by 1 meter which makes it beneficial from the point of view of lack of sluices. Eastern Oder river from Widuchowa to Szczecin has V’th class parameters, but from Widuchowa to Ognica, from Hohensaaten-Friedrichshalder Wasserstraße junction parameters lower it down to IV’th class. This factor caused, that the German Side decided to higher up the parallel western part to 4 m depth, connecting it to Western Oder river, which gives it V’th class parameters. This decision was negatively received by The Polish Side. All in all however from Berlin through Schwedt to Szczecin this type of transport shows big profitability. From Hohensaaten-Friedrichshalder Wasserstraße junction in the neighbourhood of Ognica, up to the river class of the river lower down. In the neighbourhood of Bielink instead of IV’th class we have 1,5 m immersion, close to Kostrzyn III’rd class and 1,2 immersion. From Kostrzyń do Głogów we have I’st class and partly II’nd class. From Ścinawa to Małczyce depth is under 1 m, and in the neighbourhood of Malczyce it’s 20 cm. The sluice is being built in this part. This will be
the first sluice from Szczecin instead of the one in Brzeg Dolny. From Brzeg Dolny through Wrocław up to the beginning of Gliwicki canal in Kędzierzyn it’s III’rd class - 1,8 m. Gliwicki canal also has III’rd class. This part of higher Oder river is best managed. From Kędzierzyn to Racibórz, where it ends, we have I’st class and 1,2 m guaranteed.

The worst situation is in Lubuskie Voivodeship along with short sections from neighbour voivodeships. 300 km distance from Kostrzyń to Malczyce needs investments to bring the river to III’rd class.

**Arms of Odra River**

**Odra-Havela Canal** owing to existing from the 30’s XX age elevator Lower Finow reduces the necessity for many sluices. Thanks to that 5-mio agglomeration of Berlin became more accessible. Parameters of the elevator: 82,5 m length, 11,94 m width, 2,5 m immersion. Terminal annual capacity was reached at the level of 4,4 mln tonnes, so in the 90’s there was a decision made to build New elevator: 115 length, 32,5 longer than the one existing, 12,5 m width and 4 m immersion.

**Warta** from Kostrzyń to Santok it has identical parameters as Odra River at his estuary - II’nd class. From Santok to Konin it’s I’st class. It has respectively 1,2 and 0,9 m.

**Noteć i Bydgoski Canal** - from Santok to sluice in Krzyż it’s II’nd class according to 1,5 m parameters. From Krzyż to Bydgoski Canal according to its modernization from before 1st World War it has II’nd class and 1,8m.

**Odra-Dunaj Canal** through Morawská Brama. This canal, due to its geographical position may be able to get EU financial support. This canal has huge development perspectives according to population - economical potential of Śląsk and Czech Republic region. Parameters of the canal are at least III’rd class. Parameters including immersion on Danube River are over V’th class. Transport volume is about 60 mio tones.

**Vistula River** is partly navigable. From the sea to Tczew it’s III’rd class with limits to 1,6 m, then from Ciechocinek to Toruń it’s II’nd class with limits to 1,4 m. From sluice in Włocławek it’s I’st class with limits to 1 m. From sluice in Włocławek to Płock it’s V’th class, depth 2,8 m. From Płock through Warsaw to Przewóz sluice in Cracow it’s I’st class with theoretical depth of 1,6 m. From Przewóz sluice do Łączyński canal it’s III’nd class, 1,8 m immersion. Łączyński canal - II’nd class, 1,8 m immersion. First section from Oświęcim to Łączyński Canal it’s IV’th class, 2,8 m immersion.

**Dead Vistula Vb class**

**Nogat, Szkarpawa, Kanał Jagielloński** - II’nd class

**Elbląski Canal** - Ia class

**Bug with Vistuga** - Bug - Dniepr Canal is a river partly canalised and at the section from Warsaw to Żerański Canal including Zbiornik Zegrzyński it has II’nd class, then from Brześć - Ia class but with no guarantee of immersion. From Brześć to Pińsk it’s 2 m immersion.
Turn over is around 1 - 2 mio tonnes. Belarusian side declares renovation to lower up the class to IV’th class.

**Narew River with Augustowski Canal** from Zegrzyński water basin to Pultusk it’s II’nd class, from Pultusk including Augustowski Canal to Belarussian border - Ia class.

**Oder -Vistula River.** There is a myth saying that Oder River is better than Vistula River. Both rivers in lower part has good parameters, but in whole they haven’t got homogeneous parameters allowing to long distance transportation. Project of connecting Oder and Vistula rivers exist from the time of building Klodnicki Canal (now Gliwicki Canal). Potential resulting from rail and road transport affirm that.

3 versions of routes:

1. From Gliwice to Oświęcim 60 km.

2. From Kędzierzyn through Rybnik Żory also to Oświęcim 90 km.

3. From Oder estuary close to Czech Republic border through Jastrzębie Zdrój to Goczałkowicki water basin 30 km.

First version seems to be most expensive due to course through urbanized areas. But it gives great potential because of the coal that can be transported. Second will be the longest which makes it most expensive and less used. Third - the shortest using Goczałkowicki water basin which may operate Jastrzębskie coal basin.

**Germany**

Although not part of the Baltic Sea basin Elbe-Labe is connected however with the Elbe-Lübeck canal to the Baltic. Annual capacity oscillate between 1 million tonnes due to the low parameters of locks. Acceptable parameters of barges: width 8m debt. 65 m, draft 1.5 m. The other place that connects the Elbe to the Baltic Sea is the Berlin water system. Through the Elbe-Havel Canal and the Canal Haveli the Elbe connects itself to the Oder through Szczecin to reach the Baltic Sea. Parameters of the vessels: the depth. 82.5, 9.5 units dipping 2m. Parameters for the river Elbe are not constant but dependent on water status.

Germany provides together with Russia, the most vivid demonstration in Europe of how the economic benefits of naturally navigable rivers can be extended over a vast territory by bold planning and construction of new waterways, starting in the late 19th century and continuing as we enter the 21st. The way the network has been developed, and its vital importance for the economy, carrying about 235 million tonnes (65 billion tonne-km) of freight each year, provide the backdrop for the remarkable growth in recreational use of the waterways since the 1960s.
The Elbe Aqueduct was opened in Magdeburg on October 10, 2003. High-capacity barges and push-tows now proceed from the Mittelland Canal to the Elbe-Havel Canal and Berlin without having to drop down to the river Elbe, which offers limited depths.\(^{20}\)

The three great rivers, the Rhine, Danube & Elbe, dominate the Waterways of Germany. They are connected by a network of canals in the north and by the river Main & the Rhine-Main-Danube Canal in the south. The lakes regions of Mecklenburg & Brandenburg near Berlin are populated with many bases for self-skippered boat rentals.\(^{21}\)

The Baltic Sea is available for inland waterway transport through waterways Hohensaaten-Friedrichshaler-Wasserstrasse and Oder-Havel connection, it is also possible to use the waterways in the region of Brandenburg and Berlin. This historically shaped system of river-channel was partially incorporated into the federal plan for expansion of roads, is currently being modernized and expanded. The connection with the Baltic Sea is also provided by Mittellandkanel. Port of Lübeck is planning greater use of the Elbe-Lübeck canal.\(^{22}\)

\(^{20}\) [www.eurocanals.com](http://www.eurocanals.com)

\(^{21}\) Ibidem.

Fig. 13. Waterways in Germany

Source: http://www.eurocanals.com
Fig. 14. Waterways in Germany

Source: http://www.worldcanals.com
3. Possibilities of integrating inland waterways into BSR system

3.1. Best Practice

To enhance the potential of inland navigation innovative solutions are being created. These are solutions in the field of communication, forms of crew training, and technology.

According to the PLATINA study only two countries within the Baltic Sea are examples of good practice. These are Finland and Germany. Other countries do not lead significant research in this area.

Germany has participated in work package “Job and Skills” platform for the implementation of the European Program NAIADES, therefore a lot of innovative solutions in Germany focused in the area of sourcing and training of captains.

Another example can be Project INLATRANS23. INLATRANS is an INTERREG IIC project under the BSR programme. Its overall objective is to promote inland waterways cargo shipments by identifying potential development in infrastructure & traffic systems and establishing a network of partners who share the common interest of developing a sustainable & efficient inland waterway freight system. It is believed that the outcomes from the INLATRANS project might lead to an increased cooperation in the Baltic Sea countries on utilization of inland waterways. One of the outcomes is the website which contains a database of infrastructure network and facilities in each participating countries.

In table 8 selected actions are presented.

Table 8

<table>
<thead>
<tr>
<th>Geographic area</th>
<th>FINLAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Paper rolls transport on Finnish lakes</td>
</tr>
<tr>
<td>Description</td>
<td>In the lake district in Eastern Finland, paper production is an important economic activity. Paper rolls are produced for both domestic and - more important - international markets. In the past, paper was exported by road and rail to e.g. Russia and Western Europe. For the last few years, waterway transport has been used as the main mode of exporting paper rolls. Sea-river vessels of companies such as Wagenborg Shipping are sailing up the lakes and the Finnish/Russian Saimaa Canal, which connects lake Saimaa to the Baltic sea through the Gulf of Finland and which has a capacity of up to 2,500 tonnes. The sea-river vessels can cross the Baltic sea to Szczecin in Poland and navigate to Berlin, or even to the Netherlands and the Ruhr area in western Germany. Currently around 100,000 tonnes of paper per year are being transported by waterways.</td>
</tr>
<tr>
<td>Objectives and targets</td>
<td>The shift to waterways had two objectives: • use of more environmentally friendly transport modes</td>
</tr>
</tbody>
</table>

**Cost savings due to less handling (direct delivery between production site and clients, without the need of terminal handling or road transport)**

**Users and stakeholders**
- several shipping companies (among which Wagenborg, but also e.g. Russian companies)
- paper factories

**Key success factors and innovative aspects**

The success is attributed to the fact that cost savings of 5 up to 10 EUR/ton could be realized, compared to traditional road transport, as well as the environmental gains which helped the image of the paper industry.

As such, the paper transport chain does not contain technological advantages. However it is rather unique in its unimodal transport chain from almost door to door.

Challenges for Finland to further develop inland waterway transports are to deal with winter season problems, i.e. due to ice, the services can only be delivered in summer, while rail or road need to be involved in winter.

**Geographic area**

**FINLAND**

**Title**

**Canal and fleet development - Keitele Canal**

**Description**

The Keitele Canal was built in 1993 with the aim of realising an 8 m water depth and sufficient height to allow feasible transport of timber and other wood products. For several reasons, at that time, the project was not completed. One issue was the fact that the waterway was only accessible in the summer season.

Today the sector is still affected by this uncompleted canal, not only because of the increased demand for environmentally friendly transport, and especially of the export of bio fuel produced in Finland, but also by the cruise industry, for which only a few vessels could enter the canal, while only minor investments were the barriers.

The infrastructure component of the project concerns:
- elimination of traffic obstructions on the route of the Keitele canal
- foundation and provision of working order of 10-12 terminals in the Keitele-Päijänne region

The target area of each terminal is 10-15 hectares with the shore line length of minimum 200 m. The preliminary plan is that the terminals will be subordinated to the Coastal and Inland Water Traffic Association which will lease them out to local chip plants and bio energy companies. The representation in the Association will be extended by local communities entering it.

An essential part of the project is also the construction of a new vessel in a domestic shipyard in order to provide all-year transportations. The vessel is privately financed through a newly established company named Biolaivat Ky.
Source: Biolaivat Ky

The vessel will be ultra light to allow ice-going, it will be energy-efficient and use the relatively environmental friendly LNG as fuel. Some of its features are:

- length: 110 m, width: 14 m, height: 10.4 m
- SOLAS 2002 17 F regulations to be used
- draught min. 0.5 m, ship’s own weight approx. 1,000 tonnes
- draught max. 2.4 m, total weight of vessel and cargo 3,400 tonne
- maximum capacity approx. 2,400 tonne (dwt)
- maximum capacity of ballast tanks 2000 m3 which can also be partly used for ballast
- 4 x propulsion thrusters, 2 in both ends

Objectives and targets

The objectives are threefold:

- to complete the canal started in 1993
- to establish terminals for (bio fuel and other) cargoes to be handled
- to construct vessels that allow year-round sailing

The project is macro-economically profitable. The realisation of the project supports the regional and local economy strongly. The long-term effect on environment, industry’s business preconditions and population’s life conditions is indisputably positive and its significance will increase.

Users and stakeholders

- Finnish Waterway Authority (FWA)
- Biolaivat Ky (vessel design & construction)
- exporters of bio fuel (clients)

Key success factors and innovative aspects

New ship design that allows year-round sailing, including dealing with ice.

Geographic area

GERMANY

Title

Calculator for combined transport with CO2 emissions - IMTIS Software

Description

Contargo specialises in trimodal container logistics. Since 1996 they have used an “Intermodal Tariff Information System” (IMTIS) which helps clients with evaluating the best transport mode and route. The system is permanently being updated and by now possesses knowledge of more than 115,000 destinations in Europe.

In 2007, the calculator was extended by a new factor: the CO2- emissions of each mode of transport. The system is easy to handle as you only need to enter the name of the seaport and the destination in the hinterland: the programme will suggest a route by means of combined transport, also including CO2 emissions. Thus, a comparison of the environmental friendliness of barge, train and lorry is possible.

IMTIS acknowledges a variety of factors in its calculations, i.e. if a ship travels up- or downstream, if the carriers need to travel with an empty container, the consumption relating to loading and unloading in the terminals and many more.

Transporting a container between Bruchsal (near Karlsruhe) and Antwerp by lorry produces 476 kg CO2- emissions. Using a barge and lorry would reduce the emissions by more than a half, which illustrates the advantages of IWT.

Objectives and targets

increase transparency of transport costs in money and environmental impact

Users and stakeholders

Contargo and clients (also open to public)
### Economic and ecological operation of inland barges with flow meters

**Title**
Economic and ecological operation of inland barges with flow meters

**Description**
The LEHNKERING fleet is or will be equipped with flow meters in the fuel system and a display in the wheel house. The display shows the fuel flow in litres per hour. As a result, the master directly sees the relationship between the speed of the ship and its fuel consumption. If the engine is operated at a slightly lower speed, the fuel consumption will be reduced remarkably without a big loss to the speed of the ship. This can be related to the effect of shallow water on fuel consumption.

The master, in cooperation with the freighting department, will quickly learn to operate the ship in an economic and environmentally friendly way, because the exhaust emissions depend on the fuel consumption.

**Objectives and targets**
Reduction of fuel consumption and conservation of the environment

**Users and stakeholders**
LEHNKERING Reederei GmbH
LEHNKERING Rheine-Fracht GmbH

**Key success factors and innovative aspects**
- fuel consumption is displayed and monitored real-time
- the ability and willingness of people to learn and to improve
- worth the money, easy, and fast realisable method to save fuel and conserve the environment

### ELWIS-Notices to Skippers = ELWIS-Abo

**Title**
ELWIS-Notices to Skippers = ELWIS-Abo

**Description**
The German Waterways and Shipping Administration (WSV, Wasserstraßeverwaltung) has a very extensive website - Electronic Waterway Information System (www.elwis.de) where different types of services are being offered, inter alia the “Notices to Skippers”.

The information, provided free of charge, contains fairway and traffic related messages, water level related messages with a 4 days forecast for the river Rhine and messages about the ice-situation.

The WSV has designed an inventory for the harmonised description of all available mooring facilities across all national waterways, which is part of the ‘Notices to Skippers’. The inventory aims at providing a full coverage of all waterways. The new inventory allows access to the following information:
- exact description of location (km of waterway, left or right bank, exact description of banks, fairway, port...)
- ownership of a waterway
- contact details of competent authority for a part of waterway
- vessel category
- mooring facility for dangerous goods
- restrictions at mooring facility (no land energy, no car parking facility)
- connections (transhipment facilities, nearest shopping location, coordinates of drive-through)
- infrastructure of mooring facility (car park, lightning, energy, waste disposal...)
This Inventory was to be available to all users in the beginning of 2011. Since winter 2009/2010 ELWIS provides a new information tool on current ice developments on national waterways. With an easy to use search machine an exact status of ice development on specific waterway stretches can be obtained online. This tool also allows a prognosis for the coming days and enables an overview how long the ice situation has already been lasting for. In addition, it can be seen which Ice-Breaker is working in which regional areas and when a breaking of ice can be expected. It is an easy system using pictogrammes in order to improve client-service. It is possible to register for specific regional waterways. Elwis-Abo is an automatic notice with selected information that is sent regularly or event-driven by e-mail to a free selecting e-mail address. Elwis-Abo also informs the skippers on blockings of waterways, locks or on accidents which facilitates the planning of the journey. Over 40 % of the German inland navigation fleet have subscribed to Elwis-Abo.

Objectives and targets
- comply with European RIS regulation and CCNR standards on Notices to Skippers
- provide user-friendly harmonised information, consolidate existing information in an easy to access way
- increase service to inland navigation shippers
- allow shippers to make a more precise planning of the transport-process

Users and stakeholders
- German Waterways and Shipping Administration
- all subscribers

Key success factors and innovative aspects
- user-friendly and free of charge
- services can be tailored according to needs; 4 days forecast for other stretches of the river Rhine and/or other rivers might facilitate effective voyage planning
- consolidation of up-to-date data across all regional boundaries.
- could easily be applied in other regions

Geographic area GERMANY

Title Integrated planning law

Description A revised infrastructure planning acceleration law (Infrastrukturplanungsbeschleunigungsgesetz) enables faster infrastructure investments (in average a decrease of 2 years per infrastructure planning project is expected) and decreases administrative burdens as follows:
  - The Federal Administrative Court is competent as the only instance for explicitly mentioned transport projects including seaport hinterland connections and enumerated waterway infrastructure projects (shortening of legal process for faster decisions).
  - Nature and Environmental interest groups have the right to participate in planning projects but only within a limited time frame of 2 weeks after the end of the public consultation process; they are not informed separately anymore but included in the general hearing process.

Objectives and targets
- decrease planning duration for infrastructure projects and increase planning stability for future investments
- prompt enforcement of planning approval procedure for waterway infrastructure projects
- consolidated examination of different aspects such as for example strategic environmental assessment

Users and stakeholders It is hard to define who are the real users and stakeholders of laws that are...
stakeholders enforced by national governments.

| Key success factors and innovative aspects | • bundling of revision levels of jurisdiction  
|                                          | • consolidation of examinations to be carried out  
|                                          | • simplification of public consultation process |

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<th>Geographic area</th>
<th>GERMANY</th>
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<th>Title</th>
<th>KLIWAS: interdisciplinary research programme on climate change</th>
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| Description | KLIWAS (Klima, Wasser, Schiffahrt) is a research programme comprised of more than 17 different research disciplines bundling more than 100 scientists in more than 30 independent projects of the German Ministry of Transport (BMVBS) which deals with the consequences of the climate change on waterway and inland navigation in Germany.  
Since 2009 adaptation strategies have been developed which should help the inland navigation sector to adjust to the changes of the natural circumstances caused by climate change.  
This research programme should protect the efficiency of inland navigation as well as the natural conditions of water and fauna.  
This project also acts as an advisory element for the Federal Government concerning the department “inland navigation/waterways”. Beyond, KLIWAS is likewise important for the agriculture and the energy sector because these are major partners of inland navigation. |

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<th>Objectives and targets</th>
<th>Analyse and mitigate the consequences of climate change for inland waterways</th>
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| Users and stakeholders | The German Weather Service (DWD), Federal authority for maritime studies and hydrography (BSH), Federal Institute of Hydrology (IfB) Federal Waterways Engineering and Research Institute (BAW) have joined forces to contribute research results to policy makers, industry representatives, different ministries, waterway users and other stakeholders. |

| Key success factors and innovative aspects | It is a broad and fundamental study which proves itself by the fact that this study makes it possible to arrive at future-proof decisions. |


Other interesting examples of the utilisation of IWT are described below.

**DIPCITY: Waste transport Liège, Brussels, Paris, Lille**

DIPCITY (Development of Inland Ports as Sustainable Tools for the CITY) is part of INTERREG IIIB/IVb - an EC funded initiative for knowledge sharing. DIPCITY entails the communication on good practices with waste transport by IWT in four cities, two in Belgium and two in France:

- Lille: waste production of up to 1,300 tonnes per day. Since September 2007 two valorisation plants are linked by barges, transporting a volume of approximately 220,000 tonnes per year
- Liège: the intercommunal agency INTRADEL ships household refuse over a 20km distance to an incinerator, using barges of 1,350 tonnes.

• Paris is leading the themes on multimodality and the role of ports in urban distribution

• Brussels: the port is leading the actions on the integration of ports into cities and the attractiveness of port areas.

Fig. 15 Transport of wastes and containers in France and Belgium


The project partners cooperate in five actual themes, the general objective is to strengthen the link between city and port, the themes are:25

• Transport of waste and recyclables on inland waterways.

• The attractiveness of port zones and city-port relations.

• The development of multimodal transport.

• The role of ports in the distribution towards the city.

• Port safety, security and environmental aspects

Airbus transport with Ro-Ro motor barge Bordeaux, France

Special motor- barge designed for the transport of Airbus aircraft body parts using Ro-Ro technologies, combined with a secure monitoring of this boat due to GPS positioning linked with navigation maps to ensure safe transport during transit under the narrow and low stone bridge of Bordeaux.

Objective & target is to avoid wide and heavy load lorries on the road to the plant.

Beer boat Utrecht (Netherlands)

Since 1996 a small ship is deployed by the City Council of Utrecht that supplies the shops, restaurants and bars located on the canal banks of the city centre. The ship is an alternative for road traffic that has to work under constraints like traffic jams, weight and length restrictions, supply times and environmental zones. The choice was made for a ship to prevent damages on historical wharf basements and bridges, caused by road traffic. The current vessel is an altered open-top, pram-shaped barge driven by a diesel engine.26

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Ibidem.
Talking about initiatives one should mention INTRASEA Project. One of the outcomes of the project is database, which provides key information on strategic inland waterways and routes in the Baltic Sea Region. The database consists of two parts, one for commercial fairways - goods transport - and one for tourism.

### 3.2. The development of containerisation premise of the potential of sea ports capacity through the use of waterways

The ability to participate in integrated IWT chains is a consequence of technological development in the container transport modes. Containers are today the basic load units in land and sea transport. They are the realisation of the concept of creating large batches of cargo which are packed together, what allows to simplify and speed up cost-intensive and time-consuming operations handling especially in seaports. Containers now dominate in intermodal transport. However also as the loading units others - semi-trailers, swap bodies, lorries are used. In the containers bales of paper, and even some types of coal and coke are transported. Currently over 500 million TEUs are transhipped worldwide. By the year 2014 - according to forecasts - the transport volume will reach 700 million TEUs. It affects mainly the growth of global trade, but not without importance is the promotion of intermodal transport carried by many European Union countries.

The success of containerisation is a chance for inland waterway transport development particularly in the service of sea ports’ hinterlands. An additional premise for the use of inland waterway container traffic is a massive character of this mode of transport and the use of economies of scale of transport. Container ships calling at ports carry even 8 000 TEU at one time. Inland navigation is particularly suited to handle such a large batches of cargo using the sets of barges once transporting even 100-500 20 feet containers. A barge type Motor Europe (length 85 m, width 9.5 m) allows the transport of three rows of 54 TEUs, which is equivalent of about 50 lorries. Modern big motor barge GS (Grossmotorgueterschiff) in the shorter version (length 100 m, width 11.40 m) allows to move 88 TEUs, and the capacity of a typical, large motor boats with a length of GMS 110 m and a width 11.4 m is 96 TEUs. For transport of containers the barges ro-ro decks, universal barges and river-sea vessels can also be used.

For the carriage of containerised general cargo by the inland waterway a specialized container fleet can be used. According to the Central Commission for Navigation on the Rhine annual sum of more than one million TEUs is supplied by the inland waterways on the Rhine to and from the ports by using a specially constructed vessels used for transporting containers. These vessels will be gained in importance in the future also in shipping on the Danube. Sets of barges being pushed and having total capacity of 576 TEUs.

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28 http://www.pgt.pl/index.php?option=com_content&task=view&id=901&Itemid=4
30 http://www.hafen-hamburg.de
are considered in the future optimal method of container transport on the Danube. Each 
individual set would transport of 144 TEUs arranged in three levels. For comparison “JOWI 
the largest container ship sailing on the Rhine (length 135 m., width 17 meters) has a capacity of 500 TEUs \(^{32}\).
Conclusions and proposed actions

Inland waterways shipping in BSR needs investments that would bring the waterways to the state that allows its usage. Rest of the elements which create market game - subjects and clients - will appear at the market if the conditions to trade business appear. Inland waterway branch has a relatively weak position due to small market share but the potential exists at least in countries like Poland, Czech Republic, Germany and chosen transport connections and market segments (for example in Poland it could be - transport of coal from Silezia and transport of containers to and from sea ports).

Transport policy, due to many regulations on the market concerning internalisation of external costs, will make it necessary to conduct economical calculations, which include on the same level economical and social costs and benefits, its spatial influence and infrastructure capacity.

To make White Paper conception real, The European Commission plan an expansion of eco-friendly modes of transport. In this context perspectives of inland shipping are good. Faced with such European transport policy - European countries cannot neglect inland shipping development. The impulse and transparent measures for creating and stimulating this mode of transport from policymakers are needed - especially of long-term character. Good example is Germany - a country situated in the middle of European inland waterways network, which uses its natural potential of inland shipping. 63% of European inland waterways freight is being carried on the river Rheine 33.

Transport should be organised in an environmental friendly way. Inland shipping is one of the most eco-friendly modes of transport. One of the main directions of economical policy development is the policy based on stopping the climate change, resources management and securing energy supplies. “Greening the transport” is most popular watchword. “Greening the transport”, “Green corridors”, “Green logistics” - political slogans are based on environmental friendly solutions.

The study of Dutch company Planco34 from 2007 shows clearly that external costs of inland shipping bulk cargo are 83% lower than in road transport and as for rail transport - 70% lower. In container transport it is respectively - 78% and 68%.

External costs generated by Inland shipping are very low - 0.10€/100tkm. In road transport it is 1,94€/100tkm, rail transport 0,43€/100tkm. To show it clearer - costs of building and maintain infrastructure are 0,82€/100tkm for inland shipping, 1,86€/100tkm in rail transport and 0,51€/100tkm in road transport35. Although costs of building and maintenance of inland waterways are higher than road infrastructure, relation between external costs to expenditures are most beneficial for inland shipping.

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Energy absorption for Inland shipping is over 10 times lower that it is in road transport (0,43 MJ/tkm for Inland shipping; 4,06 MJ/tkm for road transport; 0,73 for rail (diesel engine); 0,59 MJ (electric engine)). Pollution emission made by transport vehicles depend on their load capacity and technical solutions. But it is always positive for inland shipping.

External costs in inland navigation are mostly estimated in an unfavourable way. Costs of building and maintenance of road and rail infrastructure are totally ascribed to those modes of transport, because the infrastructure is are being used only by them. Inland waterways has many users. Waterways are used as water supplies, for water sports and exploited by industry. According to that, costs of building and maintaining waterways shouldn’t be ascribed only to inland shipping.

How big is efficiency in inland transport - it might be presented with this example: a container barge navigating on Rheine with capacity load of 3000 tonnes can transport by once cargo corresponding to 120 lorry tractors or 75 rail carriages. “JOWI” the biggest container ship which navigates on Rheine (135m length, 17m width) has 500TEU load capacity. In inland shipping there is no congestion. Time of the transport on the most popular waterways: Rheine, Men or Danube is longer that rail or road transport, but only then, when there is no congestion for other modes of transport.

Transport on inland waterways is economical competitive in comparison to land transport and might be the dominant form of transporting mass goods. Using bigger ships may cause an increase in demand for water transport, which will lower down transport price.

Inland shipping is the most environmental friendly mode of transport, and the only one with carriage capacity reserve.

To strengthen potential of this mode of transport, innovative solutions are being constantly created. Including information transfer, forms of crew trainings or other effective technical - exploitation solutions. Examples of Germany and Finland show that it is achievable (see “Best practice”).

In Baltic countries water transport is underestimated not only from economical view but also ecological and technical.

The assessments of capacities of described waterways in BSR and possibilities to transfer land transport to inland shipping and inland-sea shipping showed, that almost in every case there are huge potentials. On weakly expanded inland waterways in some polish regions and Baltic countries it might be possible only when necessary infrastructure development will be started. Almost all inland waterways in BSR still have transport capacity. Their

usage may be achieved by lowering down “bottlenecks”. It relates mainly to shallow rivers, too low bridges and limited size of sluices.

Full usage of inland shipping and inland-sea shipping might cause that combined transport of containers from Berlin through Szczecin to Scandinavia, would be more economically beneficial that road transport on ro-ro ferries. The problem is, that in comparison to single road transports at anytime, collective transport working at a time schedule might be necessary. At existing market conditions this process might be hard for realisation.

Huge opportunity for inland shipping might be container transport in Baltic region.

Baltic region is dynamically developing economical area with highest position in international trade, which leads to trade connections intensification. The increase in recent years allows to assume, that turnover will double until 2020. Sea transport has a great opportunity to increase its share in modal share, and thus also for inland shopping in Baltic countries there are perspectives for freight transport increase.

Existing configuration of transport corridors in Baltic region - sea and land - and formed trade relations between them, and above all planned new connections in this region and its direct neighbourhood, including opening so called Northern Maritime Corridor - NMC connecting Europe and Asia - mark new directions of trade and accordingly new modal split in this part of Europe.

Development of transport corridors in this configuration, without promoting sea transport in inter and external - Baltic connections, may cause therefore threats for further development of sea transport in the Region. Planned transport corridors in any case, that means independently from pace of realisation of those infrastructural investments, may change existing configuration of strengths in this part of European transport market and, as a consequence - may cause demand - supply relation change between each partial transport markets. It may cause a danger for inland shipping, which activity is directly connected to hinterland transportation.

These are the main factors that could be important for future development of inland navigation in the BSR:

- Development of common market in BSR will generate increase in freight transport;
- Development impulse in form of financial resources designated for inland waterways investments is needed;
- Inland shipping has a chance to inscribe itself into intermodal transport chains, especially in containers transport;

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39 Hautau H., Pawellek G., Schönhnecht A.: Binnenschifffahrt im Ostseeraum: Ungenutze Potenziale. op. cit
40 Grzelakowski A.S.: Rozwój transportu morskiego w regionie Morza Bałtyckiego, Zeszyty Naukowe Akademii Morskiej w Gdyni, nr 67, grudzień 2010, s. 82.
41 Grzelakowski A.S.: Rozwój transportu morskiego w regionie Morza Bałtyckiego, op. cit.
• There are group of products especially predisposed to be carried by this mode of transport - there is potential to use this type of transportation in Baltic region. Example of Finland (paper rolls) indicates that it is beneficial activity;

• Full usage of inland shipping in the Baltic area will be coherent with European transport policy goals;

• Initiating in Baltic countries innovative solutions will allow increase of inland shipping capacity and strengthening its market position;

• Inland waterways ports should be developed as an intermodal transport nodes function;

• Building new road and rail connections may cause danger for inland shipping.

Traditionally, inland shipping has specialised in the transport of bulk goods, but in recent decades is also entered in the segment of high-value freight and containers. This trend occurs mainly in countries of the so-called the old EU, while in the new member states is only in its infancy. This also applies to the development of such sectors of the transport market, such as transport of waste, recycling and transportation of dangerous goods and transport of vehicles and heavy cargo. In these areas, inland waterways of Western Europe achieved very good results.

In the Baltic states inland shipping is not yet properly appreciated not only in terms of its economic and ecological importance, but also from a technical point of view. Consequently, the inland waterway transport is often regarded as an “inferior” mode of transport, what is the reason that the existing potential is not exploited sufficiently.

In the Program INTRASEA Vision 2020 + the proposals have been presented, whose implementation should contribute to a fuller use of inland waterways in conjunction with other carriers:

• development of a common market in the Baltic Sea region will generate an increase of freight;

• logistics strategies in a globalizing economy will also have a regional impact;

• year-round coastal shipping will be the main carrier across the Baltic;

• inland navigation will be for the Baltic region (including the western part of Russia), an efficient mean of transport;

• spatial planning will focus on the future location of centres of intermodal freight transport in the nodal points, such as ports, river, rail and road routes;

• better use of inland navigation in the Baltic Region will be consistent with the objectives of European transport policy, therefore, contribute to improving road safety;

• the introduction in the Baltic states the electronic systems will allow to significantly increase the efficiency of inland navigation.
The authors of the project postulate the increase of the level of integration of logistics chains, which use the inland waterways. This is undoubtedly the correct view. Observation of the market of transport services leads to the conclusion that without this integration it will be difficult to encourage transport users to switch from direct road transport to more organizationally complicated waterborne one, even if the latter is very cheap.

Another area in which inland navigation could show its advantages is tourism and recreation especially in Baltic Sea Region. The Region have great tourist and recreation value what is appreciated by tourists who more and more often come here to spend their leisure time. The demand for such services is considered to have substantial impact on regional development. The tourism industry is expected to grow in the BSR and inland transport can play important role in this development. The inland waterway can offer not only typical transportation services but also tourism related high quality services. And what is also important the development of such branches goes along with sustainable EU’s policy. Of course also here proper infrastructure investments are needed. The question is how much different these tourism related investments are from the ones for cargo transport.

There is a need for conducting an extensively research concerning the IWT especially in the context of integrating it with the whole Transport System of the Region. Without solid analysis backed by economy calculations it is impossible to find optimal solutions concerning the role of IWT in the BSR transport system. The advantages of inland transport are generally widely described in many expertises, analysis, documents, research papers. There is however a need for conducting economic (widely understood) calculations, the results of which would serve as an argument for changes in transport policies in favour of inland navigation.

That is why a feasibility study must be conducted, which of course is not an easy task. Firstly due to limited access to necessary data, secondly one of the goals of this feasibility study is to identify needed actions (Investments, legal initiatives).

This should take the form of a cost-benefit analysis of investments in inland transport (Fig. 15) which would take into account different problems e.g. the impact on socio-economic prosperity and growth in the Baltic Sea Region, impact on environment, possibilities of shifting the long road haul traffic to IWT, efficiency of IWT. The idea of such an analysis is to take into account the effectiveness of operators (micro level) and its results for the whole economy. In the case of inland water transport the calculations are specific and differ to some extent in comparison to calculations made for other modes of transport (or at least should differ). Investments in inland infrastructure (rivers, canals) have an impact not only on transport alone but also on the whole economy and society what of course should be taken into account also in the other modes of transport. There are, however, some issues that are specific for the inland water transport problems. Maybe there is a greater chance for this form of transport to serve other needs than needs of shippers of commodities. Water infrastructure could be used for passenger transport and for tourism. The second problem are floods and the associated costs. It is estimated for example in

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42 If for example this kind of tourism becomes fashionable.
Poland that since 1997 up to 2010 the costs of damages caused by floods amount to 30 billion PLN (7.5 billion EUR). This should also be included in the analysis. On the other hands however there is a question if these different needs can be fulfilled by the same investments and thus total costs can divided between different users. For example as the INTRASEA’s authors noted: “water services (energy) and water supply functions have quite different demands”. It is interesting if such “conflict” doesn’t exist between cargo inland transport and transport for tourism purposes. Perhaps a proper strategy should be worked out in order to exploit the advantages of this mode of transport in the optimal way.

The key task of the research will be a feasibility study of IWT development. In order to work out concept of inland water transport development in the BSR which could be assessed on the basis of measured criteria the concrete data will be needed. These data concern: present and forecast flows, transport needs of users and their preferences, types of commodities that are suitable for this mode of transport, bottlenecks, etc.

It is also important to take have in mind specific features of inland navigations. For example although inland transport can be named as a bulk mode of transport, it is used on relatively shorter distances what seems to be rather unique situation in comparison to rail and sea transport. Therefore, the question arises - to what extent the inland waterway transport can significantly exploit economies of scale. The relation between distance and costs exist. For example on the relation Hamburg- Berlin costs are 17 % lower in comparison to rail (284 km by rail, 357 km by waterway) and between Rotterdam-Duisburg costs of carrying containers are 43% lower (268 km - rail, 229 km waterway). It is interesting that this correlation is not proportional. We can only guess that distance is not the only factor but in order to find out what are the reasons a research should be conducted.

Such a study should take into account a broader view - trends in the surroundings of transport. For example it is interesting to study the impact of changing strategies of potential users in post crisis global economy. Some enterprises are reevaluating their strategies, becoming more and more willing to act regionally instead of globally due to first of all increasing costs of transport (fuel). It may seem that it is a factor that favour inland transport which is used in domestic or regional distribution. From the other hand however if inland transport is a part of global logistics chain the time of delivery by a waterway has no significant impact on the total time of transport from point of origin to destination. As it was said earlier - probably the best strategy for inland transport could be to serve sea ports and perhaps indirectly also the global trade.

New conditions for the functionality of transport result not only from globalisation but also from other phenomena on a European or even national scale - bigger and bigger financial burden, stringent regulations.

The possibility of categorical statements on what may be the impact of above mentioned phenomena and trends on inland navigation’s development requires in-depth study.

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43 Purely Inland – and not river – sea transport.
44 Verkehrswirtschaftlicher und ökologischer Vergleich der Verkehrsträger Straße ..., op. cit, 35, 38.
There is also a problem of a proper calculation methods. Some authors notice the problem of different approaches to costs of inland transport in different countries. As stated in the Final Report of INTRASEA Project (p. 9):

“The high cost of upgrading the systems is difficult to justify using the applied models of assessing the benefit to cover for the costs”.

The problem is not only costs but also demand for waterborne transport and its quality. It is interesting that demand for the services of this mode of transport is relatively low. For example in road transport sector customer in most case look for the cheapest possible carrier. There are few shippers who choose better services from for example logistics operators what means that very often the price have the highest quality (despite that in the modern transport economics theory quality has the highest rank). It is understandable why rail loses market in competition with road carriers - it is not cheap and at the same time offers poor service. Inland navigation’s quality level however is also low but it offers low price. In fact the problem is not what is more important - price or quality but the relation between them. It seems that service of inland transport is too poor even for such competitive price. A question arise here in connection to this problem - what should be a proper marketing strategy for IWT - to increase level of quality or to decrease even more the price or both? The decrease of demand is linked with the change of the demand structure (bigger share of high value goods). The demand exists and can be high but in chosen market segments and in these segments the inland navigation will be competitive. It can play its role in chosen regions. It is very difficult to find answer for this question without conducting profound market research which should help understand what are shipper’s preferences.

Talking about quality it is worth to come back the problem mentioned already - transport of hazardous goods. As we said earlier in this expertise inland navigation could be suitable mode of transporting dangerous commodities. From the other hand the effects of environmental contamination could be also bigger than in road transport, especially if volumes transported were really relatively bigger. That means that additional expenditures would be required in order to increase safety on water and more complex economical calculations should be carried out.

The result of the feasibility study should be a list of investment in infrastructure, logistics and transport capacity which will be needed. There is no chance for investing in all, of political interests the BSR countries needed connections, so there’s one should concentrate on the actions that have the greatest potential for success and could enable the attainment of the goals mentioned earlier. Priority should be given to projects which are important from the point of view of the whole region and help in integrating the whole Transportation System of BSR.
Fig. 18 The scheme of Cost & Benefit Analysis of inland transport investments

*Source: author’s own work*
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