
Assessment of the Potential of the Main Seaports of the Baltic Sea Region

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Abstract:

Purpose: The aim of the study was to assess the potential of the major seaports of the Baltic Sea Region (BSR).

Design/Methodology/Approach: This analysis covered the seaports included in the Trans-European Transport Network (TEN-T) in the European Union (EU) and the major Baltic ports of the Russian Federation. The research was based on an analysis of the data found. An assessment of the surveyed seaports was made on the basis of the author's index comprising four sub-indicators. The following were taken into account: access to ports from the sea and land, functioning of intermodal terminals, connection from ports to industry, size of the port centre.

Findings: A total of 89 ports from nine countries were surveyed, of which 17 received a good rating on a three-point scale. The ports of Gdansk, Riga and Gothenburg were rated highest with the maximum number of points. The results of the assessment were partly in line with the previous classification of the ports and the current handling volumes. Differences were due to the fact that other factors, especially geopolitical factors, additionally influenced the cargo volume of individual ports.

Practical Implications: On the basis of this analysis, it is possible to identify seaports in the Baltic Sea region that have the potential for further development and those where further development of the port requires investments primarily related to improving access to the port.

Originality/Value: This article presents the results of my own research into various aspects of seaports in the Baltic Sea region. Part of this analysis is an update of previous research, which has made it possible to identify changes in the environment of some of the ports studied.

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1. Introduction

Seaports are important transport hubs and are of strategic importance to coastal states and regions. In the Baltic Sea Region (BSR), there were more than 250 ports with transshipment berths (Bochenski, 2019a). In contrast, 89 Trans-European Transport Network (TEN-T) ports were included in the present study, including 22 core network ports (Regulation (EU) No 1315/2013; Ziółkowska *et al.*, 2018) and six ports in the Baltic Federation, including two in the Königsberg Region and four in St Petersburg and Leningrad Region. A total of 95 seaports were included in the study.

It was assumed that the most important factors influencing the size of a port and its trade volume include: access to the port from land and sea, proximity to a major city or agglomeration, a developed processing industry benefiting from the port's proximity and having intermodal terminals. These factors have therefore been taken into account when assessing individual ports.

2. Literature Review

The Baltic Sea Region (BSR) has been variously delimited and comprises between 9 and 11 countries, including one or two only partially. A review of the delimitation of the Baltic Europe region was made by Palmowski (2017). The undisputed BSR countries include Finland, Sweden, Denmark, the north-eastern part of the Federal Republic of Germany (the states of Mecklenburg-Vorpommern and Schleswig Holstein), Poland, Lithuania, Latvia, Estonia and part of the North-Western District of the Russian Federation (Kaliningrad Oblast, Leningrad Oblast and the city of St. Petersburg). This is also the area assumed in this analysis.

Relevant in the context of the present analysis is the research of Bochenski, who identified ports with transshipment berths in the BSR and investigated the connection of these ports with land transport (2019a; 2020) and industrial plants (2019b). This author also classified the BSR ports taking into account trade volume, specialisation and hinterland connectivity.

An important source of information on the operation, including cargo turnover of BSR ports are reports published by the BPO and other institutions (e.g., Klopott, 2016; Synak-Miłosz and Rozmarynowska-Mrozek, 2023; Ziajka and Chmielecka, 2023; Ziajka and Rozmarynowska-Mrozek, 2021; 2023).

They contain data on cargo turnover and cargo groups handled in the largest Baltic ports. It was also helpful to read the trade press and conference materials of Maritime Economy Forum Gdynia 2023 (2023), which contained articles discussing the current situation in the studied ports.

3. Methodology

The research procedure consisted of three stages. In the first, assessments were made on four indicators. The rating scale in each case was a three-point scale. The scores were then added up and the surveyed ports were divided into three groups, poor (1-4 points), medium (5-8 points) and high potential (9-12 points). The following elements were assessed:

- seaward access - maximum draught of vessels: 5.0-9.9 m - 1 point, 10.0-14.9 m - 2 points, 15 m and above - 3 points;
- access from land - one point each for: connection to public road, rail transport (port rail siding), connection to inland waterway of 4th and higher class navigability;
- intermodal terminals and links to industry - one point for: ferry terminal, container terminal, non-maritime industrial plant (shipbuilding and fish processing omitted) connected to the port so-called near-port industry (see: Bocheński, 2019b)
- proximity to a large city - the boundaries of the ranges were determined on the basis of the average size of the cities in which the surveyed ports were located, excluding the two largest cities of St. Petersburg and Stockholm: 50-99% of the average i.e., 46-91 thousand inhabitants - 1 point, 100-199% of the average i.e., 92-183 thousand inhabitants - 2 points, 200% of the average i.e., 184 thousand inhabitants and more - 3 points.

The next, third stage of the research was to look at the ports with the highest cargo turnover. A list of the 'Top 10 Baltic ports' based on data for 2019-2022 was used and matched with the ports with the highest rating.

The data used in the assessment came from publications by T. Bocheński (2019a; 2019b; 2020), information on the maximum parameters of ships handled at a given port (The Shipping Platform, n.d.) and cartographic material (OpenStreetMap, 2023). On the other hand, reports from the Port Monitor series (Ziajka and Rozmarynowska-Mrozek, 2021; 2023) were used to identify ports with the highest cargo turnover.

4. Results

The first element of the assessment was access to the surveyed ports from the sea. In the surveyed group, 43% were ports accessible to vessels with a draught of up to 10 m (Table 1).

There were only 15 deep-water ports in the Baltic Sea fully adapted for Baltimax-class ships: four Finnish (Kotka, Naantali, Pori, Sköldvik), three Swedish (Göteborg, Nynäshamn, Oxelösund,) and Russian (Primorsk, Ust-Luga, Vysotsk), two Latvian (Riga, Ventspils), and Estonian (Tallin Muuga, Sillamäe), and one Polish (Gdańsk).

In contrast, a further 38 ports surveyed were open to vessels with a draught of between 10.0 and 14.9 metres (The Shipping Platform, n.d.).

Table 1. Access to the ports under study - selected parameters

Country	Number of ports	Maximum draught of vessels			Inland waterways	Port railway siding
		under 10 m	10,0-14,9	15 m and over		
Total	95	41	39	15	11	64
Denmark	26	19	7	0	0	8
Germany	6	3	3	0	2	6
Poland	5	2	2	1	3	4
Lithuania	1	0	1	0	1	1
Latvia	3	0	1	2	1	3
Estonia	8	5	1	2	0	3
Finland	17	4	9	4	0	15
Sweden	23	8	12	3	1	19
Russian Federation	6	0	3	3	3	5

Source: Own elaboration based on Bochenki, 2020; OpenStreetMap, 2023; The Shipping Platform, n.d.

The second element of the assessment was access to the surveyed ports from the land side. In the study group, 67% of the ports had a railway siding (Table 1).

It is worth mentioning that due to the construction of the rail and road tunnel under the Fehnerbelt between Denmark and Germany and the reconstruction of the railway lines leading to it, the ports of Puttgarden and Rødby were temporarily deprived of rail access.

Access to inland waterways included in the AGN agreement with 4th or 5th class navigability was available to 12% of the surveyed ports (Table 1). Despite this, inland waterway transport could only be used effectively in the case of 7 ports (Kiel and Lubeck in Germany, Świnoujście, Police and Szczecin in Poland, Goteborg in Sweden and St. Petersburg in the Russian Federation).

The third element of the assessment is the operation of intermodal terminals at the port in question and the port's connection with industrial plants, which are important generators of cargo turnover.

Among the ports surveyed, 64% had ferry or ro-ro terminals and 36% had container terminals (Table 2). 18 ports (19% of those surveyed) were exclusively ferry berths that were extensions of important land routes connecting the northern and southern Baltic Sea coasts or islands with the mainland. Near-port industry establishments were identified in 35% of the ports surveyed. These included:

- chemical plants in 9 ports, including 4 in Sweden (Helsingborg, Karlskrona, Kokkola, Norrköping), 3 in Poland (Gdansk, Police, Szczecin) and one each in Latvia (Riga) and Estonia (Sillamäe);
- oil refineries in 7 ports, including 2 each in Denmark (Fredericia, Statoil-Havnen), Finland (Hamina) and Sweden (Nynäshamn, Göteborg) and one each in Poland (Gdansk) and Russia (Ust-Luga);
- wood and paper industry plants in 6 ports, including 3 in Finland (Jakobstad, Kaskinen, Oulu), 2 in Sweden (Gävle, Umeå) and one in Latvia (Ventspils);
- metal works in 6 ports, including 3 Swedish ports (Luleå, Oxelösund, Sundsvall), 2 Latvian ports (Riga, Ventspils) and one Finnish port (Raahе);
- mineral industry plants in 3 ports, including 2 Swedish (Karlshamn, Köping) and one Danish (Aalborg);
- biofuel plants in German Kiel and Latvian Ventspils;

Previously, there were also coal-fired power plants at the ports using imports of this raw material by sea. This was particularly the case in Denmark and Finland. However, due to CO₂ reduction policies, these were closed or converted to burning biomass - thus ceasing to use the supply by sea.

At present, the only back-up thermal power plants operating in the surveyed ports are the heating oil plant in Karlshamn, Sweden, and the coal plant in Pori, Finland.

Table 2. Near-port industry and intermodal terminals at the ports studied.

Country	Number of ports	The percentage of ports with		
		near-port industry	ferry terminal	container terminal
Total	95	33	61	34
Denmark	26	4	18	7
Germany	6	1	5	3
Poland	5	3	3	3
Lithuania	1	0	1	1
Latvia	3	2	3	1
Estonia	8	1	7	1
Finland	17	8	7	7
Sweden	23	12	14	8
Russian Federation	6	2	3	3

Source: Own elaboration based on: Bocheński, 2019b; OpenStreetMap, 2023.

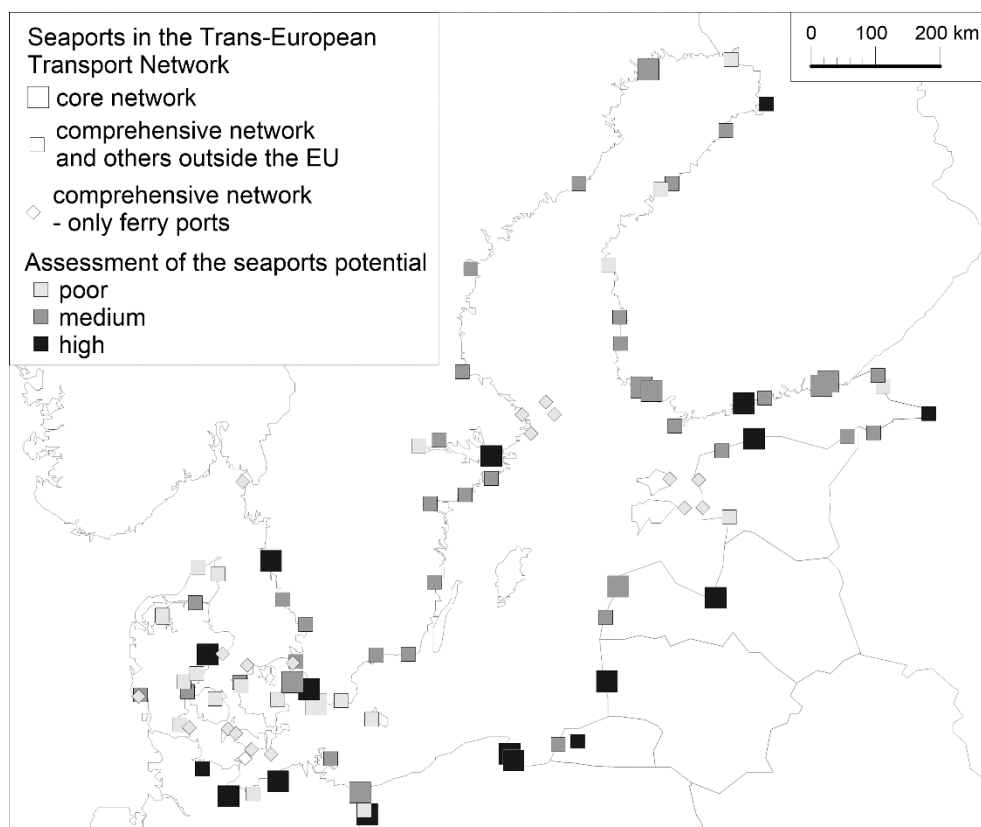
The final assessment criterion was the size of the port centre. The population of more than 70 % of the surveyed port centres was below the average for the surveyed group. The largest port cities on the Baltic Sea were St. Petersburg with 5.6 million inhabitants and Stockholm with 1.6 million inhabitants.

More than 0.5 million inhabitants were also found in Gothenburg, Riga and Copenhagen, and if we consider agglomerations also Tallinn, Tricity (Gdansk,

Gdynia, Sopot) and Kaliningrad. In 5 cases, the studied ports were located in the capitals and at the same time the largest cities of the Baltic countries (Stockholm, Helsinki, Riga, Copenhagen, Tallinn).

On a three-point rating scale, 18% of the surveyed ports received a high rating, 39% a medium rating and the largest group a poor rating (Figure 1). The maximum rating (12 points) was given to Gdańsk, Riga and Gothenburg, followed by Rostock, Tallinn and St. Petersburg with 10 points. The most important factor determining the rating was access to the port and its connection to the transport system.

Figure 1. Assessment of the ports surveyed



Source: Own elaboration.

The situation in the BSR countries with the largest number of ports is interesting. Denmark, which had the highest number of ports, was by far dominated by small ports with little potential. The port of Aarhus, the most important container port in Denmark, was rated highest (9 points).

Many of the ports were mainly used for ferry shipping, connecting numerous islands. In Sweden, 61% of the ports in the study group were medium-sized ports.

In addition to Gothenburg, the highest rating went to Malmö and Stockholm, which scored 9 points each. The situation was similar in Finland, where the group of ports with an average score was 59%. Helsinki and Oulu scored best with 9 points each.

Among the BSR countries with fewer ports, only Estonia had a preponderance of ports rated poorly. These ports primarily served ferry shipping which was the only connection to the islands.

5. Discussion

Bocheński (2019a) distinguished four classes of ports: main - primary, supporting - secondary, complementary – tertiary and other - quaternary. In this classification, he took into account the ports' access to rail transport, the range of goods handled and the volume of cargo handled.

The main - primary - BSR ports included: Gdansk and Gdynia in Poland, Gothenburg in Sweden, harbour complex Hamina-Kotka in Finland, Klaipeda in Lithuania, Riga in Latvia, harbour complex Tallin in Estonia, St. Petersburg and Ust-Luga in Russian Federation.

Compared to that study, the present analysis additionally covered port access to inland waterways and the issue of industrialisation and intermodal terminals, while the range of goods handled and the volume of cargo turnover were omitted. For a comparison of the results of these studies (Table 3).

Table 3. Comparison of port assessment with T. Bochenki's classification

Class of port 2019	Assesment of port 2023	Ports
first-class	high	Gdańsk, Gothenburg, Riga, Gdynia, Klaipeda, Hamina-Kotka*, St. Petersburg, Tallinn,
secondary	medium	Ventspils, Sköldvik, Naantali, Kokkola, Raahe, Luleå, Rauma
first-class	medium	Ust-Luga, Fredericia
secondary	high	Rostock, Helsinki, Kaliningrad, Lübeck, Malmö, Stockholm, Szczecin
third	poor	Primorsk, Vysotsk
third	high	Oulu

Note: * assessment after considering both ports together.

Source: Own elaboration based on: Bocheński, 2019a.

If we look at the cargo turnover of ports in recent years, the list of the Top 10 Baltic ports includes three Russian ports (Ust-Luga, Primorsk, St. Petersburg), two Polish ports (Gdansk and Gdynia) and the ports of Szczecin-Świnoujście, Sweden's Gothenburg, Lithuania's Klaipeda, Germany's Rostock and Estonia's Tallinn.

There was a noticeable increase in the importance of Polish ports and the largest German Baltic port, Rostock. In 2015, in the list of Top 10 Baltic ports from Polish ports, only Gdańsk was in seventh position (Klopott, 2016).

In 2019, Gdansk was already in fourth place, in 2021 in third place and in 2022 in second place (Ziajka and Rozmarynowska-Mrozek, 2021; 2023). At the same time, a decline in the importance of Latvian ports was apparent - the ports of Riga and Ventspils were still ranked 4th and 8th respectively on the list of Top 10 Baltic ports in 2015, while in 2019-2022 they were outside the Top 10. The position of a given port and its cargo turnover does not depend solely on its potential, but also on geopolitical considerations.

As a result of the war triggered by the Russian Federation, supply chains have changed. Imports of Russian raw materials to the EU were largely halted, PRC-EU rail transit was reduced and some shipowners stopped calling at Russian ports.

This situation has had a significant impact on transshipment volumes especially in the ports of the southern Baltic. Until 2022, imports of energy raw materials (oil, gas, coal) to Europe were mainly transported by rail and pipeline from the Russian Federation.

The reduction and subsequent cessation of supplies from this direction made it necessary to import raw materials by sea from other parts of the world. The closure of the branch of the Druzhba pipeline supplying Poland from the Yamal and Nord Stream pipelines led to an increase in the volume of imported LNG and oil transhipped at Baltic ports.

In the case of EU countries, these raw materials were imported from the USA and the Gulf States, while Russian ports exported the same raw materials to the Asian market.

Ports in Lithuania, Latvia and Estonia recorded declines in transshipments, which should be linked to a reduction in transshipments of goods originating from Belarus and Russia.

These countries are small and poorly industrialised, so an important part of the hinterland of the ports there is Belarus, which, as an ally of Russia, has also been sanctioned. At the same time, however, transshipments of containers and LNG have been growing at the Lithuanian port of Klaipėda.

Another factor affecting the development of Baltic ports is EU climate policy. As mentioned, countries in the region with seaborne coal-fired power plants in their ports have replaced this raw material with others, which has translated into a decline in port handling. Oil consumption is also falling in the Nordic countries and Finland.

6. Conclusions

The potential of individual ports has an impact on their cargo turnover, but other factors that cannot be measured by simple indicators are also very important. The size of a port's hinterland and competition between ports, as well as geopolitical conditions, play an important role. The latter are the most unpredictable and have an impact especially for ports whose hinterland includes the area of neighbouring countries (e.g., ports of the Baltic States).

Based on the assessment of the investigated ports and trends in cargo turnover, further growth in cargo handling can be forecast for the port of Gdansk. Klaipeda also has considerable potential, but further growth is contingent on the port's expansion and adaptation to accommodate the largest vessels entering the Baltic Sea.

In addition, the volume of trade with Belarus is the most important for the ports of Klaipeda and Riga, which is significantly influenced by geopolitical conditions related to the course of the war with Ukraine.

In recent years, changes in the economy related to EU climate policy, including a reduction in the use of fossil fuels, significant amounts of which are imported by sea, have become increasingly important.

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