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Polish Container Ports, New Baltic Hubs?

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ABSTRACT: Over the last decade, the Baltic ports have welcomed a remarkable growth, especially oil transportation and containerised flows. The regional container network is mainly made up of feeders services. Consequently, Baltic ports as nodes of a regional maritime network are integrated into a larger system. Indeed, the port development and the evolution of maritime traffic are symptomatic of economic and territorial mutations.

In this context, the Polish ports, Gdansk and Gdynia, were originally mainly connected to the Polish hinterland and Central European market. They are now becoming new transshipment ports for the regional traffic. It is especially the case for Gdansk which recorded considerable and continued growth in container traffic during the last years.

The purpose of this paper is to analyse the activity of the Polish container ports and examine their role and position in the Baltic and European container network. This study is based on a literature review and mainly on the analysis of a statistical database as well as using Automatic Identification System data.

1 INTRODUCTION

World maritime trade is increasingly depended on containerization. The traditional gates to Europe are the ports located between Le Havre and Hamburg.

The Baltic Sea as a basin for ocean-going container ships is limited by physical prerequisites. Small markets and limited hinterlands may also reduce the competitiveness of ports [11]. Baltic ports are therefore essentially served by a feeder network. The BSR is mainly connected to Europe with less than 10 regular container lines to the rest of the world in 2015. Starting from Northern Range ports, the rotations of the feeder ships are either circular, serving a small number of ports, either direct to one or two ports. So Baltic ports are not relays of large European and global flows but rather secondary nodes in the

maritime network, even the most developed of them are connected through feeder services to some other ports' range [19]. However, this landscape is evolving, as evidenced by the increase of large vessels or direct deep-sea connections to the Baltic Sea.

In 2017, the largest regional container port, Saint-Petersburg, stood only 15th in Europe. Even if the composition of the 20 largest container ports remained stable, Polish ports recorded considerable and continued growth in container traffic.

According to recent forecasts, the continuous growth of cargo turnover is expected in the Baltic ports [12]. Ships will become larger and the transport of containers will continue to be the most dynamic segment of the shipping business [4]. Maritime transport in the Baltic sea is undoubtedly impacted by its physical configurations. The basic gates are the

Danish Straits and the Kiel Canal. Then the strongest container streams traditionally hold towards the Gulf of Finland and the Russian market.

The changes of modern seaports are affected by many factors taking place in the global economy, national policy, the environment of seaports, supply chains, but also a number of stimulants i.e. innovation, new technologies or sustainable development [17]. Container terminals in seaports are key elements of the intermodal transport infrastructure. In Poland, as in other countries, container handling is playing an increasingly important role. Until 2009, Gdynia was the largest Polish container port, but in 2010 Gdansk became the leader in this respect [3].

Thus, this paper proposes to study the place of Polish ports in the Baltic maritime system. To this end, we will use numerical data, including port traffic, to complete a literature review. Moreover, in order to highlight the original role of Polish ports and to explain it, we will mobilize data from the Automatic Identification System (AIS).

2 POLISH CONTAINER PORTS

Polish ports of Gdansk, Gdynia and Szczecin-Świnoujście are located in the central part of the southern Baltic Sea coast. In the recent years, the cargo turnover of the Polish ports has significantly increased. The most measurable increase can be observed on the containerized cargo which turnover rose by almost 2 times in 2012-2022. Indeed, since the early 2010's, the dominant group in the transshipments in Polish seaports is general cargo, which share around 48%. The large share of general cargo is due to increased container handling.

The major port is the port of Gdansk. It is situated in the southwestern part of the Gulf of Gdansk. It plays a large role in the national economy, with 68,2 million tons of traffic in 2022. The largest terminal is the Deepwater Container Terminal (DCT) which is able to accept vessels containing more than 20,000 TEU [27]. Since 2005, the port of Gdansk was responsible for more than 40% of cargo traffic and its share among Polish seaports in 2019 reached 48.5%. The port of Gdynia was responsible for more than 20%, with a peak in 2007 when it reached 28.3%. Other Polish ports were of minor importance [3].

Gdansk is clearly also the leader in term of containerisation with 2,072,000 TEU in 2022. In 2018, through the port of Gdansk have passed 69% of all containers handled by Polish seaports [5].

In second place is the port of Szczecin-Świnoujście, which handled 36.8 million tonnes of cargo in 2022, but only about 75,000 TEU. For this reason, we do not include it in our study focusing on containerised activity.

With a traffic of 28 million tons of goods in 2022, the port in Gdynia is the third largest seaport in Poland. The port is a universal port specialized in handling general cargo, mainly unitized cargo transported in containers and in a ro-ro system. The services are provided through a network of

multimodal transport connections with the hinterland and through short sea shipping and ferry connections. The Port of Gdynia is a link in the Corridor VI of the Trans-European Transport Network (TEN-T) [15]. But, due to the location of the port of Gdynia near the city center, its further development is difficult. The only direction of development leads to the construction of port facilities on the water [26].

So, the main Polish container terminals are located in Gdansk and Gdynia. Due to their diversified infrastructure, handling capacities and commercial relations, these container terminals offer a varied range of services. But there is also an oligopolistic competition because there are only five main players: three of them are located in Gdynia (Baltic Container Terminal, Gdynia Container Terminal, OT Logistic Terminal Gdynia) and two in Gdansk (Deepwater Container Terminal, Gdansk Container Terminal).

Terminals in Gdynia do not serve any direct ocean service and are focused on feeder ships which, carry goods from the largest ports in Western Europe. Smaller units (up to 2,500 TEUs) can benefit from the Kiel Canal, which can shorten the journey by two days compared to the route through the Danish straits. To attract larger units, the port authorities in Gdynia intend to deepen the waterways as well as to increase the rotations.

In fact, the Gdansk port is formed by two districts (inner and outer port) what allows strengthening the terminals specialization. Thanks to the DCT terminal established in 2007, the Port of Gdansk became the second largest Baltic container port in 2012 (Figure 1). DCT is perpetually developing. In October 2016, Terminal 2 berth was opened at the terminal, enabling the handling of vessels with a capacity of over 22,000 TEU. The handling activity is also strongly coupled with logistics functions, for instance in the Pomeranian Logistics Centre.



Figure 1. Evolution of the ranking of the main Baltic container ports.

Moreover, according to data from Ocean Shipping Consultants Ltd., transporting a container from Shanghai via Gdansk to Warsaw in the discussed period cost approximately 28% less than via Rotterdam and approx. 20% less than via Hamburg. Since Gdansk is located closer to the eastern markets than both of these European ports, DCT also provided savings of over 10% on shipping lines to other Baltic ports in comparison to Rotterdam, while in relation to Hamburg, these savings amounted to even 15% [2].

These financial considerations and the technical characteristics (the depth is 16.5 meters) of the port allowed Gdansk to gain a direct connection from the Far East. Since 2010, DCT Gdansk accommodates the direct shipping routes of Maersk from the Far East to

Europe. Today, the port of Gdansk is still the only one in the Baltic Sea Region (BSR) directly connected to Asia with Maersk AE10 route.

With the introduction of the Maersk Line direct vessel calls, the level of transshipment has risen sharply in the port of Gdansk. The percent of the cargo transshipment in the total cargo turnover of the port Gdansk has highly increased: in 2004 the part of transit cargo passing through the port was 5.0 % and in 2012 those cargoes were already 60,3 % [24]. Currently, with the ability to handle the largest ships, DCT becomes a leading Baltic deep-sea port, where cargo is being transported to customers in countries like Russia, Sweden, Finland and other Baltic States.

For its part, Gdynia benefited from the Baltic Sea market intensive progress. In particular, in the middle of the 2010s, MSC has launched two new ocean services to replace the existing MSC service connecting the port of Gdynia with transshipment ports in Western Europe [6].

Consequently, Polish ports are experiencing rapid changes, oscillating between medium-sized ports with an essentially national vocation and intermediate shipping hubs. As a result, Gdansk is now in first position in the region for container handling. In 2019, Gdansk has entered the top ten of the European port-level liner shipping connectivity index generated for all container ports of the world that receive regular container shipping services [24] even if Gdansk ranks only 203 in the Container Port Performance Index 2021 behind some other Baltic ports like Klaipeda (186) or Gothenburg (118) [24].

Considering what was mentioned above, it seems reasonable to state that each terminal offers a slightly different service and yet their offer is to a large extent complementary. Increasing transshipment capacity of Polish terminals also allows to recover the cargoes that had previously been directed to the major western ports. Gdansk and Gdynia are today strong competitors for Gothenburg [18] which has benefited for a long time from its location outside the Danish straits but is going doing in the container port ranking.

3 AIS CASE STUDY

We have seen that Polish ports have an increasing market share and are strengthening their position among the Baltic ports, although the situation in Gdynia is different from that in Gdansk. The latter seems to be strengthening its centrality and positioning itself in a system of competition/complementarity with North West European ports, whereas Gdynia appears to be more of a regional port.

From a methodological point of view, this part of the analyse is based on a database constructed using the IHS maritime database (<https://maritime.ihs.com/>) and with directly collected AIS data. Broadcasting AIS data in real-time makes a tangible contribution to the scientific community. The automatic character of transmitting vessel positioning signals and its generalisation provide an opportunity to track and

analyse the vessels' itineraries. Once this source of information has been properly checked through matching it with external data with regard to vessels and ports, it opens the way to reasoning on a global scale as well as on the scale of port approaches, in real-time as well as long term. It is then possible to analyse the maritime networks. In reality, the results of AIS data analysis also concern different types of studies like port performance analysis, shipping companies' strategies or regional markets analysis [21].

It should be noted that we were unfortunately unable to use data from 2022. Indeed, their collection and especially their processing (which takes a relatively long time) have not been completed. So, we have chosen to start this analysis by looking at the situation a few years ago.

We have already established that between January and November 2016, 60 different operators provided containerised services to Baltic ports. [19]. Shipping lines operating in the Baltic Sea Region mainly offer feeder services between the ports of the Baltic Sea and the ports of the North Sea (Hamburg, Rotterdam, Bremerhaven, Antwerp). However, they use different operating strategies on the market. Some feeder companies have only one port and some up to five such lines as Unifeeder have up to 20 ports [13]. Some companies such as Containerships have quite local strategies with ships calling only at 3 ports (Helsinki, St-Petersburg and Riga) when others for instance MSC propose services to almost all BSR.

The case of Gdansk is interesting as in spite of the low number of lines its traffic was relatively high. This is mainly the results of shipping companies' strategies. For instance, Maersk Line offered a capacity of 966 336 TEUs in the port of Gdansk but only 40 233 TEUs in Kaliningrad. It is an interesting way to focus on the three different types of actors present in the region. It clearly appears that companies have different strategies: global carriers concentrate their flows on some ports as Gdansk while companies specialised in feeder services have a more decentralised network.

Recently, the number of containerships' port calls in Gdansk has grown to 601 in 2020 according to AIS data one third less than in the port of Gdynia (960 in 2020). Beyond the overall volume of calls in the ports, we observe that while the structure of traffic in the two ports is very different. In Gdynia, we count 32 operators whose ships call at the port, while in Gdansk this number is only 20. We can also see from the outset that in Gdynia, local and regional stakeholders (Nordic Hamburg, Containerships...) are more present than the global carriers who are very active in Gdansk.

Moreover, in Gdansk, this structure is totally dominated by the Maersk group (Maersk itself and Sealand Europe) which accounts for 40% of the calls in 2020 when in Gdynia, the dominating company only represents 23% of the total (Figure 2). This company is Unifeeder, what also show one more difference between the two Polish ports. The use of AIS data corroborates what was said in the previous section: the port of Gdynia is mainly a port affected by feeder vessels (Containerships, X-Press Feeders, etc.), whereas Gdansk is positioned in a different sector of

activity, even if the presence of feeder vessels illustrates its position as a transshipment port.

On the studied period, container handling statistics in Gdynia and Gdansk were very different: 905,000 TEU were handled at the Gdynia terminals, less than half the volume handled in Gdansk (1,924,000 TEU) In concrete terms, while there are many more calls in Gdynia, the traffic is lower. There are two reasons for this: firstly, the size of the ships that touch the ports, and secondly, the handling shares.

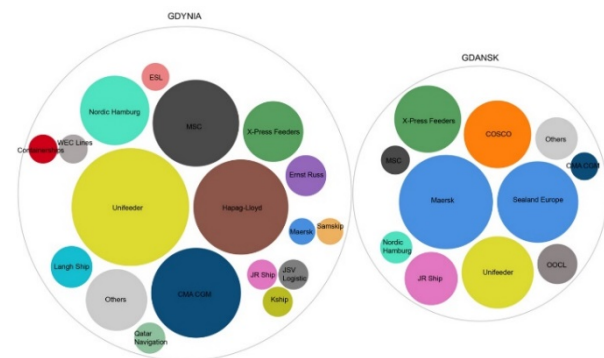


Figure 2. Ports calls bay operator in Gdynia and Gdansk in 2020.

So, to evaluate this handling share, we need AIS data and a database that gives container ships' capacity (IHS Maritime). The capacity of transport in each port is considered by adding the capacities of all the container ships making a call over a certain period. This average handling rate allows to assess the average number of containers which are loaded and unloaded during a call. For instance, an average handling rate of 40% on a container ship with a transport capacity of 10 000 TEUs means that 4000 TEUs will be handled on average. The maximum rate can be 200% under hypothesis that the ships are unloaded and reloaded completely. We have calculated that handling share for Gdynia and Gdansk in 2020 and the result is that they are very similar: 66% in Gdansk and 67% in Gdynia. That means that the differences between the two ports are most likely due to the size of the vessels.

In the other Baltic ports, the capacity provided is generally relatively low but the handling rate is very high compared to the European average (44%). If Gdynia and Gdansk are both in the top five, they are behind the ports of Saint Petersburg (112%), Hamina-Kotka (78%) and Klaipeda (75%)., Indeed, some ports, especially those in the Gulf of Finland, which are served to small units, are impacted by a dead-end effect, which also explains the rather high rates [9].

Once again, we can have an accurate view of the ships thanks to the AIS data (Figure 3). Thus, we found that in 2020:

- the average size of container ships operating in the port of Gdynia was 1,404 TEU while the average size of ships berthing in Gdansk was 4,846 TEU;
- the largest PCs sailing to Gdansk could carry 23,756 TEU compared to 8,241 TEU in Gdynia.

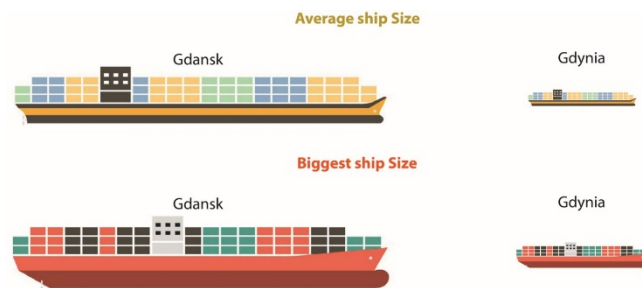


Figure 3. Containerships' size in Gdynia and Gdansk in 2020.

Using AIS data, it's possible to build a maritime network. Here, we have the simplified Northern European Maritime Network of container-ships in 2018 (Figure 4). We used the method of the major flows. The principle is to keep the strong link from an European port to an another European port. The port size in this graph is the degree that is the number of links incoming and outgoing and the colour is the betweenness which is the fact of having to pass through a port to reach the other ports. It is a bit of an indicator of the centrality of the network.

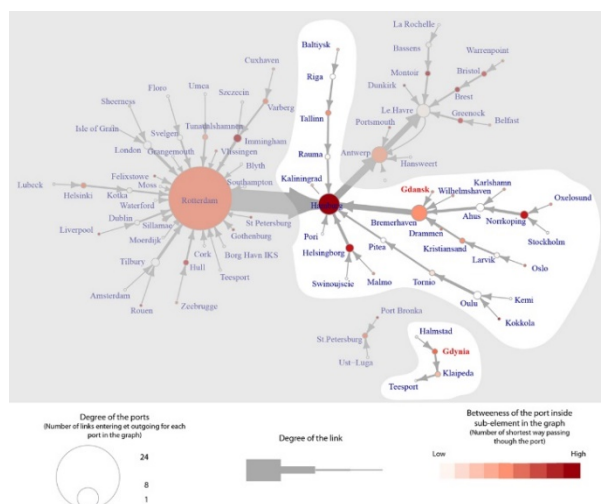


Figure 4. Simplified containerisation network in North West Europe in 2018

From 2018, the port of Gdansk emerged as a port which remained secondary in the European network but which was directly connected with the dominant ports in the network, primarily the German port of Bremerhaven [21]. At the same time, Gdynia was less directly integrated into the network but strongly connected to some regional ports like Klaipeda in Lithuania.

In 2020, the situation remains similar. Gdansk is in close contact with the ports of Bremerhaven and Zeebrugge for inbound links and with Wilhemshaven and, again, Bremenhaven for outbound links. Although links are not present in this scheme, due to the 150,000 TEU capacity threshold, it is increasingly becoming a central port in the Baltic network (Figure 5). This role is confirmed by the large capacities offered to and from the port of Gdansk.

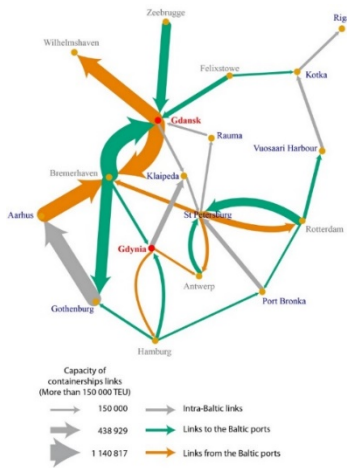


Figure 5. The Baltic container network in capacity in 2020 (Author, according to Joly & Kerbiriou [8]).

Speaking about Gdynia, we can see the persistence of strong links between Gdynia and Klaipeda as well as its privileged connections with Hamburg and, to a lesser extent, Antwerp. We can also state that in this containerised network, this port is of a lower rank than that occupied by its neighbour.

4 GDANSK, THE BALTIC HUB

Nowadays, Gdansk port works as a hub and it has a strategic position on the main routes of shipping companies; a distinct role in the maritime network; a high level of transshipment and it can accommodate larger vessels than the region neighbouring ports. At the Baltic scale, the reorganisation of traffic has generated standardisation on all shores of the Baltic Sea, responding to the hub and spoke mode.

4.1 Elements of Gdansk's affirmation as a hub port

At first, DCT Gdansk is the only port in the Baltic Sea, which technical features make possible to accommodate Triple-E container vessels, even if Vessels with a maximum draught/draft of 15.3 m can enter the Baltic Sea. This has become one of the most fundamental in the decision to include Gdansk in Maersk linear ocean route AE10 from Southeast Asia to Europe (as the final ship entry port). This circumstance has allowed the Gdansk port to start specialization in the transshipment operation and transit to Russia, Sweden, Finland and other Baltic countries [7].

In connection with the concentration of activity regularly observed in the shipping industry, the Deepwater Container Terminal receives also additional benefits such as: direct calls ocean carriers at the terminal (2M Alliance «Hyundai Merchant Marine also uses this loop service»), higher terminal handling costs in other container terminal operators, and a faster and higher increase of containers throughputs and consequently a rapid increase in market share.

The port of Gdansk and the state-owned company that manages it are an excellent example of how concession agreements and major infrastructure

development projects can generate enormous economic benefits for the port and the country as a whole. The port was ranked among the top 15 European ports in terms of container throughput in 2018, thanks to excellent growth results [14]. According to UNCTAD's port Liner Shipping Connectivity Index, Gdansk port connectivity index grew very strongly from 5.2 in 2006 to 46.25 in 2022 [23].

The financial investments made by the Gdansk Port Authority have already paid off. They have also greatly benefited from the fact that Poland has been able to modernize and develop the surrounding infrastructure with the help of the European Union's infrastructure development funds. After the completion of the first outer harbour project and its sale to a consortium of partners in May 2019 (PSA International Ptd Ltd, the Polish Development Fund and the IFM Global Infrastructure Fund), the Gdansk Port Authority has started to develop a new outer ports construction project, which is implemented through private-public partnership contracts. It will be the most modern and largest investment concession port project in Europe. The development of this infrastructure will help the Port of Gdansk to become one of the leading ports in the European Union in terms of cargo performance.

Concretely, two groups of drivers have been developed the most. Of course, port infra and superstructure is one of them. An important factor affecting the development of terminal is the use of the existing handling capacity. In Gdansk, the share in the handling of containers exceeded the share in the handling capacity. Definitely, the existing Polish container ports still had capacity reserves. It is forecasted that in 15–20 years, container handling in Polish ports may reach 8 million TEUs [24].

Hinterland connectivity is also very important. The Polish ports, Gdansk and Gdynia, were originally mainly connected to the Polish hinterland and Central European market. They are now becoming new transshipment ports for the regional traffic. It is especially the case for Gdansk which benefits from the choices and investments of Maersk shipping lines and from its alliance with Mediterranean Shipping Company (MSC). Gdynia's container terminals are currently on its way to achieve a good position among secondary ports in the BSR and Deepwater Container Terminal in Gdansk is slowly aspiring to the role of one of the biggest handling bases in the Baltic Sea [16].

The enhancement of hinterland connectivity was a key development driver for the Polish ports. It has made it possible to redirect some goods that used to be delivered from the Polish hinterland to German ports of the North Sea. The scale of road infrastructural investments, focused mainly on the development of express roads and highways, has reduced travel times from the south of Poland to the ports located in the north by 23–34%. In the case of rail development projects, the enhancement resulted from the rail infrastructural projects and expansion of the network of intermodal containers terminals in whole Poland. While in 1995 there were only 9 of them, in 2015 their number reached 38, which has significantly enhanced accessibility to intermodal transport services. Most of them have regular

connections to the leading Polish ports in their offer [22].

4.2 Some factors of explanation and driving forces

Once more, we can use concrete evidence to explain the dynamism of Polish container ports. The question of port competitiveness is central for port authorities because it profoundly influences the choices of shipping companies and operators. This especially includes port operation efficiency levels, handling charges, reliability or landside accessibility. Regarding the Baltic ports, we can analyse port efficiency using the duration of port calls given by AIS data. Baltic container ports appear very differently (Figure 6): two ports in particular, namely Gothenburg and Gdansk, are served by ships offering a larger capacity than in the other ports.

In the case of Gdansk, the situation is clearly the result of Maersk Line choice to make the Polish port its Baltic hub as well as the important investments made by the port authority and the consortium operating DCT.

However, we note that the time spent by ships in both ports is on average the same, which raises questions about the efficiency of the terminals and suggests that due to the average size of ships in both ports, the Gdansk port is significantly more efficient than the Swedish port.

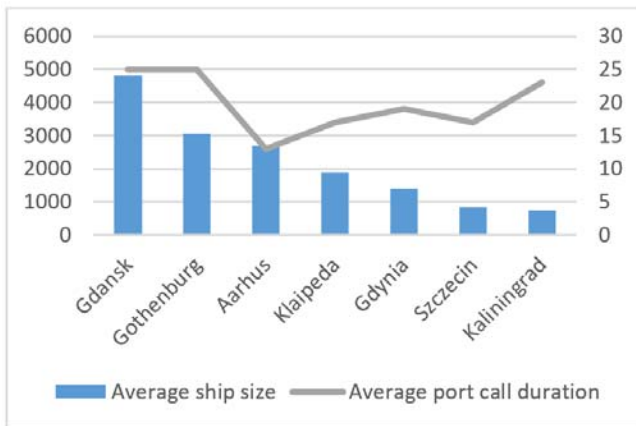


Figure 6. Container ships' capacity and duration of port call in some Baltic Sea ports in 2020 (Source: AIS data).

By integrating the port traffic in the research process, it is also possible to estimate the average length of handling of one TEU in each port. In the study, we integrated all the containerized flows. However, they could be weighted by integrating the volumes of containers transported by ro-ro ships. Such analysis could be more precise with the number of cranes used in each terminal for instance. Despite these few restrictions, the results are remarkable and give an interesting order of magnitude. Container port efficiency is very variable in the southern Baltic Sea (Figure 7) in the port of Gdansk, the average time to operate one TEU it is three times lower than in Szczecin and twice as good as its main competitor, Gothenburg. Gdansk is clearly more efficient than other Baltic ports which also explains the quick expansion of its container flows. The situation of

Gdynia seems to be not so good with a lower efficiency than the regional average.

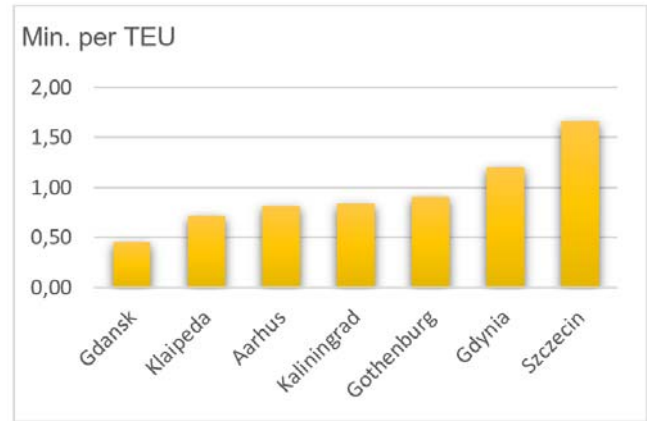


Figure 7. Evaluation of average speed per TEU in 2020, according to AIS data (author's calculations).

At least, containerised cargo shipping competitiveness compared that of the direct road transport depends primarily on the cost and time of the whole land-sea transport chain [10]. It is difficult to know the reality of cost in the region but we can state that rates are the lowest where traffic is higher because of potential market proximity or transshipment possibilities. This way will be explored in our future work to complete our analysis.

5 CONCLUSIONS

Since the mid-1990s, in the Baltic Sea Region, the development of seaports took place in a very competitive environment. The potential of ports and the volume of transshipments were influenced by the location in relation to the hinterland and the connection with important inland transport corridors. The infrastructure of these corridors has been significantly expanded over the past decade. Bathymetric conditions were also of great importance in the development of the ports. In the context of the analyses carried out, we can conclude that the construction of a deep-water container terminal in Gdansk and then the launch of direct connections with Asia were important factors that dynamized the increase in port turnover.

Obviation, the development of the port of Gdansk is now more important than that of Gdynia. But, we can say that the development of containerized traffic in both Polish ports is also the result of the strategies of shipping companies. Whether the ability of the port of Gdynia to attract regional stakeholders or the positioning of Maersk in Gdansk and the impact of the 2M alliance on the same port, both entities have been able to benefit from their attractiveness to shipping operators. Though, it is important to consider the impact by the end of 2025 of the disappearance of this alliance, which could be synonymous with the flight of part of the containerized flows (particularly those of MSC) to other ports in the region

In the medium term, the competing Gdansk-Gdynia duo could aspire to become a true "twin port"

like Los Angeles-Long Beach. A powerful ecosystem would then combine the political ambitions of the Polish state, the interests of powerful Asian handlers, the deployment of international rail operators and the positioning of logistics investors. Everything that Hamburg already offers, but without the nautical constraints of the Elbe, the cost of land and metropolitan pressure [1]. However, the development of Polish ports and their role as a hub in the region may be impacted in the medium term by geopolitical considerations. In 2022, the sanctions against Russia do not seem to have stopped their dynamism, but their reinforcement over a long period of time would in fact constitute a brake on the development of container traffic.

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