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IMPROVING SEAPORT COMPETITIVENESS BY CREATING A CONNECTION TO THE NATIONAL RAIL NETWORK

Summary. This article discusses the issue of seaport competitiveness. This is one of the most important issues in port studies. Conducting a port competitiveness analysis focuses on comparing components of port competitiveness for selected ports or terminals. First, a comparative analysis of selected seaports was performed in the article, followed by a detailed analysis of selected terminals in indicated ports. The main purpose of the article is to assess the effect of the new investment in the seaport in the town of Police (the construction of the railway connection with the national network) on its competitive position in relation to seaports in the immediate vicinity. To achieve the assumed goal, the following research methods were used: literature review, documentary method, linear weighting method, and variant analysis. The areas covered by the research study are selective seaports in Zachodniopomorskie Voivodeship (Szczecin, Świnoujście, and Police), Poland. Based on the research studies completed so far, it was shown that connecting a seaport with the national rail network may be a significant factor affecting the port's competitiveness in relation to the ports located in the direct vicinity.

1. INTRODUCTION

A seaport is a socio-economic space with a multi-faceted effect on the environment, combining the processes of transport between the sea and the mainland [1]. As complex economic structures and in addition to the main transport function, seaports also fulfil other significant functions: commercial, industrial, logistics and distribution, and also city- and region-forming functions. Recent research studies also indicate the role of seaports in the greening of supply chains [2].

An important area of research regarding seaport studies is seaport competitiveness. Seaport competitiveness depends on multiple factors. Among the ones widely discussed in the academic literature, the most relevant is accessibility of a seaport from the sea and the land. The research studies conducted for the purpose of this article focused on the issue of the seaport hinterland connectivity, in particular on how the port's competitive position is affected by having (and in the case of the seaport in question – establishing) a connection with the national railway network.

In the spatial aspect, the conducted research studies pertained to three Polish seaports located within the West Pomeranian Voivodeship: the seaport in Szczecin, the seaport in Świnoujście, and the seaport in the town of Police. All the three ports are situated in the direct vicinity of each other; however, owing to their specific nature, accessibility from the outside, and the fulfilled functions, they have diverse competitive positions.

The seaports in Szczecin and Świnoujście are universal ports. Pursuant to the Act of 20 December 1996 on maritime ports and harbours (AMPH), they belong to the group of ports that are "fundamental to the national economy". The entity appointed to manage both of the ports is the Szczecin and Świnoujście Seaports Authority SA (SSSA). The shareholders of SSSA are State Treasury,

municipality of Szczecin, municipality of Świnoujście, and private investors. Both ports are engaged in providing transport and transshipment services for various entities. The ports in Szczecin and Świnoujście have at their disposal a system of transport connections with the hinterland, including road and rail transport as well as inland shipping.

The seaport in Police, which is the object of a detailed analysis in this paper, is a totally different entity. Pursuant to AMPH, it belongs to the category of "Other maritime ports and harbours". The port's grounds and infrastructures are administered by the Police Seaport Authority (PSA). The shareholders of PSA are the chemical company Grupa Azoty Zakłady Chemiczne Police SA (GA/Police) and the municipality of Police. The operations of the seaport in Police are run predominantly on demand of one shipper – GA/Police; the port in fact plays the role of a company port. Moreover, the seaport in Police is the only one out of the discussed three that does not have a rail connection with the national railway network. The dependence of the port's transport and transshipment operations on a single entity, as well as the lack of a transport infrastructure developed on a similar level to the one observed in other ports, hinders the port's ability to compete on the transport market.

In view of the aforementioned, the main purpose of this article is to assess the effect of the new development project in the seaport in Police (construction of a rail connection with the national railway network) on its competitive position in relation to other seaports in the direct vicinity.

2. PORT COMPETITIVENESS – LITERATURE REVIEW

Port competitiveness is one of the major and frequently discussed issues of port studies [3]. In the academic literature, it is defined as the degree to which a port competes with another port or ports [4].

Ports compete with each other both regionally and internationally to provide a better service to their users, among which shippers and carriers are mainly highlighted, as they play a significant role in port choice decisions [5]. Changes in the business environment require the ports to respond so that they can sustain their competitiveness [6]. A port's competitiveness analysis usually focuses on benchmarking the components of the port's competitiveness in relation to selected ports or terminals. The way they are selected to a large extent depends on the adopted research perspective. Determinants of a port's competitiveness may be both internal and external to the Port Authorities' control [7]. The traditionally enumerated factors include geographical location, hinterland networks, availability and efficiency of transportation, port tariffs, port stability, and port information system [8]. Still, this is not an exhaustive, generally accepted list of components of competitiveness. Their selection to a large degree depends on the specific nature of the analyzed ports and the researcher's approach. For example, according to another approach, the list includes distance between exporter or importer locations and the port location, port prices, frequency of ship calls, frequency of cargo loss and damage, service quality, port efficiency, port equipment availability, port information services, and size of shipper [9]. Yeo, Roe, and Dinwoodie, who analyzed large container hubs, enumerated as many as 38 such components [10]. At the same time, they pointed out that for the purposes of research it was advisable to narrow down the list to the most important, appropriately selected components that reflect the specific nature of the compared ports. The most influential factors for shippers choosing a port can be divided into categories. For example, it is possible to distinguish physical criteria (sufficient draught, number of berths, capacity of port facilities, ship chandelling, port location, and degree of technology employed in port operations), and service attributes (working time, stevedoring rates, port safety, port entrance, operating cost, international policies, night navigation, quality of port management, port labor, and customs formalities) [11].

Hinterland connectivity, understood as efficient inland transport networks (e.g., rail and road transport), is considered to be one of the key determinants of port competitiveness [12-15]. A particularly important factor in this case seems to be the seaport's access to the national railway network. Owing to its features, rail transport seems to ideally suit the transport needs and functions of a seaport. The features indicated in the relevant literature include, among other things, appropriate for long-distance transport of homogeneous bulk cargoes [16], high level of transport safety (e.g.

multistage traffic management), or high transport speed [17, 18]. Other features also include punctuality of deliveries – a train moves along a separated infrastructure (independence from road congestion) and according to the timetable. An important factor is also that railway transport is an ecological way of freight movement, as it makes it possible to save approximately 30% of total externalities [19].

Special attention should be paid to the close relations between ports and supply chains, which to a large extent affect the competitiveness of contemporary supply chains and their implications on the port environment [20, 21]. Shippers, logistics service providers, and ship operators do not necessarily choose a port, but they select a chain in which a port serves as a node [22, 23]. Along with the development of subsequent port generation concepts (4th Generation Port and 5th Generation Port) perceived as logistics platforms, the competitiveness factors include yet another set of attributes. New port generations are characterized by i.e., telematics networks, close integration into the international transport logistics chains, door-to-door services, and serving community stakeholders as well [24]. However, researchers dealing with port studies agree that providing good transport connections between the port and its hinterland is one of the fundamental factors decisive for choosing a particular port by a cargo shipper.

3. RESEARCH METHODOLOGY

This article attempts to find out to what extent the new development project consisting in construction of a railway infrastructure to connect the given port with the country's national railway network will contribute to increasing the seaport's competitive position in relation to the ports located in the direct vicinity. The applied research procedure is presented in Figure 1.
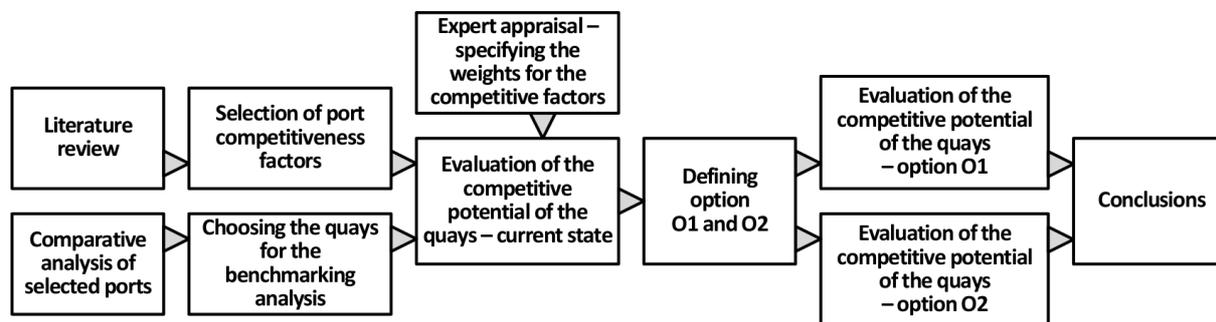

Fig. 1. Research procedure

The benchmarking analysis covers the following three seaports in Poland: Szczecin, Świnoujście and Police. As indicated in the Introduction, the two former ports have access to the railway infrastructure, whereas the port in Police has no such access. For the purpose of the study, it was necessary to precisely define the benchmarked ports. It would not be reasonable to analyze ports in their entirety, because they differ in terms of size and characteristics. As the main transshipment area in the seaport of Police takes up only one quay, the benchmarks in the analysis of the competitiveness factors were only single respective quays in the ports of Szczecin and Świnoujście. Finally, the benchmarking analysis included three quays that were the most representative for the purpose of the research study (all quays handle bulk cargo):
- the Sea Terminal in the Police port (ST/Police),
- the Katowickie Quay in the Szczecin port (KQ/Szczecin),
- the Górników Quay in the Świnoujście port (GQ/Szczecin).

The review of the academic literature on port competitiveness as well as the case study analysis, which focused on identifying the conditions and barriers to ports development and possibilities of their improvement, made it possible to specify the most important criteria for evaluating the competitive

position of the quays. The authors focused on the factors that were differentiators for each of the quays and were stable over several years' time horizon. Any factors that were similar for all the analyzed ports (e.g. social and economic stability of the business environment) were not applied. Moreover, the analysis excluded factors such as the number of shipping lines or availability of intermodal connections, owing to the specialization of ST/Police in transshipment of dry bulk cargoes. Another excluded factor was the prices of port services, owing to their small share in the costs of the whole transport chain – besides, they are easy to modify. The port in Police, being a port that is being upgraded and looking for new customers, will be adapting its pricing strategy to the offer proposed by the competitors.

Eventually, the most important factors affecting the competitiveness of the analysed quays were listed as follows:
- geographical location,
- permissible draught and size of vessels that may be moored at the quay,
- storage space size (open-air and roofed),
- quay length (including transshipment quay length),
- technical facilities at the quay,
- land available for development in the vicinity of the quay,
- access to the road infrastructure at the port hinterland,
- access to the railway infrastructure at the port hinterland, and
- connection with inland waterways.

Further on, taking into account the described factors, a tool was devised to assess the competitive potentials of the quays on the basis of the identified criteria. In the course of the study carried out by means of the Delphi method [25], weights were established for the individual criteria. The expert appraisal was made by management staff of seaports, experts and managers working the field of transport and logistics, who deal with the maritime economy in their work, and by academics. The expert group comprised 11 persons.

Further on, the linear weighting method [26] and variant analysis were applied, which was aimed at benchmarking the current competitive position of ST/Police in relation to the other quays, and examining the changes of the competitive relations between the analyzed quays for the two options that assumed the following:
- (O1) implementation of the development project consisting in construction of a rail connection between ST/Police and the national and international railway network and
- (O2) rejecting the development project.

For the purposes of assessing the individual criteria for current state, O1 and O2, the 1 – 5 scale was adopted, where 1 is the lowest mark, and 5 is the highest. It should be noted that assigning mark 5 does not mean the given quay meets the criterion optimally. Mark 5 indicates the best situation in the analyzed sample, whereas mark 1 means the worst situation in the sample.

4. BENCHMARKING ANALYSIS OF SELECTED PORTS

The geographical location of the port is one of the major factors for cargo shippers to make decision on choosing any given port and using its transshipment and storage services. The location is also particularly important for making decisions connected with non-transport operations to be carried out in the port, e.g., logistics and distribution or industrial functions. The geographical scope adopted in the article covers the ports located in the vicinity, which allows for taking an assumption that some of their attributes are similar. The comparable factors may include i.a. potential hinterland or access to inland waterways. Nevertheless, it should be noted that a similar hinterland of a port, i.e. a territory from which cargoes are brought, is not tantamount to transport accessibility from the hinterland, which is different for each of the ports. The locations of the analyzed ports are shown in Figure 2.

Fig. 2. Locations of the ports in Świnoujście, Police, and Szczecin Source. Own work based on:
openstreetmap.org

The seaport in Police consists of four functional areas: the Sea Terminal, the Barge Terminal, the Mijanka Terminal, and the Terminal in Jasienica. The analysis focuses on the Sea Terminal, as it plays the main role in the port. Resources transported by sea to GA/Police constitute a predominant part of the cargoes. Thus, the transshipment volume is closely related to the volumes of ordered resources and production processes taking place at GA/Police. Figure 3 shows that after the transshipment peak in 2011, there was a drop in transshipment volumes which then levelled off at ca. 1.5 million tonnes. As the functioning of the quay is dependent only on the one company, during any periods of decreased demand for resources used by GA/Police, the transshipment capacity of the quay is underused. Diversification of forwarders might improve the utilisation of the transshipment potential at times when GA/Police being the main user of the quay shows a smaller demand for transshipments.

The cargo volumes both in Szczecin and in Świnoujście were more than twice as high than in the case of the Police port. However, it should be noted that also the transshipment potential in Świnoujście and Szczecin is much higher. For example, the bulk cargo terminal owned by OT Port Świnoujście SA has at its disposal three quays with facilities that enable transshipment at the rate of 25,000 tonnes per day, and also storage of 1 million tonnes of cargoes on open-air storage yards and 100,000 tonnes under roof [28]. The terminal has its own Rail Department serving all the manoeuvring works at the railway siding. The company Bulk Cargo – Port Szczecin Sp. z o.o., whose transshipment volume is dominated by bulk cargoes, has at its disposal 11 quays totalling 3364 m in length, 300,000 m^2 of open-air storage space, and 40,000 m^2 of roofed storage facilities [29].

In order to be able to compare the analyzed transshipments in the three terminals with different characteristics, it is necessary to obtain comparable ratios. One of the possibilities is applying a quay occupancy rate showing the intensity of transshipments over a specified period of time, usually a year. It is calculated as a quotient of transshipment volume and the quay length. The calculations were done with regard to the dry bulk cargoes; therefore, the study included only this kind of transshipped bulk cargo, and the total length of the quays which serve this type of cargo. The results are presented in Table 1. The best result was achieved by the port in Świnoujście, followed by the port in Police and then the port in Szczecin.

Another condition that affected the research perspective and the selection of the optimal factors of competitiveness is the kind of cargo that would be dominating in the port in Police upon completing the development project in question. The target cargo group, at least for the first few years, was assumed to be bulk cargoes. Bulk cargoes are typical for tramp shipping which is characterized by e.g.

vessels calling at ports on an irregular basis. Therefore, the competitiveness factors excluded those that would show when concentrating on containerized or general cargoes, which are characteristic for the liner shipping – first and foremost the presence of liner services. Consequently, the list of shipping lines served by the ports in Szczecin and Świnoujście was ignored. Naturally, selecting a cargo group does not mean that the port in Police will not be able to expand the range of cargoes to be handled there in the future. Focusing on bulk cargoes in the first phase following commissioning of the planned railway infrastructure would enable a reliable assessment of the port capacity with the transshipment facilities already in place. This scenario does not assume any costly accompanying development projects, the scope of which could be much greater in the case of handling e.g. containers.
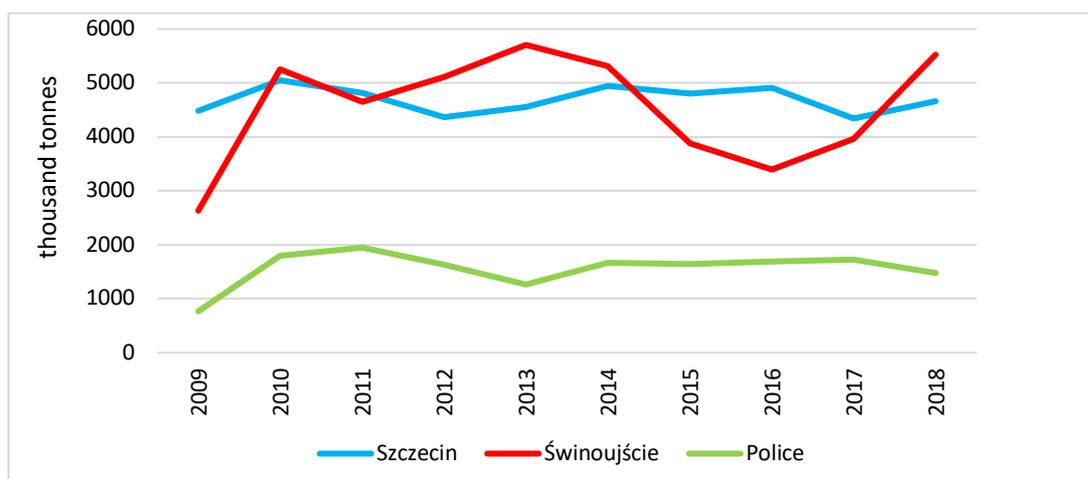

Fig. 3. Dry bulk cargo transshipments in the ports in Police, Szczecin, and Świnoujście in 2009-2018. Source: [27]

Table 1

Quay occupancy rate for dry bulk cargo transshipments in 2018

Port	Quay occupancy rate [t/m]
Police	1477.0
Szczecin	1386.9
Świnoujście	4648.1

Source: own calculations

5. ANALYSIS OF THE COMPETITIVE POTENTIAL OF THE SEA TERMINAL IN POLICE, IN COMPARISON WITH THE SELECTED QUAYS IN THE PORTS IN SZCZECIN AND ŚWINOUJŚCIE

Table 2 presents the factors of the competitive potentials of the analyzed quays. Further on in this section, the described factors are applied to develop the criteria for evaluating the competitiveness of the quays.

Analyzing the data presented in Table 2, special attention should be paid to the two factors: the first is the size of the ships handled in the ports, and the other is availability of land on the port premises.

The bulk carriers served in the ports of Police and Szczecin most often are of the Handysize category, i.e. they have the deadweight tonnage of 10000 – 30000 tonnes. However, in practicem the port is most often called by vessels with a deadweight tonnage of a few thousand tonnes. The possibility of receiving ships is constrained by their size. The operational depth of ST/Police is 10.5 meters, which makes it possible to handle the biggest ships able to use the fairway to Szczecin, i.e. 160 m in length and with a draught of 9.15 m, or 206 m in length and with a draught of 8.15 m, which corresponds to a fully loaded 16,000 – 18,000 DWT bulk carrier or a partially loaded 40,000 DWT one. Figure 4 presents the sizes of bulk carriers calling at the analyzed ports. It shows

that the biggest ships call at Świnoujście. On average, the parameter was 66,000 DWT, whereas the maximum level is set at 80,000 DWT.

Another major issue which is extremely important for the functioning and development of the ports is availability of land for development in the vicinity of the quay. In Szczecin, the land reserves are located in the vicinity of the general cargo area. However, there are no land reserves in the vicinity of the Kaszubski Basin, where KQ/Szczecin is located. SŚSA is planning to acquire some land by way of land reclamation (land fill) of the Notecki Basin and constructing a new bulk quay on the island of Ostrów Grabowski. The upgrading concept for KQ/Szczecin includes providing a possibility of handling ships with an increased draught (up to 11.1 m), obtaining carrying capacity of the quays amounting to 40 kN/m^2, and improving the technical condition of the hydrotechnical infrastructure.

The port in Świnoujście is located at the open sea, which might mean a possibility of further expansion of the outer port also in view of bulk cargo handling. However, taking into account the tourist and spa functions of the town of Świnoujście, and the ambiguous stance taken by the residents in relation to the planned construction of a new container terminal, it is hard to expect that the local community would consent to expanding the bulk transshipment infrastructure.

In terms of availability of land for development, the seaport in Police is in a very good situation, which is a great advantage for that port. Land for development is available in the industrial zone located around the port, taking up 117 hectares. It is also possible to obtain additional grounds from GA/Police. The grounds that are administered by SŚSA will make it possible to construct new storage facilities in the direct vicinity of the quay as well as to build industrial or logistics facilities.

The factors determining the competitive potential of the quays, which are presented and described in Table 2, were used in developing the tool to assess the competitive potential of the quays. The tool comprising 6 criteria was presented to the group of experts. Their task was to specify the weight for each of the criteria. The weights established by the experts were used for calculating the competitive positions of the analyzed quays. Two factors were excluded when establishing the list of criteria: '*transshipment characteristics*', due to the too extensive diversity of the cargoes handled in the ports in question, and also '*access to inland waterways*' – as the ports are located at the Oder estuary, the access is similar. The list of criteria adopted for the expert appraisal is presented in Table 3.

Table 2

Factors determining the competitive potentials of selected quays in the ports in Police, Szczecin, and Świnoujście

FACTORS	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście
transshipment characteristics	phosphorites, apatites, ilmenites, fertilisers, coal	coal, ores, scrap metals,	coal, biofuels, aggregate, general cargo, heavy weight cargo, containers, both exported and imported.
distance from the breakwater heads in Świnoujście	49 km	67 km	2 km
max. vessel size	20,000 DWT or partially loaded 40,000 DWT	20,000 DWT or partially loaded 40,000 DWT	80,000 DWT
storage space (open-air and roofed)	storage yards of 5,000 m^2	storage yard of 8,000 m^2; bunkers of 11,980 m^2	storage yards totalling 120,000 m^2, capable of storing up to 700,000 tonnes of coal at a time. The storage yards are equipped with stacker-reclaimers with operating capacity of up to 1,000 tonnes per hour, defrosting station, 2 wagon tipplers with a capacity of up to 20,000 tonnes per day,

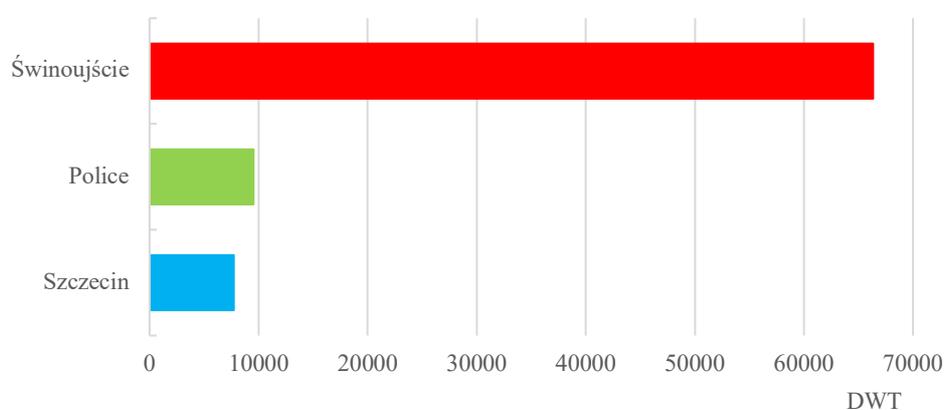| quay length	415 m	440 m	331.50
max. draught	9.15 m vessels up to L=215 m and B=31 m; safe passage width for vessels with the max. draught at the approach to the port from the turning basin in Police is 100 m;	9.15 m Over the length of 423m, the draught = 9.15m; Over the length of 17m, the draught = 7.4m.	13.2 m Max. vessel length: 270 m
transshipment equipment and mechanised equipment	- unloading berth equipped with: two KONE travelling gantry cranes for unloading, total capacity of 6,000 tonnes per day; - berth for fertilisers, intended for loading the GA/Police products: MVT cargo handling equipment with capacity of 3,500 tonnes per day and two grab cranes with lifting capacity of Q=10 tonnes and total capacity of 3,000 tonnes per day	- 2 gantry grab cranes with lifting capacity of 10 tonnes and operation capacity of 100 tonnes per hour - 3 grab cranes with lifting capacity of 16 tonnes and operation capacity of 130 tonnes per hour	- a series of conveyor belts totalling ca. 7 km in length, linking the quay with the storage yards, capacity of 2,000 tonnes per hour - two LIEBHERR LHM 500 cranes with 140 tonne lifting capacity, and operation capacity of 1,000 tonnes per hour - 2 overhead gantry cranes with lifting capacity of 10 tonnes and operation capacity of 120 tonnes per hour - cargo handling equipment with capacity of 25,000 tonnes per day - wagon loading facility with capacity of up to 10,000 tonnes per day
land available for development in the vicinity of the quay	very good	limited	limited
access to road infrastructure	at national road no. DK 114	at national road no. DK 10	national road no. 3
access to railway infrastructure	None	in place	in place
access to inland waterways	in place	in place	in place

Fig. 4. Average deadweight tonnage of dry bulk carriers calling at the analyzed seaports in 2018. Source: [27]

Table 3

List of criteria used in the expert appraisal

FACTORS		CRITERIA
transshipment characteristics	→	---
distance from the breakwater heads in Świnoujście	→	distance from the breakwater heads in Świnoujście
max. vessel size	→	vessel size
storage space (open-air and roofed)	→	the quay's transshipment and storage capacity
quay length		
max. draught		
transshipment equipment and mechanised equipment		
land available for development in the vicinity of the quay	→	land available for development in the vicinity of the quay
access to road infrastructure	→	access to road infrastructure
access to railway infrastructure	→	access to railway infrastructure
access to inland waterways	→	---

Applying the weights of the individual criteria, established by the experts by means of the Delphi method, while taking into account the technical and operating parameters of the analysed quays, we evaluated the competitive potentials of the quays. The calculations done for the current state are presented in Table 4.

Table 4

Evaluation of the competitive potentials of the quays. Current state

s/n	Criteria	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście	weight [%]	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście
		points				score		
1.	distance from the breakwater heads in Świnoujście	4	3	5	20	0.8	0.6	1
2.	vessel size	2	2	5	20	0.4	0.4	1
3.	the quay's transshipment and storage capacity	3	4	5	10	0.3	0.4	0.5
4.	land available for development in the vicinity of the quay	5	2	2	20	1	0.4	0.4
5.	access to road infrastructure	2	5	4	5	0.1	0.25	0.2
6.	access to railway infrastructure	0	5	3	25	0	1.25	0.75
	Total	-	-	-	100	2.60	3.30	3.85

The obtained weighted scores indicate that currently the most competitive port of the analyzed three is GQ/Świnoujście, followed by KQ/Szczecin, and then ST/Police.

Further on, this section describes a variant analysis examining changes to the Police port's competitive position over a horizon of several years, for two options:
- O1 – Option 1 – assumes construction of a railway infrastructure for ST/Police, and
- O2 – Option 2 – assumes rejecting the development project.

Both options also assume an additional change – an increase in the size of vessels to be handled in the ports in Szczecin and Police – as a result of carrying on the dredging works on the Świnoujście – Szczecin fairway. The development project is scheduled to be completed by 2022. It would be fallacious to analyze any expected effects of the railway infrastructure development project for the port in Police, which may be completed by 2022, against the background of the ports' potentials dating back to 2017. The fairway upgrading will make it possible for bigger ships to call at the ports in Szczecin and Police (the Kaszubski Basin is to be adapted to serve vessels with a draught of up to

11.1 m). Consequently, these changes must be reflected in the score: criterion 2 (size of handled ships) for KQ/Szczecin and ST/Police was increased from two to three points, for both options, O1 and O2.

Thus, Option O1 assumes two changes in relation to the current state (Table 5). The first one is the increased score for the size of handled ships at ST/Police and KQ/Szczecin, and the second one – access to a railway infrastructure for ST/Police – which means an increase from 0 points in the current state (no access) to 4 points. The port in Szczecin has the highest mark (i.e. 5) owing to its direct connection with the international railway network. The applied changes indicate an improved competitive position of ST/Police. Even though in this option (O1) Świnoujście is still the leader, this time it is ST/Police that comes second and supersedes KQ/Szczecin (3rd place). The significant increase in the weighted score for ST/Police results from recognizing access to railway transport as a strategic prerequisite for bulk cargoes handling and assigning it a weight of 25%.

Table 5

Evaluation of the competitive potentials of the quays. Option O1

s/n	Criteria	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście	weight [%]	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście
			points				Score	
1.	distance from the breakwater heads in Świnoujście	4	3	5	20	0.8	0.6	1
2.	vessel size	3	3	5	20	0.6	0.6	1
3.	the quay's transshipment and storage capacity	3	4	5	10	0.3	0.4	0.5
4.	land available for development in the vicinity of the quay	5	2	2	20	1	0.4	0.4
5.	access to road infrastructure	2	5	4	5	0.1	0.25	0.2
6.	access to railway infrastructure	4	5	3	25	1	1.25	0.75
	Total	-	-	-	100	3.80	3.50	3.85

Option O2 represents a situation where a railway infrastructure for ST/Police has not been developed, but the port's accessibility from the water side has been improved. The calculations are presented in Table 6.

Comparing the weighted scores obtained for both options O1 and O2 (Figure 5) made it possible to draw conclusions about the future standing of ST/Police against the background of the ports in the direct vicinity. In Option 2, Świnoujście still holds the leader's position, but ST/Police falls back to the third place, which is a setback in view of Option 1. Although its total score rose in relation to the current situation, it was not enough to come second in the ranking of competitive attractiveness of the three analyzed quays.

Table 6

Evaluation of the competitive potentials of the quays. Option O2

| s/n	Criteria	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście	weight [%]	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście
			points				Score	
1.	distance from the breakwater heads in Świnoujście	4	3	5	20	0.8	0.6	1
2.	vessel size	3	3	5	20	0.6	0.6	1
3.	the quay's transshipment and storage capacity	3	4	5	10	0.3	0.4	0.5
4.	land available for development in the vicinity of the quay	5	2	2	20	1	0.4	0.4
5.	access to road infrastructure	2	5	4	5	0.1	0.25	0.2
6.	access to railway infrastructure	0	5	3	25	0	1.25	0.75
	Total	-	-	-	100	2.8	3.5	3.85
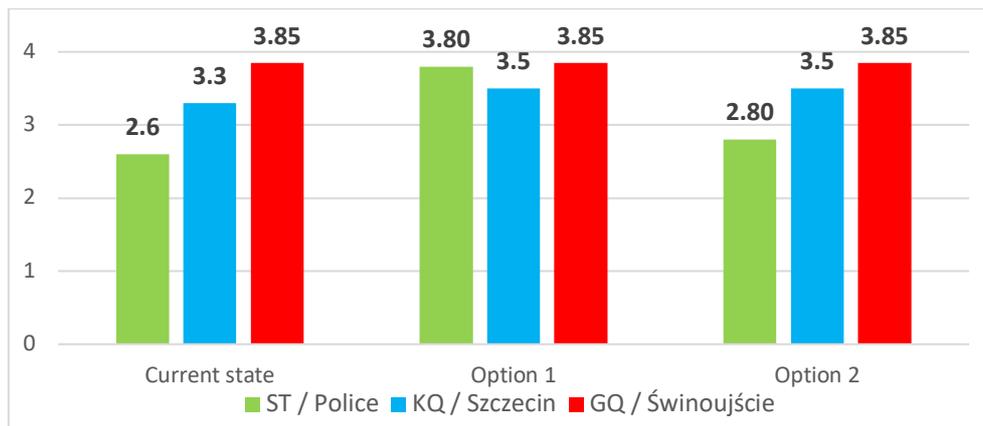
Fig. 5. Comparison of weighted scores for the current state, Option 1 and Option 2.

In addition, we examined whether application of other weights in the calculation would result in maintaining the investment decision. Thus, the sensitivity analysis (i. e. the process of recalculating outcomes under alternative assumptions) was applied, which allows for a better understanding of the relationships between input and output variables in a system [30]. The weights for two criteria have been changed. The first was '*access to road infrastructure*', for which the weight in the new calculation was increased from 5% to 10%. The second was '*access to railway infrastructure*', for which the weight was reduced from 25% to 20%. The calculations are presented in Table 7.

Table 7

Sensitivity analysis results

			Current state			Option 1			Option 2		
			ST/ Police	KQ/ Szczecin	GQ/ Świnoujście	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście	ST/ Police	KQ/ Szczecin	GQ/ Świnoujście
s/n	Criteria	weight [%]	score			score			score		
1.	distance from the breakwater heads in Świnoujście	20	0.8	0.6	1	0.8	0.6	1	0.8	0.6	1
2.	vessel size	20	0.4	0.4	1	0.6	0.6	1	0.6	0.6	1
3.	the quay's transshipment and storage capacity	10	0.3	0.4	0.5	0.3	0.4	0.5	0.3	0.4	0.5
4.	land available for development in the vicinity of the quay	20	1	0.4	0.4	1	0.4	0.4	1	0.4	0.4
5.	access to road infrastructure	10	0.2	0.5	0.4	0.2	0.5	0.4	0.2	0.5	0.4
6.	access to railway infrastructure	20	0	1	0.6	0.8	1	0.6	0	1	0.6
	Total	100	2.70	3.30	3.90	3.7	3.5	3.9	2.9	3.5	3.9

The results showed that recalculations did not change the original decision. In option O1, GQ/Świnoujście took the highest competitive position, followed by ST/Police. In option O2, ST/Police took the 3rd place. It turns out that even the reduction in the importance of access to rail transport did not change the fact that the investment in a railway infrastructure for ST/Police raises the competitive position of the port in relation to KQ/Szczecin.

6. CONCLUSIONS

The main purpose of this article was to assess the effect of the new investment in the seaport in the town of Police (the construction of a railway connection with the national network) on its competitive position in relation to seaports in the immediate vicinity. The seaport in Police is currently the only one big seaport in the region of West Pomerania that does not have access to the national and European railway network. This contributes to the currently weak competitive position of the analyzed port in relation to the ports in the vicinity (in particular, the seaports in Szczecin and Świnoujście).

The research results available in the academic literature mainly pertain to the greatest port structures, without paying attention to local company ports. This article aims to fill the research gap. Additionally, it may constitute the basis for making decisions by the Police Seaport Authority; it may also be helpful to authorities of other seaports.

The research study completed by the Authors has shown that it is possible to improve the competitive position of the seaport in Police; however, this requires some specific investments. The analysis of the current technical and operational condition of the seaport in Police as well as the seaports in its direct vicinity (Szczecin, Świnoujście), combined with the study of the competitive position of the said ports, made it possible to formulate the following conclusions:

1. The Sea Terminal in Police may improve its competitive potential and may move up to the second place from the currently held third place in the attractiveness ranking of the most representative bulk transshipment quays in the region. However, a prerequisite for that is completing the development project consisting in connecting the quay with the national railway network in the port's hinterland, which means carrying out Option 1 considered in this article.

2. Linking the seaport in Police with the national railway network will moreover provide a possibility of attracting external shippers. This will provide the port in question with a possibility of competing on the market and offering services to external shippers.

3. The interconnection between the seaport in Police and the chemical company Grupa Azoty Zakłady Chemiczne Police SA does not exclude a possibility of active cooperation with other shippers; still, this would most probably lead to a need to divide the port area on a functional basis in such a way so that serving any external shippers does not collide with serving the main shipper. This would contribute to opening the port to the market, gaining independence from the demand of just one shipper, better utilisation of the port's transshipment potential, thus making it possible to compete on the transshipment market.

It should be noted that the development project in question is a necessary condition for the port development, but it will not guarantee an increase in the transshipment volume. What is equally important is also active sourcing of customers and cargoes as well as completing additional development projects in the future, e.g. fitting the port with terminal equipment, storage yards, and roofed storage facilities.

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