Dariusz Bernacki,[1] Christian Lis[2]

[1]Maritime University of Szczecin
Engineering-Economic Faculty on Transport
e-mail: dariusz.bernacki@o2.pl
[2]University of Szczecin
The Faculty of Economics and Management
e-mail: chrislis@wneiz.pl

Socio-economic benefits of the improvement of transport accessibility to the port of Szczecin

Abstract: The aim of the paper is to present the socio-economic effects which will appear in relation with the realization of the large-scale investments consisting in (1) the deepening of the fairway Świnoujście-Szczecin down to 12.5 m and (2) the adjustment of the infrastructure in the port of Szczecin (deepening of the port water area and modernization and deepening of the selected berths) to handle larger seagoing vessels. Those are complementary projects and their combined realization will allow the handling of fully laden vessels with deadweight of 40 thou. tonnes (at present that is 15 thou. tonnes). The realization of the investment projects will contribute to the creation of the socio-economic benefits which will arise in:
– the land section of the transportation chain running through the port of Szczecin; within the hinterland transport there will arise savings in the land transportation costs and in the external costs resulting from the shortening of transportation distance and changes in the sectoral structure of transports (modal shift);
– the sea section of the transportation chain running through the port of Szczecin; within the sea transport there will arise savings in the sea transportation costs and in the external costs resulting from the shortening of transportation distance, and in the costs of exploitation of vessels resulting from the increase of their size (economies of seagoing vessel's size);
– the port of Szczecin in the form of the increased gross value added (GVA) in the port activity, additionally created value of port services.
The socio-economic analysis covered all planned complementary investments. The socio-economic effects have been identified with the use of the cost benefit analysis (CBA).

Introduction

The conditions under which the port in Szczecin comes to function currently are as follows:

– the accessibility of the port from the sea is determined by the Świnoujście–Szczecin fairway. This is a transport infrastructure object connecting the port in Szczecin with the open sea (Pomorska Bay). It was built by the end of the XIX century. With the observation of the permissible technical depth of the fairway at the level of 10.5 m and the fairway's width of 90 m at its bed, it enables a safe navigation and entering the port in Szczecin for sea vessels with their maximum draft of 9.15 m or with maximum length of 215 m, however, the vessels with the maximum draft of 9.15 m cannot exceed the length of 160 m;

– the accessibility of the port in Szczecin from the sea at the current stage of development of maritime trade and shipping is very low. Except for the ports in Kaliningrad and Lubeck, all other main ports situated at the Southern coast of the Baltic Sea poses better navigational conditions enabling handling seagoing vessels with tonnages and capacities greater than those in Szczecin (Hozer, Bernacki, Lis, Kuźmiński 2011);

– the low accessibility of the port in Szczecin from the sea causes that the port of Szczecin can handle vessels of small tonnage (fully laden of up to 15,000 tonnes deadweight). Bigger vessels can call the port in Szczecin only under the condition that they are not fully laden (Kotowska, Mańkowska, Pluciński 2014).

Among the Polish ports of the essential importance to the maritime economy, in the period of 2008–2014, the port in Gdańsk noted the highest dynamics of turnover. The transhipments in the port of Gdańsk in that period increased by 81.5%, i.e., they increased by the average of 10.4% a year. In the port of Świnoujście, the cargo turnover increased by 40.2%, i.e., by the average of 5.8% a year, whereas in the port of Gdynia, they increased by 25.5%, i.e., by the average of 3.9% a year.

Against this background, the port in Szczecin did not note any evident increase of cargo turnover. In 2008, the turnover in the port in Szczecin amounted to 8.95 m tonnes whereas in 2014 – to 9.009 m tonnes, which means the increase by 0.7%, i.e., by the average of 0.1% a year. The consequence of that was the diminishing of the transport importance of the port in Szczecin among the Polish ports of the essential importance to the economy (Table 1).

Table 1. Transhipment volumes in sea ports in 2008–2014 (thous. tonnes)

Year	Sea ports				Total
	Szczecin	Świnoujście	Gdynia	Gdańsk	
2008	8,950	10,266	15,467	17,781	52,464
2009	7,821	8,677	13,257	18,863	48,618
2010	8,798	12,045	14,735	27,182	62,760
2011	8,889	12,465	15,911	25,305	62,571
2012	8,203	13,063	15,809	26,898	63,974
2013	8,715	14,035	17,659	30,259	70,668
2014	9,009	14,393	19,405	32,278	75,084

Source: own elaboration on the basis of data obtained from the port authorities of Szczecin and Świnoujście, Gdynia, Gdańsk.

The changes of turnover in the Polish sea ports in the period of 2008–2014 are shown in Fig. 1.
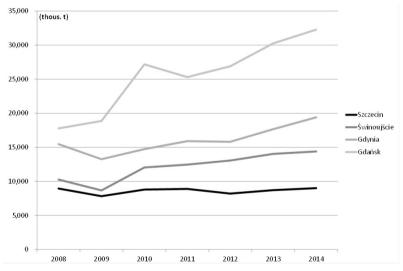

Fig. 1. Cargo turnover of the sea ports in Szczecin, Świnoujście, Gdańsk, and Gdynia in the period of 2008–2014 (thous. tons)

Source: own elaboration.

The share of the port in Szczecin in the total transhipments of Polish ports dropped from the level of 17.1% in 2008 down to 12.0% in 2014 (5.1 percentage points).

During the period of 2008–2014 the Gross Domestic Product (GDP) expressed in basic prices increased in Poland by 16.7% and the average-annual rate of economic growth

in Poland amounted to 2.6%. On the basis of the data on transhipments in the ports of the essential importance to the national economy during the years 2008–2014 and the GDP in basic prices (in 2014), the strength of the relation between the cargo turnover in Polish ports and the gross domestic product has been analysed with the use of the Pearson product-moment coefficient of correlation. The results are presented in Table 2.

Table 2.   The matrix of Pearson product-moment corellation coefficients between the cargo turnover of Polish sea ports and the gross domestic product in the period of 2008–2014

	GDP	Szczecin	Świnoujście	Gdynia	Gdańsk	TOTAL
GDP	1	0.28	0.91	0.87	0.93	0.94
Szczecin	**0.28**	1	0.53	0.63	0.38	0.52
Świnoujście	**0.91**	0.53	1	0.87	0.94	0.98
Gdynia	**0.87**	0.63	0.87	1	0.78	0.89
Gdańsk	**0.93**	0.38	0.94	0.78	1	0.98
TOTAL	**0.94**	0.52	0.98	0.89	0.98	1.00

Source: own elaboration.

The total volume of cargo turnover in Polish ports shows a strong relation to the economic development of the country. The correlation coefficient for the port turnover in total against the GDP amounted to 0.94, similarly strong relations appeared in Gdańsk (0.93), Gdynia (0.87), and Świnoujście (0.91). The port in Szczecin is the exception where the transhipment dynamics was much lower than the dynamics of the economic growth in Poland. The coefficient of correlation between the volume of cargo transhipment in the port in Szczecin and the GDP was low and it amounted only to 0.28.

In the case of the port in Szczecin, the unfavourable tendencies with reference to the growth rate of the cargo transhipments and the weak correlations between the volume of port turnover and the economic growth of the country result most of all from the low navigation parameters of the Świnoujście–Szczecin fairway limiting the access to the port in Szczecin for sea going vessels.

The key factor determining the further development of the port in Szczecin is the improvement of the port's accessibility from the sea consisting in the modernization and deepening of the Świnoujście–Szczecin fairway. In relation to the improvement of the transport accessibility, in the port of Szczecin it will be necessary to adjust the existing quays to handling bigger seagoing vessels. The planned activities in favour of the improvement of Szczecin port's accessibility from the sea have been concretized in the form of the following investment projects:
   1.   The modernization of the Świnoujście–Szczecin fairway to the depth of 12.5 m. The investment consists in the deepening of the fairway down to the technical

depth of 12.5 m on the distance of 62.5 km with the simultaneous widening of the fairway's bed from 110 m to 130 m on the selected sections, as well as in the construction and modernization of the enforcements of the river banks, regulating constructions, and silting fields. The investment is planned for realization in 2015–2021.

2. Improvement of the accessibility to the port in Szczecin in the area of Kaszubski Basin. The investment consists in the adjustment of the port infrastructure at the bulk cargo transhipment area to handling bigger than presently bulk cargo vessels, and it encompasses the modernization and deepening down to the technical depth of 12.5 m of the three most used port quays. The investment is planned for realization in 2017–2020.

3. The improvement of the accessibility to the port in Szczecin together with the extension of the port infrastructure in the area of Dębicki Canal. The investment consists in the adjustment of the port infrastructure in the port of Szczecin at the break bulk cargo transhipment area to handling bigger than presently vessels and the extension of the port infrastructure to handling intermodal units, unitized and conventional break bulk cargo and project cargo. The project encompasses modernization and deepening down to the technical depth of 12.5 m of two transhipment quays and the construction of a new deep-water general cargo transhipment quay. The investment is planned for realization in 2017–2020.

4. The construction of a deep-water bulk cargo transhipment quay at Grabowski Islet by Przekop Mieleński. The investment is planned for realization in 2017–2020.

The aim of the investment undertaking encompassing all the above-mentioned investment projects is to increase the efficiency of the sea-land transportation chain running through the port in Szczecin.

The deepening of the fairway will allow merchant ships of bigger capacity and deadweight to enter the port in Szczecin, whereas the modernization and extension of the port infrastructure at the break bulk cargo transhipment area (Dębicki Canal), bulk cargo transhipment area (Kaszubski Basin), and at Grabowski Islet will enable handling bigger seagoing vessels. The combined and supplementary realization of the investment projects will cause the increase of the costs efficiency of sea-land transports and will guarantee proper conditions for handling vessels and cargo in the port of Szczecin.

The aim of the paper is to present the socio-economic effects which will appear in connection with the realization of large scale investment projects consisting in: (1) deepening of the Świnoujście–Szczecin fairway down to 12.5 m, and (2) adjusting the port infrastructure in the port of Szczecin (deepening of harbor water area and modernization as well as deepening of selected berths) to handling bigger sea vessels. Those are complementary projects and their joint realization will enable handling fully laden ships of up to 40,000 tons (presently it is up to 15,000 tons) in the port of Szczecin.

1. Methodology

The calculation of the socio-economic benefits for the investment undertaking has been carried out basing on the cost-benefit analysis method in accordance with the assumptions and guidelines elaborated for the investment projects co-financed by the European Union's Cohesion Fund for the period of 2014–2020 (*Regional and Urban Policy* 2014, *Ministry for Infrastructure and Development* 2015). The investment undertaking consists of four, mutually supplementing and conditioning the reaching of the objective, investment projects. The socio-economic benefits have been calculated for the complementary investments with the assumption that in the non-investment variant (W0) there will not be realized any investment project, whereas in the investment variant (WI) all the considered projects will be realized. The socio-economic effects of the investment undertaking include the transportation cost savings, external cost savings in maritime transport as well as in land transport, and the increase of the value added in the port in Szczecin established for the difference in cargo transhipment prognosis elaborated for the investment variant (WI) and for the non-investment variant (W0). The differential variant of transhipment prognosis (WI-W0) covers the period of 2021–2041 which results from the assumed investment exploitation period.

The year 1999 has been assumed as the basis for the determination of the cargo transhipment prognosis in the non-investment variant because that was the year when the change in the tendency in development of cargo transhipments in the port of Szczecin occurred. On the basis of time series of transhipments in the period of 1999–2014, the parameters of hyperbolic trend line have been estimated. The function of the trend in the total turnover in the port of Szczecin during the years 1999–2014 amounted:

$$\hat{y}_t = 6926841 \cdot \frac{1}{t} + 8461395$$
$$\underset{(829275)}{} \quad \underset{(260954)}{}$$

where $t = 1, 2,…, 16$ (subsequent years of the trend parameters estimation).

On the basis of the trend function, prognoses of transhipments in the port of Szczecin have been made for the non-investment variant. While making prognoses of the cargo groups transhipments, the structure of transhipments by cargo group in 2014 has been used. For the reference period of 2021–2041, the average rate of change of cargo turnover in the port of Szczecin amounted (-8.08%).

The demand for the transhipment services in the port of Szczecin has been, in the investment variant, conditioned on the predicted economic situation in Poland. It has been assumed that in result of the realization of the investment undertaking, the port of Szczecin will return to the development path connected with the increase of the GDP and in a greater than so far degree it will participate in the predicted increase of the demand for the transhipment services. While determining the development of transhipments in the port in Szczecin, first of all, the transhipment prognosis for the Polish ports as prepared in the minimum and maximum variants for the period until the year 2030 (Kotowska,

Mańkowska, Pluciński 2014) have been used. On this basis, the total turnover dynamics indexes for the port in Szczecin for the minimum and maximum prognosis variants until 2030 have been established. The turnover dynamics indexes for the period of 2031–2041 have been established on the basis of the mathematical functions of the transhipment prognosis trends assessed for the minimum and maximum variants. The dynamics indexes represent the average-annual rate of change in the transhipment in the port of Szczecin for the minimum and maximum variants in the period of 2021–2041. The geometric averages of the total turnover dynamics (chain) indexes in the port of Szczecin for the minimum and maximum variants are presented in Table 3.

Table 3.   Average cargo turnover dynamics indexes for the port in Szczecin in the period of 2021–2041

Average cargo turnover dynamics index for the minimum variant T_{min}	2.66%
Average cargo turnover dynamics index for the maximum variant T_{max}	3.06%
Mean cargo turnover dynamics index for the minimum and maximum variants $T_{average}$	2.86%
Spread of the average cargo turnover dynamics index between the maximum and minimum variants *h* (statistical range)	0.41%

Source: own elaboration.

The established average dynamics indexes refer to the total turnover in the port of Szczecin. The rate of change for specific cargo groups will be diversified. The 12 benchmarks of turnover dynamics indexes have been established in such a manner where the obtained turnover dynamics indexes for the minimum and maximum variants amounting respectively to 2.66% and 3.06% have been decreased or increased by the value of the dynamics index's spread which amounted to h=0.41%.

The development potential of cargo groups in the port of Szczecin is presented in Table 4.

Using the turnover dynamics indexes of the specific cargo groups, the cargo turnover prognosis for the port of Szczecin has been made for the investment variant.

The average-annual rate of increase of the total turnover in the port of Szczecin for the period of 2021–2041 amounted to 2.91%. It is being anticipated that after the deepening of the Świnoujście–Szczecin fairway down to 12.5 m, the transhipments in the port of Szczecin will amount to 15,561,136 tons in 2041, which means the increase of the turnover in 2041 by 6,938,652 tons in comparison with the non-investment variant.

Table 4.   Predicted yearly dynamics of the development of transhipment of cargo groups
in the port of Szczecin within the investment undertaking (WI)

Assessment of development potential in the scale of 0–12	Yearly dynamics index (%)	Cargo group	Scenario-development potential
0	as in W0, WI = W0	crude oil and oil products, conventional break cargo	insignificant
1	1.03		
2	1.44		slight
3	1.84		
4	2.25		
5	2.66	coal, iron ore	
6	2.86		medium
7	3.06		
8	3.47	other bulk	
9	3.88		big
10	4.28	grains	
11	4.69		very big
12	5.09	containerised break bulk	

Source: own elaboration.

The predicted volume of cargo groups turnover in the port in Szczecin, for the investment undertaking in the differential variant (WI-W0), is presented in Table 5.

Table 5.   The predicted volume of cargo groups turnover in the port of Szczecin
for the investment undertaking in the differential variant (WI-W0) in the period
of 2021–2041 (tons)

Year	Coal	Iron ore	Other bulk	Grains	Containerised break bulk	TOTAL
1	2	3	4	5	6	7
2021*	0	0	0	0	0	0
2022	50,639	8,944	105,944	46,880	33,983	246,390
2023	102,347	18,076	215,083	95,580	69,576	500,662
2024	155,182	27,408	327,576	146,199	106,873	763,239
2025	209,200	36,948	443,585	198,835	145,972	1,034,539
2026	264,453	46,707	563,268	253,588	186,973	1,314,988
2027	320,993	56,693	686,785	310,563	229,982	1,605,015
2028	378,871	66,915	814,298	369,863	275,108	1,905,055

1	2	3	4	5	6	7
2029	438,137	77,382	945,970	431,600	322,464	2,215,554
2030	498,841	88,103	1,081,969	495,886	372,171	2,536,970
2031	561,032	99,087	1,222,463	562,837	424,353	2,869,772
2032	624,759	110,343	1,367,626	632,575	479,140	3,214,442
2033	690,073	121,878	1,517,635	705,224	536,669	3,571,478
2034	757,023	133,702	1,672,673	780,915	597,082	3,941,396
2035	825,660	145,825	1,832,927	859,782	660,532	4,324,726
2036	896,036	158,254	1,998,588	941,967	727,173	4,722,019
2037	968,202	171,000	2,169,855	1,027,615	797,173	5,133,845
2038	1,042,212	184,071	2,346,931	1,116,878	870,704	5,560,797
2039	1,118,119	197,478	2,530,027	1,209,914	947,949	6,003,486
2040	1,195,977	211,229	2,719,359	1,306,888	1,029,098	6,462,551
2041	1,275,844	225,335	2,915,150	1,407,971	1,114,353	6,938,652

* The Świnoujście–Szczecin fairway is planned to be finished in 2022, which means that there are no differences in transhipments predicted till 2021 in the two variants of the investment undertaking.

Source: own elaboration.

The forecasted cargo turnover in the port of Szczecin for the investment undertaking in the reference period of 2021–2041 is presented in Fig. 2.
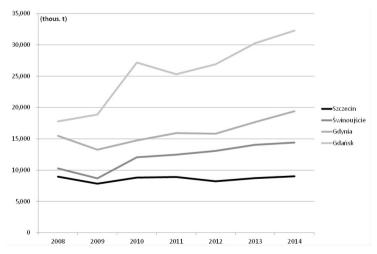

Fig. 2.   The predicted cargo groups turnover in the port of Szczecin for the investment undertaking in the period of 2021–2041 (tons)

Source: own elaboration.

2.   Study results

The realization of the investment undertaking will contribute to the origination of socio-economic benefits which will occur in:

a) **the land section** of the sea–land transportation chain running through the port in Szczecin. The hinterland transport will note cost savings in cargo transportation by land means of transport and in external costs, resulting from the shortening of transportation distance and from the change in the sectoral structure of transports (the increase of the importance of the railway transport versus the road transport – modal shift);

b) **the sea section** of the sea–land transportation chain running through the port in Szczecin. The sea transport will note cost savings in cargo transportation by sea and in external costs, resulting from the shortening of transportation distance and in the costs of exploitation of vessels resulting from their increased size (economies of vessel's size); and

c) **the sea port of Szczecin** in the form of the increase of the (gross) value added produced by port activities, additionally produced value of port services caused by the increase in cargo turnover in the port.

The socio-economic effects indicated in c) have been determined as the direct result of the investment undertaking at its exploitation phase (the effects appearing during the realization stage have been excluded), and have been limited to the activities of the port of Szczecin with disregard of the effects appearing in the surroundings of the port of Szczecin (*The Centre for EU Transportation Projects* 2014).

The socio-economic benefits in land transport (in the hinterland of the port of Szczecin) resulting from the realization of the investment undertaking include:

a) **the transportation costs savings** in land transport resulting from the shortening of transportation distance in the hinterland,

b) **external costs savings** resulting from the shortening of transportation distance in the hinterland,

c) **the transportation costs savings** in land transport resulting from the change in the sectoral structure of transports (modal shift) in the hinterland, and

d) **external costs savings** resulting from the change in the sectoral structure of transports in the hinterland.

External costs for road and rail freight transport have been estimated with the use of Marco Polo calculator while average freight transport costs for rail and road have been calculated with the use of three sources, i.e., *Social cost-benefit analysis Iron Rhine Final Report* 2009; Delhaye, Breemersch, Vanherle, Kehoe, Liddane, Riordan 2010; and TREMOVE cost simulation model 2006.

Respective costs have been indexed and through *Purchasing Power Standard* coefficient factor adjusted for Poland. Calculations of external and carriage costs for road and rail transport have been presented in Table 6, 7, and 8.

Table 6. Average external cost coefficients for the road and rail freight (electric traction) transport, year 2014

L.p.	External costs	Road transport			Rail transport (elecric traction)			Difference
		EU 27 2011 EUR/1000tkm	EU 27 2014 EUR/1000tkm	**Poland EUR/1000tkm**	EU 27 2011 EUR/1000tkm	EU 27 2014 EUR/1000tkm	**Poland EUR/1000tkm**	
1.	Air pollution	8.60	9.09	6.18	1.00	1.06	0.72	
2.	Climate change	3.90	4.12	2.80	1.50	1.59	1.08	
3.	Noise	1.90	2.01	1.37	1.50	1.59	1.08	
4.	Accidents	0.60	0.63	0.43	0.30	0.32	0.22	
5.	Congestion	3.50	3.70	2.51	0.20	0.21	0.14	
	Environmental (1 + 2 + 3)	14.40	15.22	10.35	4.00	4.23	2.87	
	Socio-economic (4 + 5)	4.10	4.33	2.95	0.50	0.53	0.36	
Total (EUR/1,000 tkm)		18.50	19.55	13.29	4.50	4.76	3.23	10.06
Total (PLN/1,000 tkm)		55.24			13.44			41.80
Average external costs (PLN/tkm)		0.0552			00134			

Source: own elaboration based on Brons, Christidis 2013.

In the calculation, the following external costs coefficients were applied: for road freight transport – 0.0552 PLN/tkm, for rail freight transport (electric fraction) – 0.0134 PLN/tkm.

Table 7. Average cost for rail freight transport (electric traction), year 2014

Cargo group	Rail transport (electric traction)				
	EU 28 2010 EUR/1000 tkm	EU 28 2014 EUR/1000 tkm	Poland 2014 EUR/1000 tkm	Poland 2014 PLN/1000 tkm	**Poland 2014 PLN/tkm**
Agriculture products (grains incl.)	6.65	7.24	4.92	20.45	0.0205
Dry bulk cargo	5.75	6.26	4.26	17.68	**0.0177**
Containerised break bulk	8.10	8.82	5.99	24.91	**0.0249**

Source: own elaboration based on Delhaye et al. 2010

Average freight rail transport cost applied in calculations amounted: for grains – 0.0205 PLN/tkm, for dry bulk cargo – 0.0177 PLN/tkm, for containerized break bulk – 0.0249 PLN/tkm.

Table 8.   Average cost for road freight transport, year 2014

Average road freight transport cost	Value	Indicator
truck> 32 tonnes EU 26 year 2010	104.60	EUR/1000 tkm
truck> 32 tonnes EU 28 year 2014	113.85	EUR/1000 tkm
truck> 32 tonnes Poland year 2014	77.42	EUR/1000 tkm
truck> 32 tonnes Poland year 2014	0.3217	PLN/tkm

Source: own elaboration based on TREMOVE cost model.

The applied in calculation average road freight transport cost amounted to 0.3217 PLN/tkm.

In order to determine the socio-economic benefits arising in the land transport in connection with the realization of the investment undertaking, the analysis has been performed of the hinterland of the port in Szczecin versus its neighboring sea ports and with reference to handling cargo transports in relations to/from the main points of the hinterland. The analysis has been performed for the following cargo groups: for containerized break bulk cargo (containers) and for grains and bulk cargoes (with the exclusion of crude oil). The socio-economic benefits have been determined, such as the savings in the transportation costs and in the external costs resulting from the shortening of the transportation distance to the port of Szczecin in comparison with alternative transport routes to the ports in Rostock, Gdynia, and Gdańsk, and such as the savings in the transportation costs and the external costs resulting from the expected changes in the sectoral structure (modal shift) of land transports caused by the realization of the investment undertaking. Modal shift from road to rail transport has been forecasted as a consequence of the raise in the shippment load and the increase in the shipment density. The socio-economic benefits have thus been expressed as the additional costs that may be avoided by the realization of the investment undertaking.

The socio-economic benefits in the sea transport (the foreland of the port of Szczecin) resulting from the realization of the investment undertaking include:

   a) **external costs savings** in the sea transport resulting from the shortening of transportation distance,
   b) **the transportation costs savings** in the sea transport resulting from the shortening of transportation distance, and
   c) **the transportation costs savings** on the sea leg resulting from economies of scale, decreasing the unit transportation cost due to carriage on a bigger sea vessel. These are the transportation costs savings resulting from the exploitation of big seagoing vessels (economies of vessel's size).

External and transport costs for freight shipping have been calculated and depicted in Tables 9 and 10.

Table 9. Average external cost coefficients for freight maritime transport (short sea shipping), year 2014

Fuel technology – low sulphur fuel	External costs	Ship type			
		General/ bulk ships	General/ bulk ships	Container ship	Container ship
		2011	2014	2011	2014
EUR/1,000tkm	air pollution	4.48	4.73	3.09	3.27
	climate change	0.21	0.22	0.40	0.42
	Total	4.70	4.97	3.49	3.69
Average external costs maritime transport, year 2014	PLN/tkm	0.0206		0.0153	

Source: own calculation based on Brons, Christidis 2013.

The following average external cost have been applied in calculus: for general/dry bulk ships – 0.0206 PLN/tkm, for container ships – 0.0153 PLN/tkm.

Table 10. Average transport cost for grains, dry bulk, and container ships calling to the port of Szczecin, year 2014 (PLN/tkm)

Ship/load type	Average DWT (W0)	Average transport cost	Average DWT (WI)	Average transport cost
Dry bulk (grains)	22,892	**0.0097**	34,967	**0.0072**
Dry bulk	7,377	**0.0216**	9,945	**0.0175**
Containership	11,000 t/ 600 TEU	**0.0191**	18,440 t/ 1,500 TEU	**0.0125**

Source: own elaboration.

In order to determine the socio-economic benefits arising in the sea transport in connection with the realization of the investment undertaking, the analysis has been performed of the foreland serviced by the sea port in Szczecin versus its neighboring sea ports. The port of Malmoe has been selected as the reference point for the ship routing alternation for the investment variant (WI) and for the non-investment variant (W0). The analysis has been performed for cargo groups showing the largest increases in their turnover resulting from the realization of the investment undertaking, namely for containerized break bulk (containers), for grains and bulk cargoes. The socio-economic benefits have been

determined as the savings in the transportation costs and in the external costs resulting from the shortening of the transportation distance to the port of Szczecin in comparison with alternative transport routes to the ports in Rostock, Gdynia, and Gdańsk, and also caused by the decrease of the unit costs of cargo transportation in big seagoing vessels.

The average gross value added created during the transhipment of 1 tonne of cargo in the port in Szczecin during the years 2010–2013 amounted to 30.94 PLN. The unit gross value added multiplied by the volume of the transhipments predicted in the port of Szczecin in the non-investment variant (W0) and in the investment variant (WI) was used to calculate the increase of the gross value added in the differential variant (WI-W0). The gross value added in the differential variant (WI-W0) means the increase in economic results which will occur in the port of Szczecin in result of the realization of the investment undertaking.

The total and discounted (at the discount rate of 5%) economic benefits for the investment undertaking are presented in Table 11.

Table 11. Total (discounted) socio-economic benefits of the investment undertaking
         (PLN)

Benefits	Total discounted value	% of cumulated benefits
Cost savings in the maritime transport	1,091,739,404,87	31.7
Cost savings in the land transport	1,172,726,456,33	34.0
External cost savings in the maritime transport	91,723,524,36	2.7
External cost savings in the land transport	173,066,538,89	5.0
Gross value added in the port of Szczecin	774,405,083,56	22.5
Residual value of the investment undertaking	144,856,310,90	4.2
Total	3,448,517,318,90	100.0

Source: own elaboration.

The structure of the economic benefits is presented in Fig. 3.
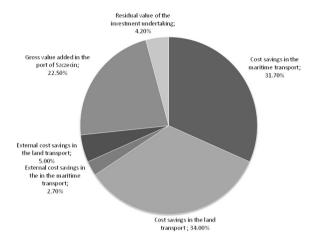
Fig. 3.   Structure of (discounted) economic benefits of the investment undertaking (%)

Source: own elaboration.

Conclusions

1. The realization of the investment undertaking will contribute to the creation of the socio-economic benefits with the combined value of 3.448.517.318,90 PLN, where the benefits in the sea transport (savings in the transportation costs and in the external costs) will in total amount to 1,183,462,929.23 PLN (34.40% of the total benefits obtained from the investment undertaking), in the land transport (savings in the transportation costs and in the external costs) – 1,345,792,995.22 PLN (39.0% of the total economic benefits), in the port of Szczecin, there will be value added created in the amount of 774,405,083.56 PLN (22.5% of the total economic benefits). The residual value of the investment undertaking will amount to 144,856,310.90 PLN (4.20% of the total economic benefits from the investment undertaking).

2. In the sea and land transports, there economic benefits prevail connected with the decreasing of the cargo transportation costs. The savings in sea transportation costs have amounted to 1,091,739,404.87 PLN (31.7% of the total economic benefits from the investment undertaking), the savings in the land transportation costs have amounted to 1,172,726,456.33 PLN (34.0% of the total economic benefits from the investment undertaking). The external costs savings connected with the transportation by sea and land in total have amounted to 264,790,063.24 PLN (in total 7.7% of the total economic benefits from the investment undertaking).

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Wytyczne w zakresie zagadnień związanych z przygotowaniem projektów inwestycyjnych, w tym projektów generujących dochód i projektów hybrydowych na lata 2014–2020 (2015). Warszawa: Ministerstwo Infrastruktury i Rozwoju.

KORZYŚCI SPOŁECZNO-EKONOMICZNE POPRAWY DOSTĘPNOŚCI TRANSPORTOWEJ DO PORTU MORSKIEGO W SZCZECINIE

Słowa kluczowe: rozwój infrastruktury, port morski, efekty społeczno-ekonomiczne

Streszczenie: Celem artykułu jest przedstawienie efektów społeczno-ekonomicznych, jakie pojawią się w związku z realizacją wielkoskalowych projektów inwestycyjnych, polegających na: (1) pogłębieniu do 12,5 m toru wodnego Świnoujście-Szczecin i (2) dostosowaniu w porcie Szczecin infrastruktury portowej (pogłębienie części akwatorium portowego oraz modernizacja i pogłębienie wybranych nabrzeży) do obsługi większych statków morskich. Są to projekty komplementarne, a ich łączna realizacja umożliwi obsługę w porcie Szczecin statków w pełni załadowanych o nośności do 40 tys. ton (obecnie jest to 15 tys. ton).

Realizacja projektów inwestycyjnych przyczyni się do powstania korzyści społeczno-
-ekonomicznych, jakie pojawią się:

– w lądowej części łańcucha transportowego przebiegającego przez port w Szczecinie; w trans-
porcie zaplecza wystąpią oszczędności w kosztach przewozu ładunków transportem lądowym
i w kosztach zewnętrznych wynikające ze skrócenia odległości przewozu i zmian w strukturze
gałęziowej transportu zaplecza,

– w morskiej części łańcucha transportowego przebiegającego przez port w Szczecinie; w trans-
porcie morskim wystąpią oszczędności w kosztach przewozu ładunków transportem morskim
i w kosztach zewnętrznych wynikające ze skrócenia odległości przewozu oraz w kosztach eks-
ploatacji statków wynikające ze wzrostu ich wielkości (korzyści skali związane z wielkością
statku morskiego)

– w porcie Szczecin w postaci wzrostu w działalności portowej wartości dodanej, dodatkowo wy-
tworzonej wartości usług portowych.

Rachunkiem ekonomicznym objęto wszystkie zaplanowane inwestycje komplementarne. Efekty
społeczno-ekonomiczne zidentyfikowano przy wykorzystaniu analizy kosztów i korzyści (metoda
AKK).