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# RESEARCH INTO THE IMPORTANCE OF SMALL SEAPORT NAUTICAL INFRASTRUCTURE IN THE DEVELOPMENT OF THE LOCAL ECONOMY

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**Abstract:** Research into the importance of small seaports in the development of the local economy is extremely rare. This applies equally to the assessment of port infrastructure. Considering the research deficiencies, the decision was made for this paper to assess the importance of nautical infrastructure to port operators and the local economy. The territorial scope of the research covers seven small ports where the vast majority of national maritime sailing is concentrated. The importance of nautical infrastructure to port operators was assessed based on a cost-benefit approach. However, in the case of the local economy, the benefits of the expansion of the nautical infrastructure were determined based on the sailors' spending, accounting for cash flows and multiplier effects. The study was based on available statistical data and the results of surveys and interviews. The studies carried out showed a negative return on nautical investments for port operators. However, nautical facilities generate net benefits to the local economy. The importance of nautical investments for port municipalities requires further research, especially into cash flows and the indirect and induced effects.

**Keywords:** nautical infrastructure, small seaports, local development, research methods.

## 1. Introduction

Small seaports are generally considered to be essential factors for the socio-economic mobilization of coastal municipalities. However, research into their importance in the development of the local economy is extremely rare. This applies equally to

the assessment of port infrastructure. Therefore, the aim of this article is to assess the importance of nautical infrastructure to port operators and the local economy. In reference to the aim of the article, the following hypothesis was formulated: the development of sailing infrastructure benefits the local economy, but is not profitable for port operators.

In this study, the author sought to answer the following questions: is it worth investing in the development of nautical infrastructure; which analytical tools should be used to assess nautical infrastructure; which sources should be used to obtain research data; which measures should be used to determine the importance of nautical infrastructure, and which reference area should be adopted for the research?

The infrastructure assessment was carried out from the point of view of the port operators and the local economy. The port operators were selected for the analysis due to the legal form in which their businesses operate. Most of these are commercial companies owned by port cities. The infrastructure's impact area was narrowed to the local economy due to the scale of the investments and the fact that nautical companies are located within the port municipalities.

The research focused on nautical infrastructure, which in the years 2011-2018 underwent major modernization and an initial assessment of the investment process was already possible. The infrastructure assessment procedure set out here may be used for research into other activities of small ports, i.e. transshipment and fishing.

Pursuing the objective of the article required the use of secondary and primary sources of information. Foreign and national literature on the subject was used to review research into port issues. However, the assessment of the nautical infrastructure was based on statistical data and on information obtained through diagnostic surveys. The studies were carried out in 2018-2019. The territorial scope of the research covered seven small seaports representing each section of the Polish Baltic Sea coast, i.e.: Dziwnów, Kołobrzeg, Darłowo, Ustka, Łeba, Jastarnia, and Hel. The vast majority of national maritime sailing activity is concentrated in these ports.

The cost-benefit method was used to assess nautical investments from the point of view of the port operators, by determining the financial net present value (FNPV). As the nautical facilities were subsidized by EU funds, the FNPV was calculated for two options: grant and non-grant. According to the guidelines on financing infrastructure investments from EU funds for sailing facilities, the reference period of 15 years and the discount rate of 5.0% (Ministerstwo Rozwoju Regionalnego, 2013) were adopted. To determine the financial viability of the investments, more data were collected from the port operators.

In turn, the importance of the infrastructure to the local economy was determined based on the sailors' spending. The available statistics were used to estimate their spending and supplemented by information on the traffic in the ports concerned, i.e. the average time of stay in port and the average number of sailors per yacht. Information about the sailing traffic was obtained through surveys and interviews.

The respondents were the presidents or directors of the operators managing the ports – port operators, as well as directors of sailing associations and owners of tourism companies. Additionally, the estimated size of the sailors' spending needed to be adjusted by the proportion of the cash flows remaining in the local economy and the multiplier effects. Given the limited availability of statistics, the importance of the above effects in the development of the local economy was assessed descriptively.

## **2. Port infrastructure research in foreign literature**

Port research is a relatively new research area and is not a separate scientific discipline. No theories or theoretical models have been developed specifically for seaports. The research thus uses methods and techniques borrowed from other disciplines such as economics, geography, management, sociology, psychology, and politics. Therefore, the research is multidisciplinary, and there is no single universal method designed for seaports (Dooms, Haezendonck, and Verbeke, 2015; Su-Han, Pettit, Dong-Wook, and Beresford, 2011). Consequently, seaport research should be guided by the general principle that such analytical tools should be selected that are appropriate for the research topics concerned. In port infrastructure research, three basic research methods are used: cost-benefit analysis, input-output analysis, value-added analysis and economic base analysis (Danialis and Gregori, 2013; Su-Han et al., 2011).

The main measures defining the importance of port infrastructure are its capacity to generate jobs, added value and tax revenue. The volume of investment is an equally frequently used indicator. However, employment is increasingly being questioned as a reliable research measure. This is linked to the ongoing changes in cargo handling technology and the use of advanced IT tools, resulting in a reduction in labour demand. On the other hand, issues related to environmental protection and external port infrastructure costs are becoming increasingly important in research (Santos, Salvador, Quaresma Dias, and Soares, 2018).

Port infrastructure research makes use of two approaches, i.e. top-down and bottom-up. The top-down approach is based on available statistics and comparative data. The bottom-up approach helps gather information from port companies. The increasing range of data published by statistical institutions could suggest that the top-down approach prevails, particularly in research into large seaports and their regional and national impact. However, the still existing insufficiency of statistics related to the local impact perspective and the smaller ports continues to result in the frequent use of the bottom-up approach. This approach serves not only to collect statistical material but also to understand changes in ports and in their hinterland. For the same reason, qualitative methods such as surveys and interviews are gaining in popularity in research into seaports (Danialis and Gregori, 2013; Mangan, Lalwani, and Gardner, 2004; Su-Han et al., 2011).

The research methodology distinguishes three types of effects of port infrastructure operation, namely direct, indirect and induced. The direct effects cover enterprises operating on the basis of the infrastructure, e.g. those involved in transshipment, transport and repair services. Providers of supplies and services for the aforementioned group of enterprises are the source of the indirect effects. In turn, the induced effects arise from the consumption expenditure of the labour force linked to the direct and indirect activities of port enterprises. It should be stressed that most research focuses on the direct effects, which are more recognized and ‘tangible’ (for example because of the availability of statistical data), and therefore do not raise such research controversy as the indirect and induced effects. Thus, the interests of researchers should focus on identifying and measuring the last two effects, which have so far been poorly described in the source literature (Dooms et al., 2015; Merk, 2015; Song and van Geenhuizen, 2014).

The trend in seaport research is to focus more on assessing individual infrastructure facilities than entire port systems, which is caused by the increasing infusion of free-market principles into port activities and, as a consequence, the privatization of transshipment terminals. The regionalization of seaports resulting from the reduction of economic space in ports and the development of containerization and intermodal transport is reflected in the revision of the approach to port infrastructure research. The links between ports and their further economic environment, i.e. regional, national and even international, are increasingly being examined, thus going beyond the local impact perspective (Bottasso, Conti, Ferrari, and Alessio 2014; Dooms et al., 2015).

The vast majority of research concentrates on larger seaports. Research into smaller ports, on the other hand, is extremely rare due to their limited impact on their economic environment and the lower availability of statistical data. Since larger seaports are mostly involved in transshipment, most research is devoted to transport activities, less to tourism activities, and extremely little to fisheries. This is not due to the lack of research methods and techniques which, as already mentioned, can be successfully applied to any port activity, but to the lower importance of tourism and fisheries to the economy.

The foreign literature offers only a few studies devoted to nautical activity. The authors of perhaps the most important one are Guerrero, Selva, Medina (2008), who investigated 13 nautical facilities in the Mediterranean using the input-output method. The aim of the study was to determine the importance of nautical activities to port cities, taking into account the direct, indirect and induced effects. The interests of other authors are not closely related to studying nautical infrastructure. For example, Silveira, Santos and Perna (2018) sought to identify the reasons why the potential of a yacht marina in one of Portuguese cities was not exploited and thus had a limited impact on the local economy. They did not estimate the loss of benefits, but only used the Delphi qualitative method to diagnose the cause of sailors’ low interest in the marina. Bizzarri and La Foresta (2011), Luković (2012) and Kovačić

and Silveira (2018) referred to the available statistics, highlighting the importance of nautical tourism. Studies by Gerke, Desbordes, Dickson (2015) and Gerke, Pria (2018) focused on analyzing the organizational structure of sailing clusters. The authors did not, however, examine the importance of nautical clusters to the local economy.

### **3. Port infrastructure research in Polish literature**

Polish literature offers extremely few examples of research into either seaport infrastructure or – more generally – seaports. The majority of researchers have limited their interest to establishing the benefits of owning small port structures, but without attempting to quantify them (Grzelakowski and Matczak, 2012; Hernik and Ściana, 2014; Miszczuk, 1999; Pluciński, 2013; Szczurek, 2002; Zieziula and Malkowska, 2010).

Bernacki has made the largest contribution to port infrastructure research. He pioneered the research into seaports from the value-added perspective (Bernacki, 2007). He used the method to, among others, assess the economic viability of infrastructure projects of relevance to the entire port, especially in situations where it was difficult to establish a direct link between the investment undertaken and its effects. In his research the benefits derived from investment projects were expressed through the value added generated by companies using port infrastructure in their business operations. Besides Bernacki, research into the value added of seaports was also carried out by Luks (2001).

In later studies Bernacki (2012; 2014) used the cost-benefit analysis method in his port infrastructure research. For example, he studied the economic impact of the Świnoujście-Szczecin fairway dredging project. In that study, the values of the financial and economic performance indicators were determined based on the market values of the investment outlays, using the comparative method (based on the outcomes of similar investment projects) and the expert method (e.g. based on his original estimate of the marginal propensity to consume and an investment multiplier for the country's economy). Apparently, the cost-benefit analysis method adopted both the top-down approach (using official statistics) and the bottom-up approach (using information from maritime industry enterprises and experts' knowledge and experience). It should be noted that the cost-benefit analysis method for assessing the efficiency of the transshipment infrastructure at Ostrów Grabowski, Szczecin, was also used by Zarzecki (2007). Klimek (1990) and Salomon (2002) are also worth mentioning as authors dealing with the assessment of port investment efficiency.

Recently Matczak (2016) made the most comprehensive attempt to define the role of seaports in the development of their economic environment. The author studied the ports at four complementary levels of analysis, i.e. those of the seaport, the port's immediate (closer) environment, and its economic (further) environment. The importance of seaports was measured by their ability to generate jobs, tax

revenues, value added, entrepreneurship and investment. The research was based on extensive statistical material and numerous original assumptions of the author. However, no detailed statistical methods were used in the calculation process. In the case of port infrastructure, the author did not examine its importance to the economic environment, but only determined the ratio of port investments to the investment outlays borne at national or coastal regional level.

As for authors studying nautical activity, the research by Heflich (2011) and Łapko (2015) can be referred to. These researchers underlined the importance of nautical facilities to the local economy, but made no numerical presentation of their results. Nowaczyk (2017; 2018) chose a quantitative approach to assessing the effects of nautical infrastructure development, however his studies were limited to case studies and needed to be expanded.

#### **4. An attempt to determine the benefits of expanding nautical infrastructure to port operators and port municipalities – research results and discussion**

Most commonly, port infrastructure evaluation makes use of the input-output, costs-benefit, economic base and value-added analyses. The decision was made to assess the importance of nautical infrastructure to port operators by adopting the cost-benefit approach. The approach is typically used to determine the viability of investment projects to beneficiaries. This choice was dictated both by the availability of statistical data and its characteristics that allow the time value of money to be accounted for (Rogowski, 2013; Tiep, Cook, and Gunawan, 2018).

In actual fact, the benefits to the local economy can be estimated by any of these methods. Rather than measuring the viability of the investment, the input-output method assesses the benefits that enterprises derive from using the infrastructure, which requires the knowledge of the input-output tables. These are published by GUS (Statistics Poland) at five-year intervals (the last input-output balance was for 2015) at a high data aggregation level, i.e. that of the national economy. Due to the time delay, the information may not reflect the ongoing changes in the economy. Furthermore, the input-output tables would need to be adjusted to take account of the local economic specificity. The research would have to include all entities that benefit from the nautical infrastructure and not just the port operators. Identifying the nautical service providers that are owned by the local capital is another problem. After all, some ‘cash leakage’ from the local economy cannot be ruled out. In addition, resident and non-resident sailors leave a different impact on the port municipalities. The latter give a better developmental stimulus to the local economy by feeding it with new money (Chaberek and Mańkowski, 2019; Danialis and Gregori, 2013; Guerrero et al., 2008).

The economic base theory accounts for the ‘cash leakage’ effect and the multiplier effects, but determining the scale of these phenomena remains problematic. In turn,

the cost-benefit method is designed to assess the viability of the investment to the local community. This does not only account for the project-related cash flows but rather for the whole spectrum of the project's impact on the economy including, among others, company revenues, employee salaries and the related tax revenues. The use of this method would require comprehensive studies, as would the value-added method (Drobniak, 2008; Tiep et al., 2018).

Given the limitations of the above methods caused by the insufficiency of statistical data, the net benefits to the local economy were estimated on the basis of the sailors' spending. To this end, statistics and information from the port operators were used. The problem of 'cash leakage' from the local economy and the multiplier effects were also addressed. However, they were presented descriptively based on a comparative analysis and information from surveys on the structure of the local economy.

The analysis showed that the return on investment in nautical facilities, as determined by the FNPV, was negative if not subsidized with a grant, which means that the investments brought losses to the port operators (Table 1). Similarly, in the case of a grant the FNPV indicated a lack of viability of the investment, although the losses were much lower. Here the only port where the investment generated profit was Darłowo, although its value for the operator was small. The significant disparities between the ports concerned in terms of the FNPV values for both the grant and non-grant options were related to the nature of the relationships between the investment outlays and the costs and revenues from the nautical facility operation. These FNPV components were in turn determined by, among others, the scale of the investment, the range of the services offered, the design of the nautical facilities, the hydro-technical conditions and the ports' accessibility from the side

**Table 1.** The volume of investments (PLN million) and the viability of nautical investments (PLN million) calculated using the FNPV for the grant and non-grant options

Name of port	Financial viability of the investment			
	Investment value	Grant	FNPV – grant	FNPV – non-grant
Dziwnów	8.3	3.3	-2.405	-3.992
Kołobrzeg	10.2	6.0	-2.010	-4.897
Darłowo	1.2	0.7	0.064	-0.272
Ustka	0.4	0.0	n/a	-0.337
Łeba	40.3	17.7	-11.180	-17.647
Jastarnia	2.3	1.8	-0.192	-1.058
Hel	1.7	1.2	-0.240	-1.106

These calculations refer to the investment process from 2011-2018 and the fifteenth period of reference, for which the profitability of sailing facilities was estimated.

Source: developed by the author based on statistical data from the port operators.

of the outpost. However, apart from the diversity of conditions for the development of nautical activities, nautical facilities bring losses to port operators. This is not an unusual situation, as infrastructure investments in seaports often show a negative profitability to the beneficiaries (Bernacki, 2014; Kożuch and Brzozowska, 2006; Silveira et al., 2018; Zarzecki, 2007).

Determining the benefits to the local economy required an estimation of the size of the sailors' spending that is the source of tax revenue, salaries and income for enterprises and which is used to pay for the costs of supplies. Table 2 shows an estimate of the size of the sailors' spending which, depending on the port, could be between several hundred thousand zlotys for Ustka and Łeba and several million zlotys for the ports in Kołobrzeg and Hel. The differences in the sailors' expenditure between the ports were due to the different numbers of yacht calls, numbers of national and foreign sailors per yacht, and lengths of stay in the port. When referring the sailors' spending to the 15-year period, it appears that its size in all the ports concerned (except for Łeba) was significantly higher than the degree of negative return of investment into the nautical facilities as calculated according to the FNPV for the non-grant option.

**Table 2.** Estimated size of the sailors' spending (PLN thousand) in the small seaports noted in 2018

Name of port	Number of yacht calls		Days per person per yacht	Sailors' expenditure		Total expenditure
	domestic	foreign		domestic*	foreign*	
Dziwnów	316	631	6	210.5	951.4	1,161.9
Kołobrzeg	439	1,402	7.5	365.5	2,642.4	3,007.9
Darłowo	181	359	12	241.1	1,082.6	1,323.7
Ustka	195	248	3	64.9	186.0	250.9
Łeba	396	594	2	87.9	298.5	386.4
Jastarnia	630	51	21	1,468.5	269.1	1,737.6
Hel	2,005	1,338	4	890.2	2,343.2	3,233.4

\* Tourists' average expenses per day of stay in Poland in 2018, with PLN 111.00 for Polish tourists and 251.3 for foreign tourists.

Source: developed by the author based on his original research and on statistics published at the Sport and Tourism Ministry website: Arrivals in Poland in 2018 and domestic and foreign travel of Polish residents in 2018.

However, the sailors' 'primary' spending should be adjusted by the amount that is to feed the local economy and the multiplier effects. The study showed that the majority of providers of services to sailors are owned by the local capital. It is therefore expected that the bulk of the expenditure will remain in the port municipalities. As for the multiplier, the source literature reports that its value in economically developed regions dominated by the local sector of small and medium-sized tourism enterprises



employing local residents can be in the range of 2 to 3 (Milewski, 2007). This means that each monetary unit introduced into the economy (the sailors' primary spending) generates one or two additional monetary units in the course of further economic circulation. The structure of the port municipalities' economies allows for a higher multiplier value to be adopted. Most businesses supplying the nautical services sector are small and medium-sized companies owned by the local capital. Both these groups of actors employ a local labour force, meaning that the consumption expenditure will be spent within the local economy. In the foreign literature references analysed here, the multiplier was calculated using the input-output method. In the already mentioned publication on the leisure ports by Guerrero et al. (2008), the multiplier's value depended on the object being examined and was estimated to range between 1.5 and 2. As for the ports' maritime transport activity, the multiplier's value ranged between 1.13 and 2.47 (Merk, 2015; Santos et al. 2018).

## 5. Conclusion

Research into the importance of nautical infrastructure in the development of the economic environment is very rarely addressed in scientific literature. Universal analysis tools for infrastructure research have not yet been developed.

The author of this article wanted to fill part of the research gap and attempted to determine the effects of nautical investments. Research on the importance of port infrastructure, including sailing facilities, most often uses methods of input and output, costs and benefits, economic base, and added value. In this article the significance of sailing infrastructure for port operators was defined with the use of the costs and benefits method, while the net profits for the local economy were estimated based on the amount of sailors' spending.

The conducted research demonstrated that the profitability of sailing facilities for the port operators is negative, be it with or without subsidy. However, in the latter case the only port which did generate profit was Darłowo. On the other hand, sailing infrastructure generates net benefits for the local economy (except for the port in Łeba). Sailors' spending which remains in the local economy – after taking into account the multiplier effects, exceeds the deficit of sailing facilities for the port operators.

The lack of profitability of the sailing infrastructure will require the co-financing of investments from public funds. The range of sailing services offered should be expanded. The complexity of the sailing infrastructure extends the stay of tourists in ports, thus affecting the volume of their spending. This is particularly important in the case of non-resident sailors introducing new money into the local economy. Multiplying the multiplier effects and preventing money from 'leaking out' from the coastal economy will require the involvement of local service providers in tourism.

The information used in the port research was taken from statistics published by statistical authorities and collected from the respondents. The research was

therefore based on two complementary approaches, i.e. top-down and bottom-up. The impact of nautical tourism was limited to the local economy, since most tourism service providers are located in port municipalities. Due to data availability, the tourists' spending was used as a measure determining the importance of the nautical infrastructure.

Further research will be needed to determine the exact importance of nautical facilities to the local economy, especially into the value of the 'cash leakage' from the local economy, as well as the multiplier effects. This will require more surveys and interviews. The results obtained in this way will allow for a better allocation of investment funds in the future, all the more so since the nautical infrastructure expansion process has not been completed. Nautical tourism may become an alternative to the current crisis in fishing, especially for small seaports incapable of involvement in transport activities.

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## **BADANIA NAD ZNACZENIEM INFRASTRUKTURY ŻEGLARSKIEJ MAŁYCH PORTÓW MORSKICH W ROZWOJU LOKALNEJ GOSPODARKI**

**Streszczenie:** Badania nad znaczeniem małych portów morskich w rozwoju lokalnej gospodarki podejmowane są niezwykle rzadko. Dotyczy to także oceny infrastruktury portowej. Uwzględniając braki badawcze, za cel niniejszego artykułu przyjęto ocenę znaczenia infrastruktury żeglarskiej dla operatorów portowych oraz lokalnej gospodarki. W opracowaniu wykorzystano metodę kosztów i korzyści z uwzględnieniem wielkości wydatków żeglarzy. Materiał badawczy oparto na dostępnych danych statystycznych oraz wynikach badań ankietowych i wywiadach. Przeprowadzone badania wykazały ujemną rentowność inwestycji żeglarskich dla operatorów portowych. Obiekty żeglarskie generują jednak korzyści netto dla gospodarki lokalnej. Znaczenie inwestycji żeglarskich dla gmin portowych wymaga dalszych badań, szczególnie nad przepływami pieniężnymi oraz efektami pośrednimi i indukowanymi.

**Słowa kluczowe:** infrastruktura żeglarska, małe porty morskie, rozwój lokalny, metody badań.