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Analysis of the Competitiveness of the Performance of Baltic Ports in the Context of Economic Sustainability

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Abstract: Baltic Seaports are a part of the sustainable global transport infrastructure. The main competitors of the Baltic countries in Baltic Sea region are the ports of Lithuania, Latvia, and Estonia. The ports of all three Baltic States are important transit corridors, connecting not only East and West, but also South and North. Periodical investments, modernization, and the construction of new terminals allow the Port of Klaipeda to successfully compete with neighbouring ports and strive for leadership positions. Thus, the aim of our study is to investigate the competitive environment of the Baltic Sea region. We use systematization, grouping, summarization of the scientific literature, data collection, comparison, financial analysis, and capacity calculation. The main results show that the Port of Klaipeda, a seaport on the eastern Baltic coast, is an important hub of the East-West (IXB) transport corridor, connecting roads and sea routes in this direction. With the accession of new members, including Lithuania, to the EU in 2004, the Baltic Sea became the internal Sea of the Union. Many Baltic seaports belong to the same system and organizations (ESPO, BPO). EU ports policy provides them with equal requirements for security, transport regulation, environmental protection, anti-air pollution, and sustainable development. The results obtained enable exploration perspectives. This includes a feasibility study for port development and attracting new investment from foreign capital markets in the Baltic Sea region.

Keywords: shipping geography; Baltic ports performance; financial analysis of Baltic ports

Citation: Gaidelys, V.; Benetyte, R. Analysis of the Competitiveness of the Performance of Baltic Ports in the Context of Economic Sustainability. *Sustainability* **2021**, *13*, 3267. https://doi.org/10.3390/su13063267

Academic Editor: Jacob Arie Jordaan

Received: 2 February 2021
Accepted: 8 March 2021
Published: 16 March 2021

1. Introduction

The Baltic Sea region is very important for shipping; therefore, the main aim of our research is to investigate the competitive environment of the Baltic Sea region. Baltic Sea region is a natural laboratory for research on sustainable development [1], especially on economic sustainability. Ports located in the region play a major role in the sustainability of countries, but at the same time face many risks that need to be explored and addressed.

In this article, we discuss in detail the most important ports in the Baltic Sea region, their performance, financial capacity, and impact on the country's sustainability with the aim of comparing the competitive environment of ports and exploring development opportunities. The Baltic Sea region consists mainly of Lithuanian, Latvian, and Estonian ports.

Klaipeda State Seaport is the northernmost ice-free, modern, universal, and deep-water seaport on the eastern Baltic coast, located in the northern part on the Curonian Lagoon, in the Klaipeda Strait in Lithuania [2]. It is the most important and largest transport center of the Republic of Lithuania, and an important hub of the East-West (IXB) transport corridor, connecting land, rail, and sea routes in this direction. The Port of Klaipeda is located in the territory of Klaipeda City municipality and occupies approximately 1437 ha of territory and water area, which is assigned to the Port Authority by the right of state land trust. The Port of Klaipeda is divided into two structural zones: the northern, located north of the mouth of the Dane river, and the southern. In total, 17 large companies operating in the Port of Klaipeda: 14 large stevedoring companies, and 3 ship repair and construction

companies, providing all services related to maritime business and cargo handling [2]. The Port of Klaipeda is an important international transport hub, connecting transport flows between East and West. About 7000 ships from more than 50 countries call here every year. The main shipping lines pass through the Port of Klaipeda to a number of European ports, and going by land, the most important industrial regions of the Eastern states (Russia, Belarus, Ukraine, etc.) can be reached from the Port at the shortest distance [3]. The Port of Ventspils is the second largest seaport in Latvia in terms of cargo handling. The Port mainly specializes in handling petroleum products and coal. When analyzing the volumes of bulk and dry bulk cargo handled in the Port, it can be stated that the volumes of cargo handling started decreasing in 2011. The main reason for this decline is the decrease in the volumes of coal, which is analogous to the situation in the Port of Riga. Under an optimistic scenario, the volumes of cargo handling will have insignificantly increased to 9022 thousand tons by 2048, while a realistic scenario predicts a decline to 7456 thousand tons. The fluctuations in bulk and dry bulk cargo handling in the Port of Ventspils is related to cyclicality and, as in the Port of Riga, to the restrictions imposed on coal in Europe and other countries. The Port of Riga is the largest seaport in Latvia [4]. The joint Port of Tallinn (Mūga, Paldiski, Old Port of Tallinn, Paljasare, and Saaremaa ports) is an important state seaport as well as the cultural, political, and industrial center of the country's sustainability [5]. The joint Port of Tallinn is the main seaport in the country. It specializes in petroleum, petroleum products, and general cargo handling. Of all the Baltic seaports, the joint Port of Tallinn has suffered the most from Russia's cargo diversion strategy [6]. Back in 2006, the Port handled more than 10,000 thousand tons of bulk and dry bulk cargo, while this number has dropped to 3958 thousand tons currently [7].

Not only the competitive environment, but also the importance of cross-border cooperation programs in achieving the United Nations Sustainable Development Goals is of particular importance to the countries of the Baltic Sea Region in pursuit of economic sustainability [8]. Nevertheless, the competitive environment constantly affects the performance of the Baltic Sea ports and enables the analysis of the main risk factors and the capacity of competitors.

2. Literature Review

The Baltic Sea region is significant for shipping, so the competitive environment of the Baltic Sea region is very important for Baltic countries. Seaports are a part of the sustainable global transport infrastructure. The main competitors of the Baltic countries in Baltic Sea region are the ports of Lithuania, Latvia, and Estonia and other countries. The ports of all three Baltic States are important transit corridors, connecting not only East and West, but also South and North. Ports located in the region play a major role in the sustainability of countries, but at the same time face many risks that need to be explored and addressed. We discuss in detail the most important ports in the Baltic Sea region, their performance, financial capacity, and impact on the country's sustainability with the aim of comparing the competitive environment of ports and exploring development opportunities. Thus, the economic environment, socio-cultural environment, and scientific–technological development are the three most important factors in the business of ports competitive environment based on literature review. The Baltic countries have achieved different results in the progress of sustainable energy development [9], and the role of shipping companies can have a major impact on the achievement of sustainable development goals.

When it comes to the economic environment of business of ports, it is an element of the macro-environment that manifests itself in certain regularities and tendencies of economic development affecting business decisions and actions [10]. This environment is related to the development and direction of the national and international economy. It covers economic activities of social structures and changes according to certain laws [11]. This environment mainly affects the stevedoring business through demand conditions, cyclical economic development, inflation, and unemployment. When assessing the impact of the socio-economic environment on the stevedoring business, it is extremely important

to identify the stage of a country's economy and its development prospects. The greatest desire to buy and invest financial resources commonly occurs during the periods of economic upswing, while in other stages buyers tend to save and refuse unnecessary goods and services, which may lead to a decline in the demand for stevedoring services. On the other hand, the fact that stevedoring services help save financial resources should not be overlooked. Thus, prudent business management can successfully take advantage of even an economic downturn. In this case, credibility of a country's financial institutions is crucial. The scientific literature analysis reveals that there is no consensus on either the components of the macro-environment or the comprehensive research concerning the factors of the economic environment. Different authors base their studies of the economic environment on different research criteria. The whole stevedoring business mainly depends on the national and global economic situation. Thus, when assessing the environment of the stevedoring business, national economic indicators need to be considered. The economic environment is characterized by the following key indicators: gross domestic product (GDP), customer income, accumulation level, commodity price level, and access to credits [12]. The authors in [13] add inflation and unemployment, while another [14] highlights the role of the investment climate, development of free economic zones, tax rates, and tax rate changes.

In terms of the socio-cultural environment of business of ports, despite the fact that the it is characterized by demographic indicators, the demographic changes taking place in Lithuania and other EU member states have a significant impact on the stevedoring business [15]. The removal of the barriers to free movement of population and labor force among the states destroys labor supply and demand equilibrium, which leads to more active migration processes, when free labor force is moving to the countries where wages are higher than in domestic markets. The tempting offers of higher wages are accepted by both high- and low-skilled people. High migration rates lead to labor force shortages in the countries where wages in the domestic market are relatively lower than those in foreign markets. The opposite effect is observed in the foreign markets. Thus, the monitoring of the population and labor force's migration processes is essential because it can help in making rational decisions regarding the current or potential labor force. The intensification of emigration leads to a shortage of the available labor force in the domestic market and a higher price of the available labor force, which raises wage costs for employers. This, in its turn, causes service prices to rise. Thus, the regular monitoring of this indicator allows for appropriate action to be taken to provide cheaper labor from less developed countries. In the case of immigration, growing labor supply leads to lower labor costs, so employers can easier find workers. It is equally important to take into account the skills of the labor force available. Complex works require competent and highly educated staff. A lack in this staff can lead to a deterioration in the quality of services, which can mean a loss of the market positions to stevedoring companies. When the number of highly qualified professionals is rising, simple and straightforward works performed by these professionals make the service more expensive because employees want to be remunerated according to their qualifications rather than the work they do. Fluctuations in all these indicators clearly show what effects they can have on the stevedoring business. Thus, they must be considered and monitored to keep the business competitive.

Life in the 21st century is unimaginable without the technology and science that serve humankind. In terms of the scientific–technological development of business of ports, by using innovative technologies, a business can operate more efficiently with less energy and resources. Stevedoring companies are no exception because being economic agents they seek economic profits [16]. This objective cannot be achieved without high-tech innovation and without due attention to staff knowledge and skills. Because time during the day is limited, knowledge and technologies need to be used to organize the stevedoring business in a way that the time of 24 h is used most efficiently because this is the only method to win the competitive battle. High technologies not only facilitate the office work, but also the work in the area of warehousing and transportation because they simplify the control of all

stevedoring processes and reduce the duration of their execution. Scientific and technical progress contributes to advanced means of transportation and warehousing equipment. Innovative technologies allow better organization of the processes of movement of goods from a producer to a consumer, which reduces costs, improves and speeds up consumer service.

Because the scientific and technical environment shows the tendencies of accelerating technical advancement, unlimited opportunities for innovation, increasing legal regulation, and research funding, it can be concluded that in the future it will be possible to further improve the quality of stevedoring services, expand the service range and reduce prices for consumers. Thus, monitoring of this macro-environmental element is essential to maintain competitive positions in the market.

The essence of the bulk cargo handling business is the cost and time of cargo delivery. To reduce cargo handling costs, innovative loading technologies that would shorten the loading time and thus lessen cargo delivery costs need to be employed.

3. Data and Research Methodology

We collected detailed data from 1999 to 2020 to form a comprehensive data set. Data from the Bloomberg database, Lithuanian, Latvian, Estonian, European statistical databases and data from port companies were used. Specific data (only related to the capacity of the Baltic ports), technical, economic, and financial data were included in the study (cargo handling, number of ship calls, operating profitability, net profitability, return on assets, return on equity, cargo turnover, number of vessels, ferry line cargo amount, cargo volume, cargo structure, revenue, adjusted EBITDA, adjusted EBITDA margin, operating expenses, personnel expenses, depreciation, amortization, impairment losses, cargo volume, market shares).

It is the northernmost ice-free Baltic Sea port that possesses a competitive advantage over other ports during the winter. The ice-free Port does not need to possess any ice class, less time is wasted, there are no additional charges for icebreaking [17,18]. Cargo flows and the geography of their transportation determine the use of optimal vessels, and according to the maximum parameters of potential vessels, the port infrastructure, i.e., entrances and inland navigation channels, ship turning basins, access to berths and berths themselves, must be planned. Analyses and evaluations of the parameters of the necessary berths based on the expected (projected) cargo flows and maximum potential vessels have been carried out [19–21]. The main parameters of berths, which are important in planning specific cargo flow handling, are as follows: water density and water depth at the berth due to cargo dumping, permitted evenly distributed loads and their zones at the berth, and berth mooring elements, i.e., mooring columns and bounces.

The depth at the berth must provide the maximum possible draft of a vessel at any water level or the maximum permissible draft of a vessel depending on the water level must be clearly indicated [22]. The depth at the berth must provide the maximum permissible draft of a vessel, an increase in a vessel's draft due to its transverse inclination (roll), an increase in a vessel's draft due to the longitudinal inclination (differential), an increase in a vessel's draft due to the effect of waves, and an increase in a vessel's draft due to the effect of currents. In this way, the depth at the berth can be expressed as follows:

$$H = T_{\max} + \Delta H_{V.L.} + \Delta \qquad \Delta T\Theta^{T}\Psi \qquad \Delta \qquad \Delta T_b T_s \qquad \Delta H_n$$

where $T_{\max}$—maximum permissible draft of a vessel at the berth; $\Delta H_{V.L.}$—potential minimal water level (for the Port of Klaipeda, it is about 0.5 m); $\Delta T\Theta^{T}\Psi$—an increase in a vessel's draft due to its inclination (for large vessels, not more than 0.5 degrees) which can be estimated by the following formula:

$$\Delta T\Theta = \left(\frac{B}{2} - \mathbb{R}_k\right) \cdot tg\Theta$$

where B—maximum breadth of a vessel; $\mathbb{R}_k$—hull rounding radius (for PANAMAX and larger vessels it shall be between 8 and 12 m; B K R); ΔT_Ψ—an increase in the draft of a vessel due to the differential (large vessels are usually fully loaded without leaving the differential, while for small vessels, it can range from few centimeters to several meters (ballast)); ΔT_b—an increase in the draft of a vessel due to the effect of waves, (under the conditions of the Port of Klaipeda (deeper into the Port from berth No. 3), it is not commonly evaluated for large vessels); ΔT_s—an increase in the draft of a vessel moored to the berth due to the effect of currents (at the speed of the current up to 3 knots, it is not commonly evaluated, i.e., for most berths in the Port of Klaipeda, it can be disregarded); ΔH_n—navigation reserve which depends on the depth maintenance conditions (under the conditions of the Port of Klaipeda, it can be accepted of about 1.0–2.0% of the depth at the berth).

Thus, given the maximum permissible draft of a vessel in the Baltic Sea (15 m), a water level fluctuation within 0.5 m, a vessel's inclination angle of 0.5 degrees, a vessel's breadth of 60 m, hull rounding radius of 12 m, the maximum differential of 0.2 m, and the navigation reserve equal to 1% of the maximum draft of a vessel, the depth at the berth for a vessel must be not less than 16.2 m. When constructing new berths, together with the above-specified depths, it is expedient to immediately provide the necessary parameters of the berth equipment (mooring columns, bounces and permitted evenly distributed load). When evaluating mooring columns (mooring column holding force), it is appropriate to adopt the EAU 2012 guidelines and consider a 25 percent increase in the holding force for locations with strong currents; the mooring column holding force must be at least 800 kN, or at least 2000 kN for new berths.

Berth bounces must be evaluated in terms of vessels' water capacity and mooring conditions. The absorption energy of a bounce (its basic parameter) is estimated as follows:

$$E_{ab} = \frac{m \cdot \Delta v^2}{2} \cdot f_c \cdot f_s \cdot f_m \cdot f_e \cdot f_t \cdot f_{tol}$$

where m—maximum potential mass (water capacity) of a vessel to be moored; Δv—maximum permissible speed of a vessel's contact with a bounce (depends on a vessel's water capacity and mooring conditions); f_c—configuration factor (for continuous berths it amounts to 0.9, for piers—to 1.0); f_s—softness factor (for bounces of rubber material it amounts to 0.9, for hard bounces (wooden panels, soft metal, etc.)—to 1.0); f_m—the liquid mass factor (for large vessels it ranges from 1.8 to 2.0); f_e—eccentricity factor which averages about 0.5 for seagoing vessels; f_t—temperature factor (under the conditions of the Baltic Sea, it amounts to about 1.1); f_{tol}—tolerance factor (i.e., potential production tolerances) which amounts to about 1.1.

Given the earlier-discussed projections of potential cargo flows, potentially maximum vessels, their mooring points (cargo loading points) and mooring conditions, the major parameters of the existing and potential berths are evaluated. Given the largest vessels for the projected cargo flows, the required depth at the berths, permissible evenly distributed load, the required mooring column holding force and absorption energy of bounces are evaluated.

The POST PANAMAX type vessels with a maximum draft up to 14.5 m can be used for fertilizer shipping; then, the required depth at the berths must amount to 15.6 m, and permissible evenly distributed load in the berth construction zone—to about 20 kN/m^2 because loading is performed with the help of a loading machine (loader) [23]. The mooring column holding force must be of at least 1000 kN, and the absorption energy of bounces—of about 800 kNm, assuming that the area is semi-water open (with partially bursting waves from the sea), i.e., between conditions 2 and 3.

The POST PANAMAX type vessels with a maximum draft up to 14.8 m can be used for grain shipping; then, the required depth at the berths must amount to 15.6–15.8 m (grain can better control the longitudinal inclination of a vessel (differential). The permissible evenly distributed load in the berth zone can amount to nearly 20 kN/m^2 because loading

is performed with the help of a loading machine (loader). The mooring column holding force must be of at least 1000 kN, and the absorption energy of bounces—of about 800 kNm, assuming that the area is semi-water open.

4. Port Characteristics

The Port of Klaipeda is considered to be a leader among the other seaports in the Baltic States. Cargo handling at the Port of Klaipeda is constantly increasing; cargo handling results of the previous year are gradually being exceeded, and the annual cargo handling record is constantly being sought. This port handled 43.17 million tons of cargo in 2020, which is 7.6 percent or 3.03 million tons more than in 2019. Over the 2014–2019 period, the handling of all types of cargo grew: handling of bulk and dry bulk cargo increased on average by 6.91 percent, handling of general cargo–by 2.74 percent, and handling of liquid cargo–by 1.72 percent. 2020 were record high, 47,743,409.4 million were handled. t. freight and was the best year of the whole period, growth was +3.2%.

In terms of the volumes of bulk and dry bulk cargo transported to or from the Port of Klaipeda in 2017, the leading partner countries were as follows: Brazil (10.22 percent), Turkey (7.75 percent), China (7.64 percent), India (6.44 percent), the Netherlands (5.65 percent), and Russia (5.34 percent). In the bulk cargo category, bulk natural and chemical fertilizers are shipped to Brazil, China, and India, while metal ores and scrap metal are shipped to Turkey and the Netherlands [24,25]. Russia is an important partner for the largest shipments of fertilizers. The remaining countries ship a smaller part of cargo. The main partner of the Port of Klaipeda in the area of transport and cargo transit by land transport is Belarus-its cargo makes up about 33 percent of the total cargo. The prospects of the Port of Klaipeda are associated with Belarusian industry and the Chinese-created industrial park "The Big Stone" near Minsk. Cargo handling in the Port of Klaipeda is increasing mainly due to the growing volumes of bulk cargo. It is also promoted by metal product and metal ore cargo, but most of all by mineral fertilizers exported by Belarusian chemical companies through Lithuania; mineral fertilizers make up the majority of cargo handled in the Port of Klaipeda (in 2017–10,350 thousand tons or 77 percent). Overall, fertilizers account for 32 percent of all cargo (29 percent–bulk, and 3 percent–liquid).

Due to the growing market demand for bulk fertilizers, an increase in the bulk fertilizer cargo handling was recorded in the period of 2012–2017 (on average 11.7 percent per year). The fastest growth in fertilizer cargo handling was observed in 2014 (49.5 percent), when, due to the political unrest in Ukraine, a substantial part of this cargo was redirected to transportation through the Baltic rather than Ukrainian ports. The growing volumes of bulk fertilizers in 2015 were also due to the fact that the Belarusian fertilizer producer increased its exports. Belarus, a competitive producer of potassium fertilizers in the global markets, is constantly investing in production development, which provides preconditions to expect that the fertilizer cargo handling record in the Port has not yet been reached. Belarusian factories export potassium fertilizers through Klaipeda, Ventspils, and Ukrainian seaports, which makes Ventspils Klaipeda's largest competitor for fertilizer cargo [9–11,19]. In terms of Belarusian fertilizer cargo, competitive advantage over other ports is ensured by the closer distance and the fact that "Belaruskalij", one of the largest Belarusian fertilizer producers, acquired a part (30 percent) of the SC "Bulk Cargo Terminal" shares, which causes the producer being interested in exporting fertilizers through the Port of Klaipeda. In April 2018, "Lithuanian Railways" and "Belaruskalij" signed a long-term mutual cooperation agreement, which allows expecting the growth of fertilizer cargo handling in the Port of Klaipeda the following year.

The growth of bulk fertilizer cargo is also determined by the growing market demand for fertilizers as well as investment of Belarusian fertilizer producers in the development of their factories. Further increases in the amount of fertilizers in the Port of Klaipeda can be expected based on the long-term mutual cooperation agreement signed between "Lithuanian Railways" and "Belaruskalij" in April 2018 [26,27]. Russian fertilizers make up only 1 percent of the total amount of fertilizers in the Port of Klaipeda. Russian fertilizers

are likely to be exported through other ports because Klaipeda is geographically further (when transporting cargo from Russian Perm or Osency stations). According to the data of the Lithuanian Department of Statistics, in recent years the largest amount of bulk fertilizers has been shipped from the Port of Klaipeda to the world's largest agricultural countries: Brazil (in 2017, 1860.9 thousand tons), China (in 2017, 1360.6 thousand tons), and India (in 2017, 1142.2 thousand tons).

Since the Port of Klaipeda is ice-free, its cargo volumes are less affected by seasonality, which makes the Port significantly more flexible. The Port's cargo handling structure indicates that the handling is diversified, i.e., there is no particular type of cargo that makes up the bulk of the cargo volume.

The history of 2004–2017 shows that the main trading partners of the Port of Ventspils were Russia, Sweden, Estonia, the Netherlands, Norway, Germany, and the UK. According to the forecasts for 2018–2048, Sweden is likely to become the main partner, followed by the UK and Norway. Russia is anticipated to fall from first to sixth position. Thus, the forecasts propose that the Scandinavian countries and the UK are likely to become the major trade partners of the Port of Ventspils in the future. The ice-free port of Ventspils is one of the leading deep-water ports of the Latvia. According to the destinations of customer's import and export port of Ventspils is creating a multi-modal transport solution infrastructure for fast and high-quality service. In total 14 large terminals form the port of Ventspils [28].

An important aspect of the analysis is to identify which partner countries the Port receives most cargo from. The history of 2010–2017 shows that the main trading partners of the Port were Finland, Russia, Lithuania, Sweden, Germany, Norway and Poland [29–31]. According to the forecasts for 2018–2048, Finland is likely to maintain its role as a key partner, followed by Lithuania and Sweden. Russia is anticipated to fall from the second to fourth position, and this decline is seen to be most pronounced. Thus, the forecast proposes that Finland and Lithuania are likely to become the major trade partners of the Port of Tallinn in the future. Port of Tallinn (AS Tallinna Sadam) is the biggest port authority in Estonia and its strategic goal is to develop the competitiveness of Estonia as a maritime sustainable country. As far as both cargo and passenger traffic are taken into account. Port of Tallinn is listed on Nasdaq Tallinn Stock Exchange since June 13, 2018. Shareholders include 67 percent Republic of Estonia, 33 percent Investment funds, pension funds, private investors.

5. Test Results

The Port of Klaipeda can accommodate vessels 400 m in length, up to 59 m in width, and with a maximum draught of 13.8 m. Cargo handling in Klaipeda Port increased approximately 3 times, respectively from 101.3 to 300.5 thousand units from 1999 to 2019 (see Figure 1). The shortest distances connect the Port with the most important industrial regions of the Eastern hinterland (Russia, Belarus, Ukraine etc.) [32–34]. The main shipping lines are to the ports of Europe. Also, 2020 was a record year in terms of cargo handling.

The number of ship calls in the Port of Klaipeda includes international and local vessels. Still, 30 percent are local vessels and as much as 70 percent are international vessels (see Figure 2). This shows the international development of the Port of Klaipeda.

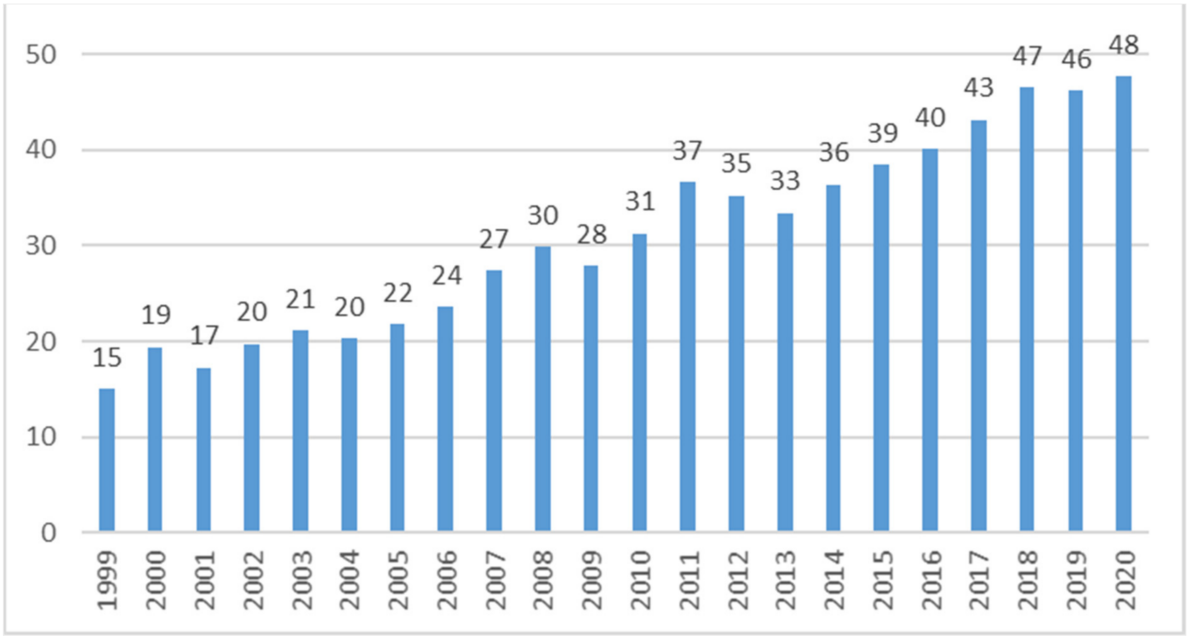

Figure 1. Cargo handling in Klaipeda port, thousand units [35,36].

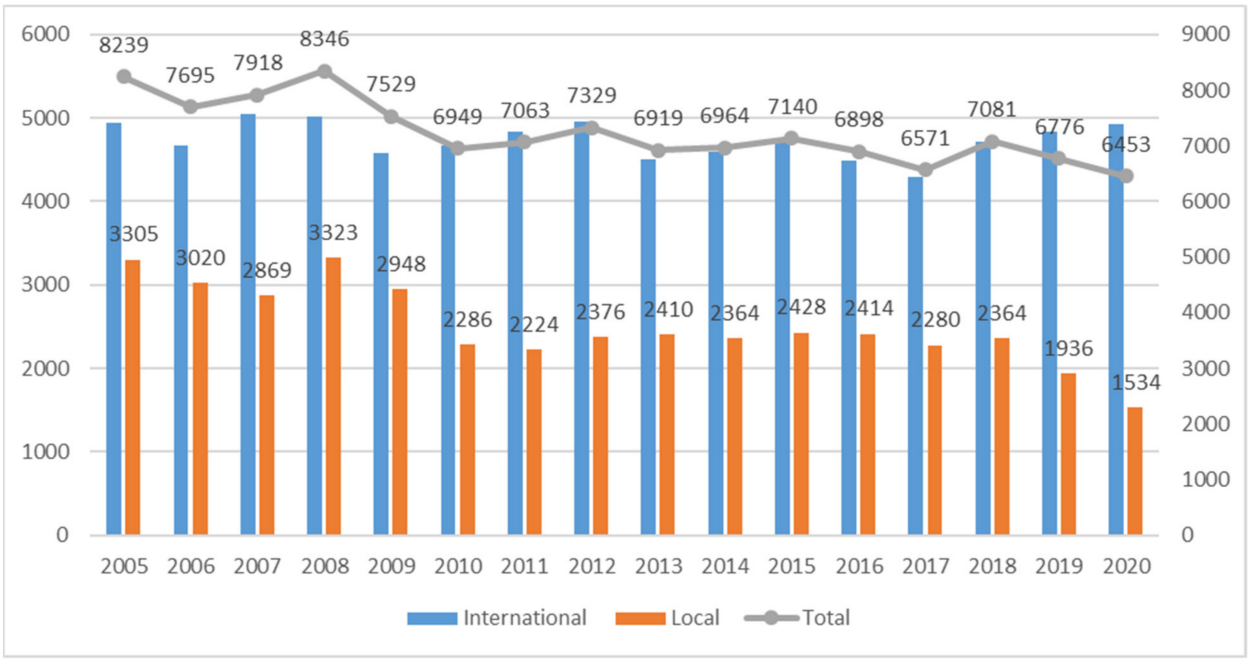

Figure 2. Number of ship calls in the Port of Klaipeda [35,37].

Operating profitability and net profitability complement the financial analysis of operations in such important respects as the value generated per unit of sales revenue (see Figure 3). Net profitability increased from 53.48 percent to 56.68 percent (+3.2 percent). This was driven by net profit growth. Profitability indicators based on Klaipeda port activities showed very good results, which directly affect the satisfaction of shareholders and the company's development opportunities. Despite the COVID-19 pandemic, Klaipeda port earned a high operating profitability and net profitability in 2020, which reached almost 55 percent.

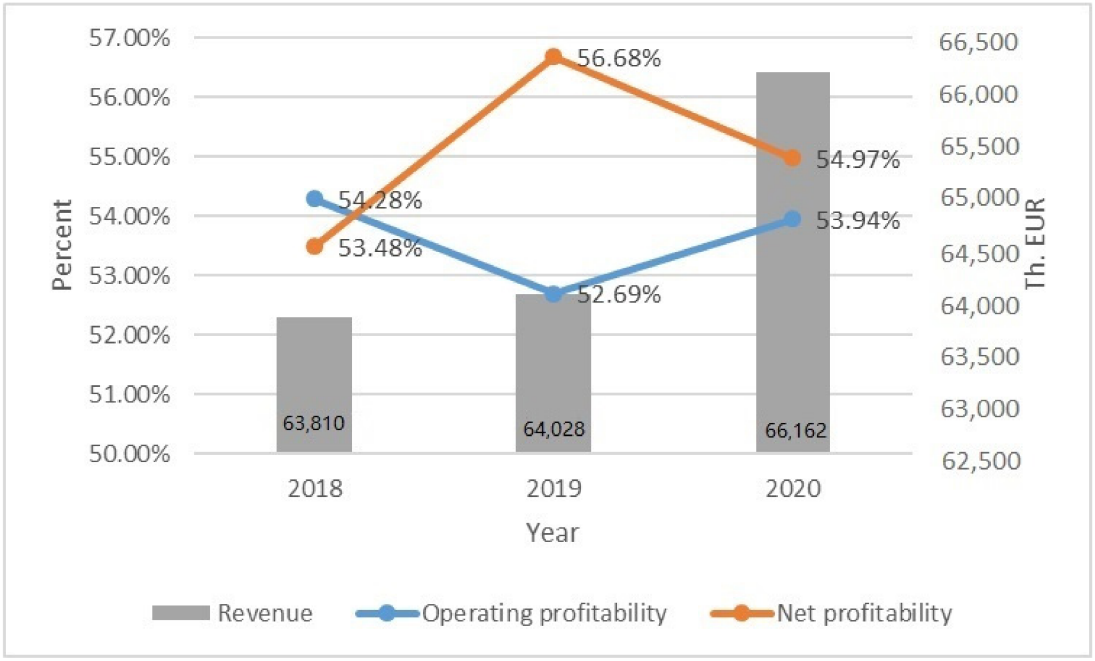

Figure 3. Dynamics of operating profitability and net profitability from 2018 to 2020 [35,38].

The Port of Klaipeda includes 14 big stevedoring companies, ship repair and ship building yards operate within the Port as well as all types of marine business and cargo handling services.

The return on assets (ROA) and return on equity (ROE) also grew in 2018–2019 (see Figure 4). The return on assets increased from 5.77 to 5.91 percent (+0.14 percent), driven by higher net profit. The return on equity increased from 6.43 percent to 6.72 percent (+0.29 percent), driven by net profit as well. Some of the most important profitability indicators (ROA, ROE) showed very positive performance of the Port. The annual port of Klaipeda cargo handling capacity is up to 70 million tons. This shows the increasing capacity of Klaipeda port. That is why Klaipeda is a multipurpose, universal deep-water port, providing high quality services. The main shipping lines to the ports of Western Europe, South-East Asia and the continent of America pass through Klaipeda port. The Port operates 24 h a day, 7 days a week, all year round.

In 2019, the Port of Klaipeda was linked by trade relations with 69 different states worldwide. The diagram below shows 20 largest trade partners of the Port of Klaipeda. The trade flow between the Port of Klaipeda and its 20 largest trade partners in 2019 amounted to 39.8 million tons or 86.1 percent of the total cargo flows handled in the Port. In 2019, the most active maritime shipping (as in the previous year) took place between Klaipeda and 5 following states: Germany, Poland, the Netherlands, Sweden, and Russia–it amounted to 18.6 million tons or 40.3 percent of the total cargo flows. The largest cargo flow in 2019 was transported to/from Germany, 5.5 million tons of cargo.

The total cargo turnover of the largest Freeport of Ventspils terminals in 2017–2020 (thousands of tons) is shown in the Figure 5. The annual cargo turnover increased from 0.65 to 1.5 percent annually from 2017 to 2019. Cargo turnover was the highest in 2019 and amounted to 20.5 million tons, but turnover declined significantly in 2020 due to the pandemic situation (−36.8 percent). The SIA Ventspils Nafta terminal had the largest annual cargo turnover unambiguously and accounted for more than 35.5 percent of the total turnover in 2017–2019. The cargo turnover of this terminal increased up to 47.48 percent of the total turnover in 2020. The SIA Ventspils Nafta terminal is very important for the activities of Ventspils port, upon which the performance results greatly depend. Cargo turnover of AS Ventibunkers and SIA Noord Natie Ventspils also accounts for a large share of total turnover.

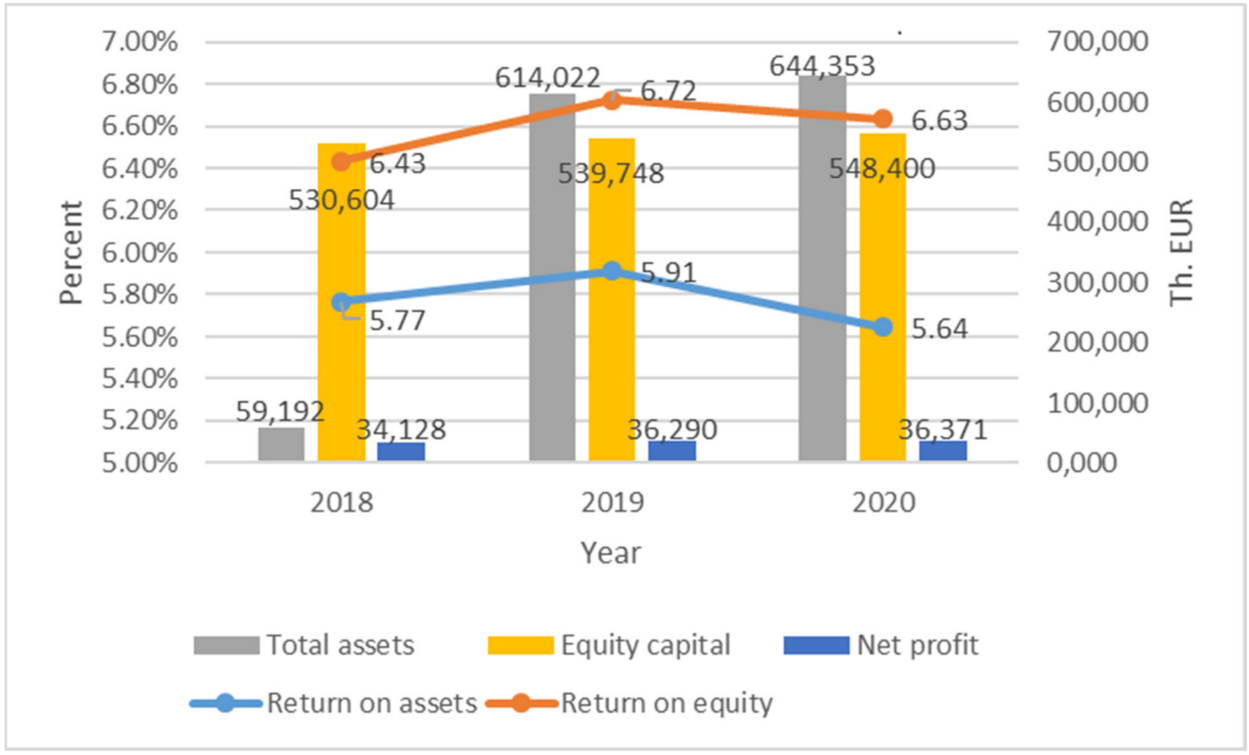

Figure 4. Dynamics of return on assets (ROA) and return on equity (ROE) from 2018 to 2020 [35,38].

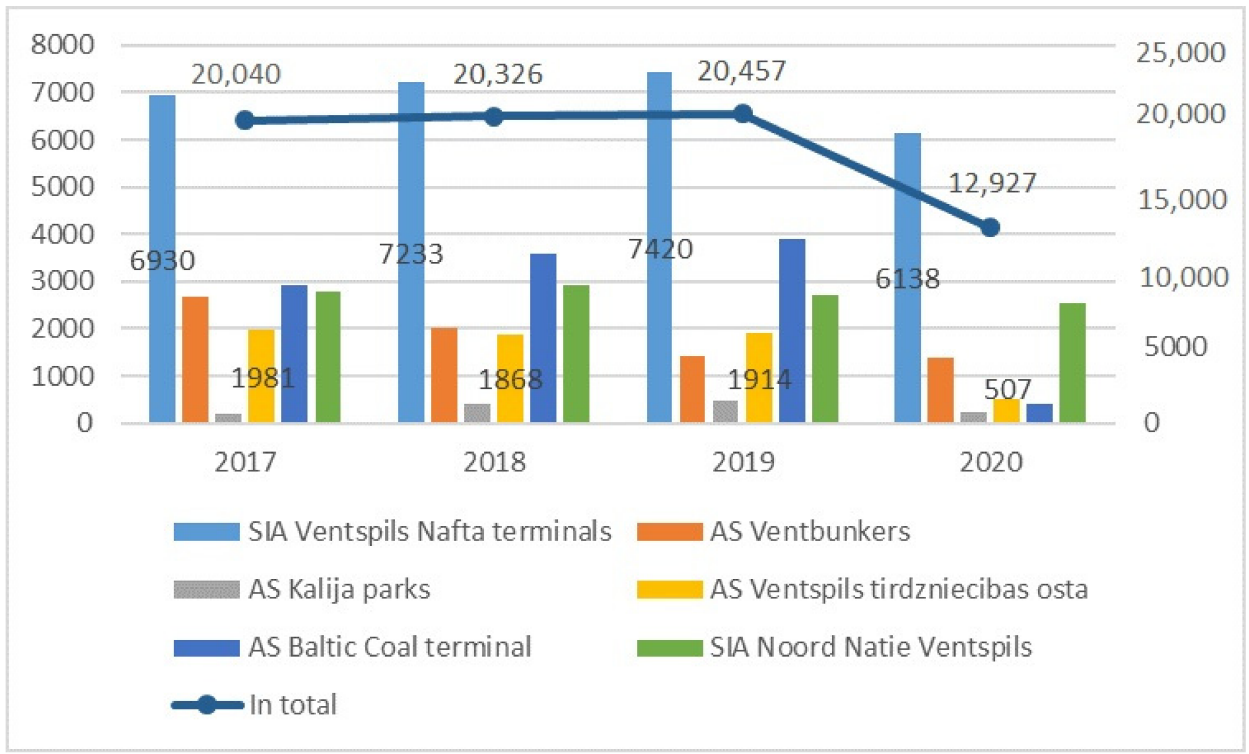

Figure 5. Cargo turnover of the largest Freeport of Ventspils terminals in 2017–2020, thousand tons [35].

The cargo turnover of Ventspils port in 2012–2020. (Thousand Tons) is shown in Figure 6. The highest cargo turnover was recorded in the first quarter of the year. Cargo turnover declined rapidly throughout 2019 year. However, 2020 was a year of stagnation

for the Latvian port. The annual cargo turnover decreased by −7636 thousand tons from 20,457 to 12,821 thousand tons in 2019–2020.

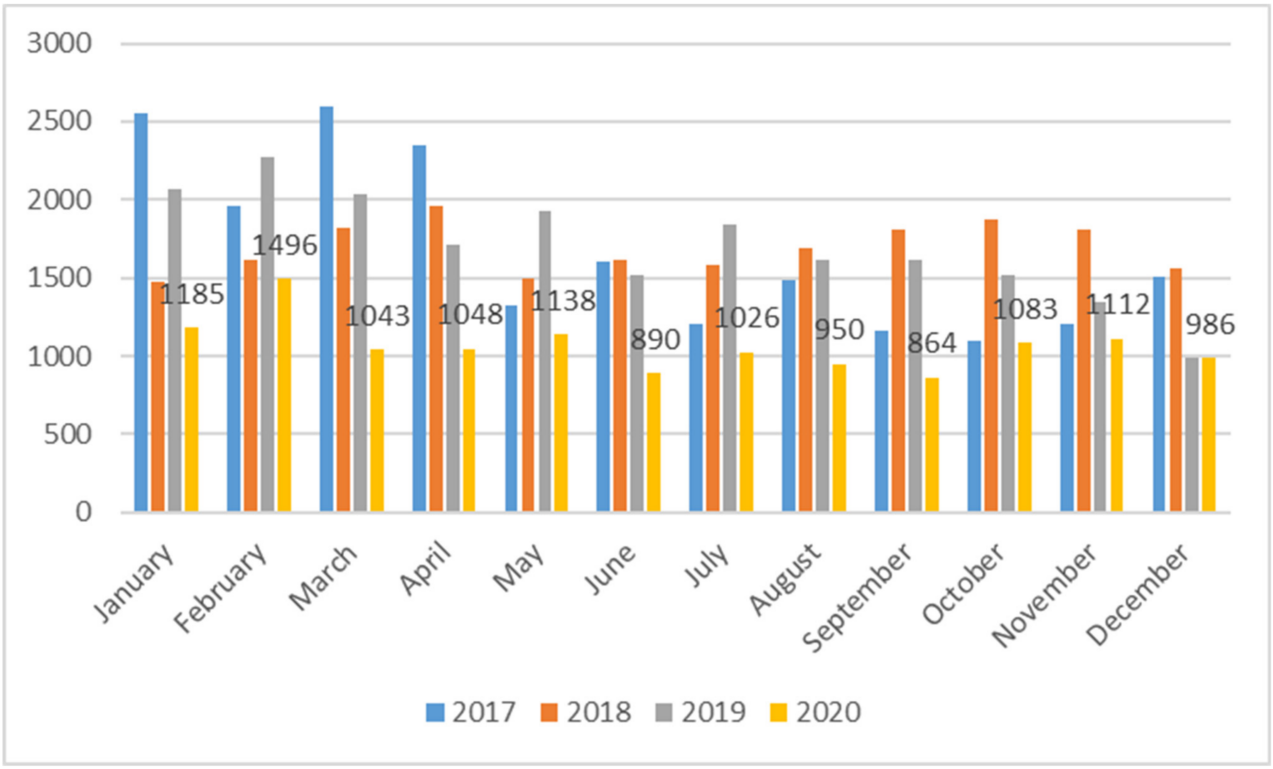

Figure 6. Freeport of Ventspils Cargo Turnover in 2017–2020, thousand tons [35].

The structure of cargo handled (thousand tons) in 2017–2019 is shown in Figure 7.

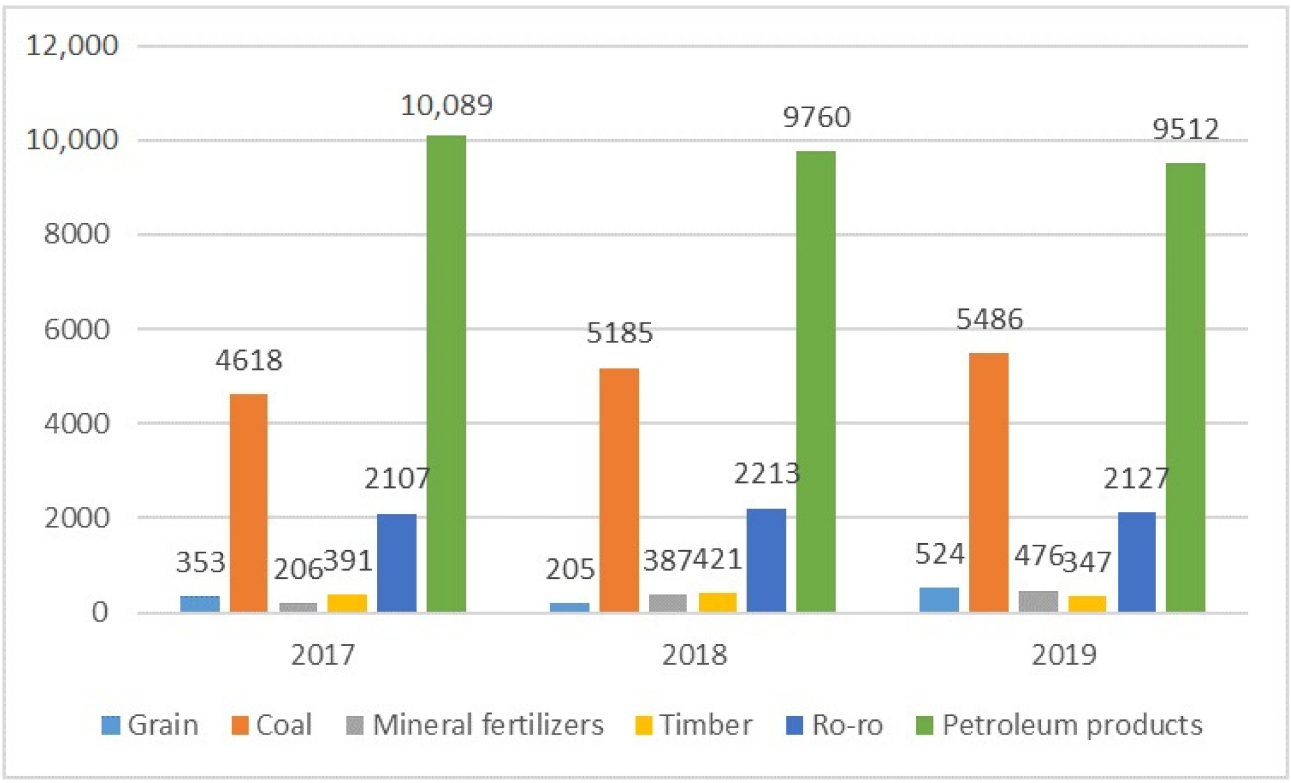

Figure 7. Cargo handled in 2014-2019, thousand tons [4].

Petroleum products, coal, and ro-ro undoubtedly accounted for the largest share in the structure of cargo handled. Petroleum products averaged about 9.8 million tons across the structure. Coal accounted for 5.1 million tons in the overall structure [39,40]. The share of ro-ro in the whole structure was 2 times lower than that of coal. Mineral fertilizers, grain, timber, and others (liquid chemicals, ammonia, etc.) accounted for a much smaller share of the total structure than petroleum product, coal and ro-ro. Grain averaged 0.36 million tons, minerals 0.35 million tons, timber 0.39 million tons overall structure of cargo handled.

The number of vessels served in Freeport of Ventspils by dry cargo ships and tanks in 2017–2020 is shown in Figure 8. Dry cargo ships accounted for almost 2 times more of the total over the period analyzed than tankers. The number of dry cargo ships increased from 84 to 93 in 2017–2018, but a high decline occurred in 2018–2020. In contrast, the number of tankers increased from 27 to 38 in 2019–2020.

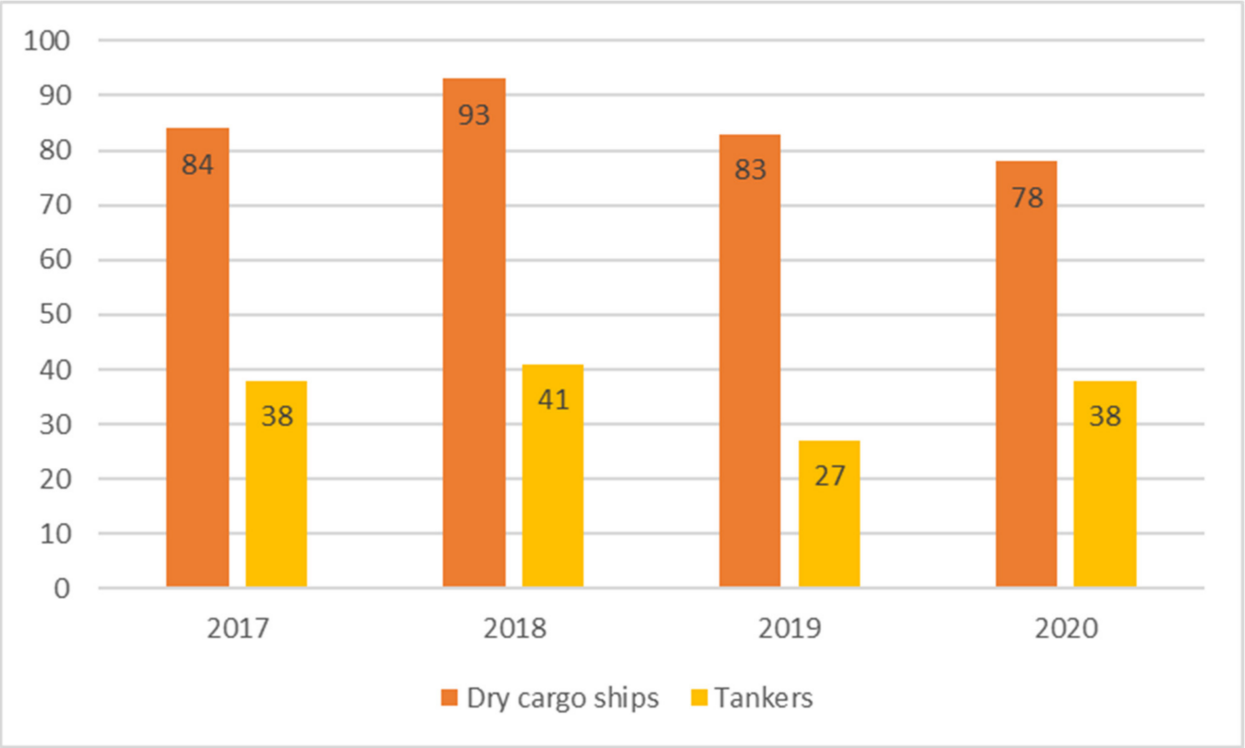

Figure 8. Number of vessels (dry cargo ships and tankers) served in Freeport of Ventspils in December 2017–2020 [35,41,42].

Types of cargo handled in 2017–2020 (thousands of tons) are shown in Figure 9. Liquid cargo accounted for the largest share, averaging 707.5 thousand tons during 2017–2020. While liquid cargo accounted for the largest share, it decreased −26.01 percent compared to 2017. Bulk cargo averaged 389 thousand tons, and this share was highest in 2018 at 741 thousand tons, however, it decreased more than 3 times in 2020. General cargo changed similarly, and the average fluctuated around 184.25 thousand tons.

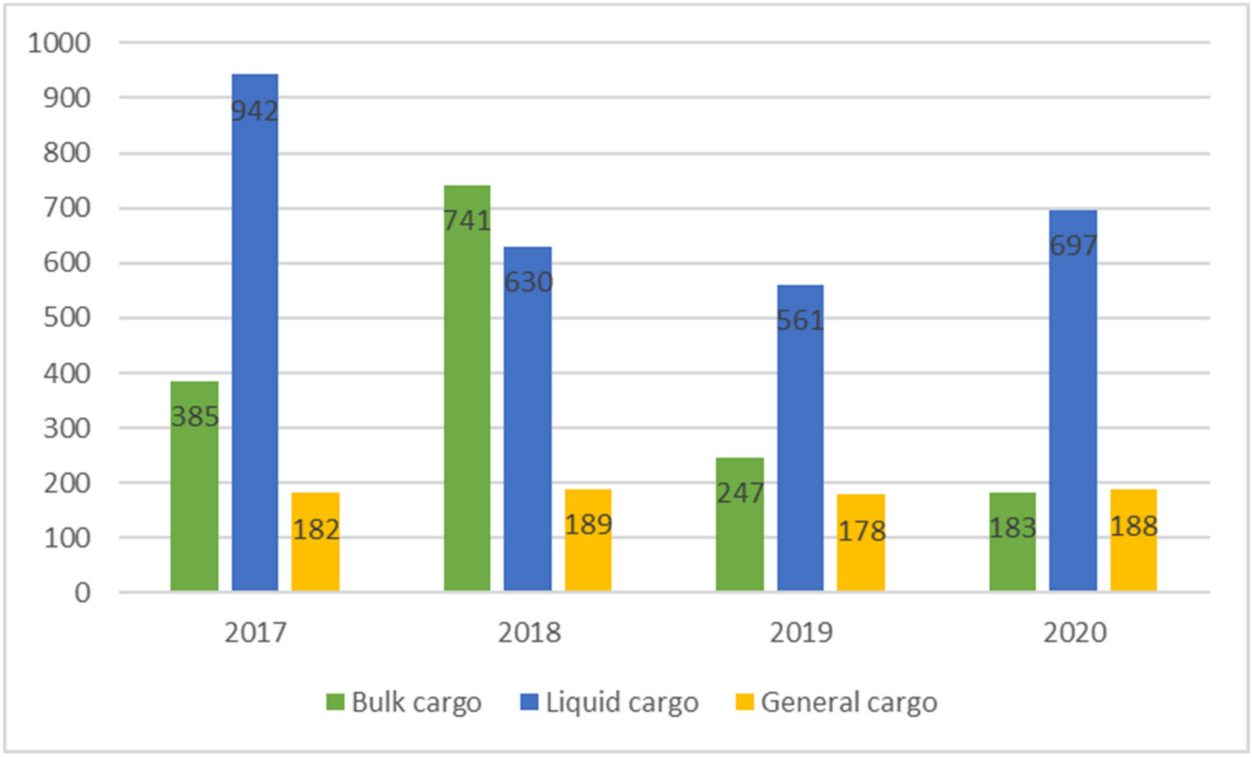

Figure 9. Types of cargo handled in 2015–2020, thousand tons [35,43,44].

The amount of cargo on the ferry line (thousand tons) is shown in Figure 10. It averaged 2.07 million tons in the last 5 years since 2016. However, the annual decline of amount of ferry line cargo was recorded in 2019 (−3.84 percent).

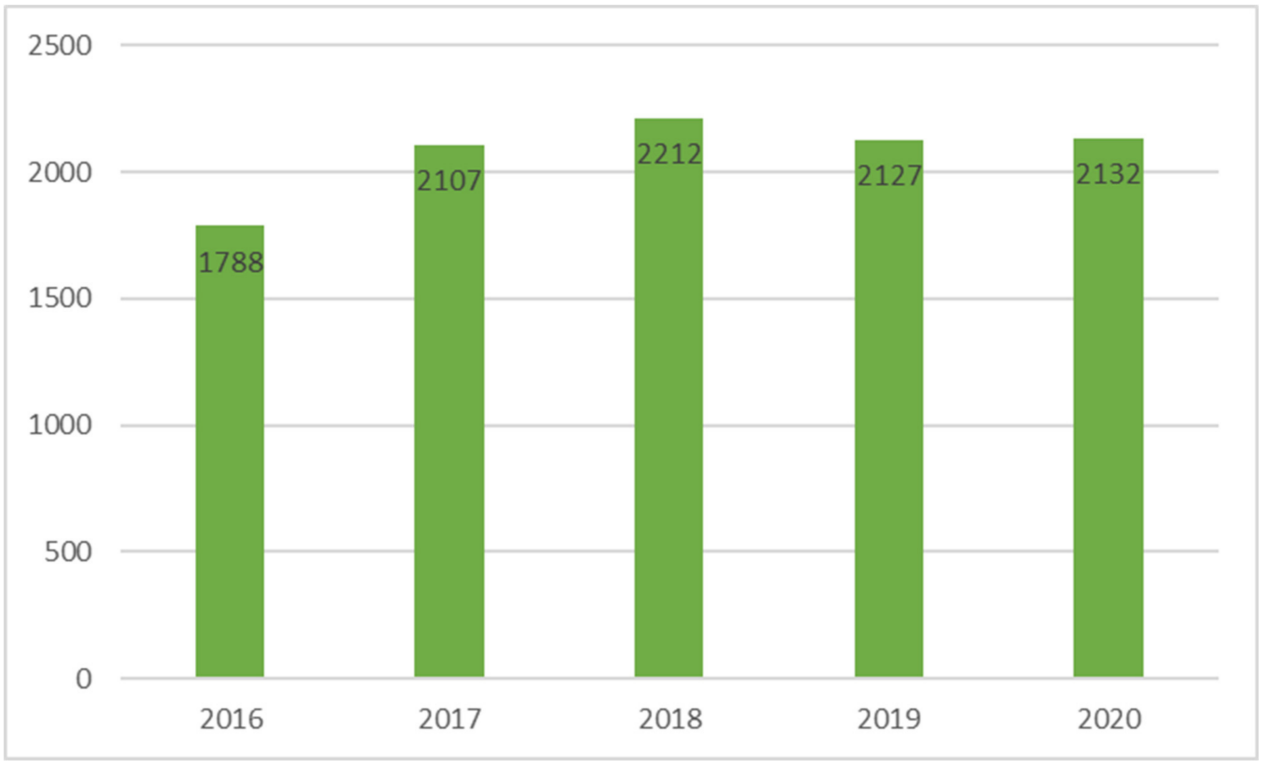

Figure 10. Ferry line cargo amount, thousand tons [35,45,46].

The largest number of vessels served in Ventspils port was in January this year. The lowest number of vessels served was in October and November. At the end of the year, the number regained its growth trend.

The historical cargo volume and structure (thousand tons) is shown in Figure 11. On average, liquid cargo volume was the largest compared to bulk cargo and general cargo. It accounted for 9.9 million tons during 2017–2020.

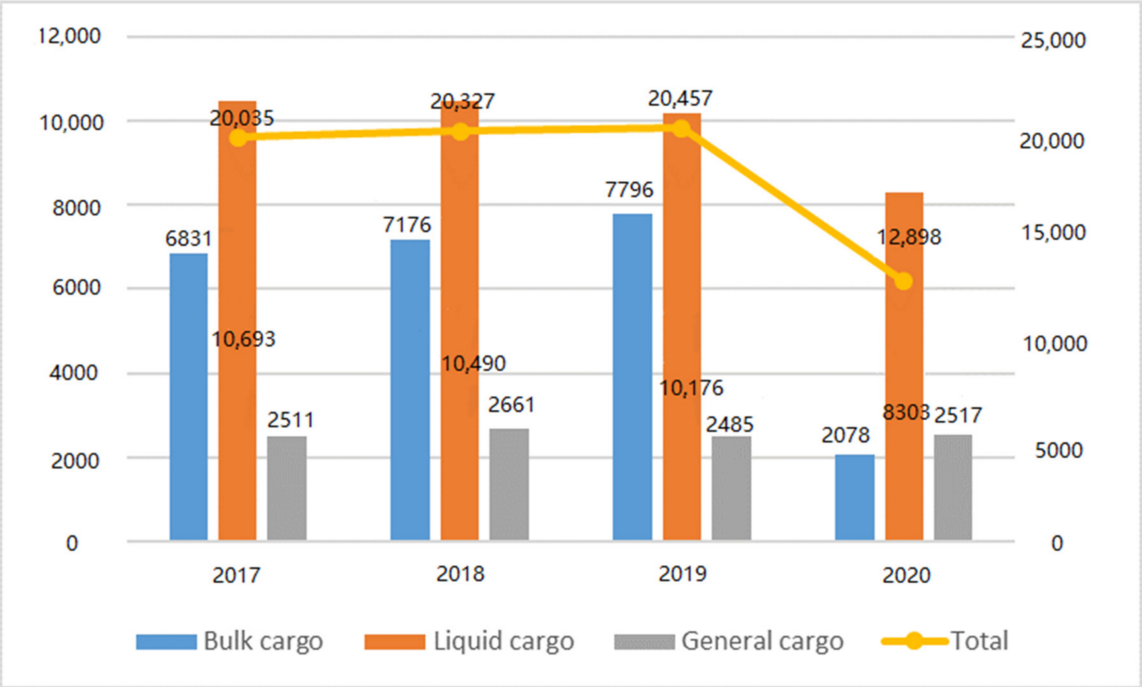

Figure 11. Cargo volume and structure, thousand tons [35,47,48].

Liquid cargo has accounted for the largest share of the total structure since 1991, but the total volume of cargo fell significantly in 2016–2020, especially in 2020. On average, the volume of bulk cargo amounted to 5.97 million tons and exceeded the volume of general cargo, except for the year 2020. The volume of general cargo overtook bulk cargo, and this showed negative trends of bulk cargo in the last year.

Summarizing the activities of the Port of Ventspils in Latvia, it can be concluded that 2020 was quite a difficult year and showed worse performance results than the previous year due to the pandemic situation.

An even greater decline is observed in liquid cargo handling. In 2004 and 2005, petroleum and petroleum product cargo handling amounted to over 25,000 thousand tons, while in 2017 it dropped to 7051 When analyzing the reasons for the decline in bulk and dry bulk cargo handling, the decrease in coal handling can be identified as the key reason. Under the optimistic scenario, cargo handling volumes in the Port will have increased to 6157 thousand tons by 2048; the increase is likely to be determined by the growth of agricultural product cargo handling [49]. The realistic scenario proposes that cargo handling volumes in the Port will remain similar to the current ones, i.e., about 3588 thousand tons.

The business model of port of Tallinn and its subsidiaries is based on four balanced business lines passengers, cargo, shipping, and real estate. The Port of Tallinn employs almost 500 people. The average number of employees was 492 in 2019 compared to 496 in 2018 (−4). The largest number of employees was recorded in 2017, exceeding 500.

Dynamics of revenue and adjusted EBITDA (million euros), and adjusted EBITDA margin (percent) are shown in Figure 12. Revenue generated by the Port of Tallinn amounted to 130.5 million euros in 2019, remaining at the level of the year before. Adjusted EBITDA

and EBITDA margin also remained stable. The Port's business lines were supplemented with ferry service in October 2016, which increased both revenues and expenses. 2019 year was a stable year for port despite divergent intra-year changes in the volumes of operations. Revenue, operating profit and EBITDA remained stable. The biggest change in operations was a slight fall in cargo throughput. The volume of cargo handled decreased by 0.7 million tons to 19.9 million tons (−3.3 percent). The fall was due to a decrease in liquid bulk cargo (−1.2 million tons), which was partly offset by growth in dry bulk cargo (+0.6 million tons).

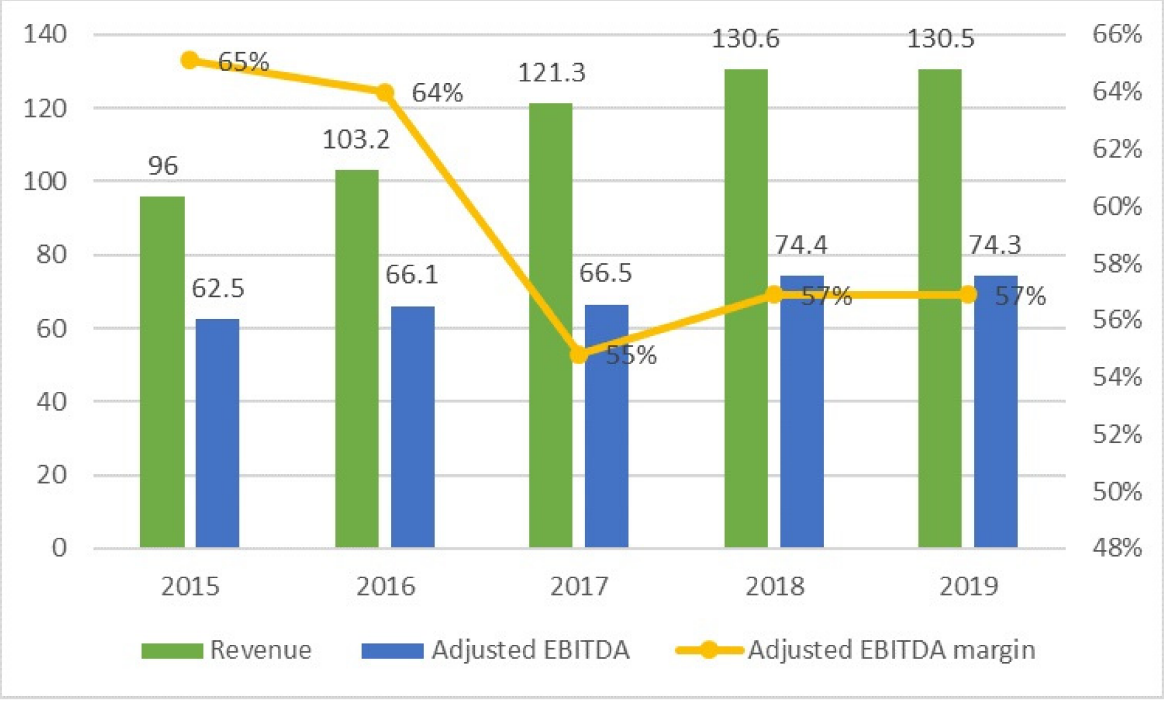

Figure 12. Dynamics of revenue, adjusted EBITDA (million euros) and adjusted EBITDA margin (percent) [35,50,51].

The dynamics of revenue stream from 2015 to 2019 are shown in Figure 13. The biggest change occurred in revenue from vessel dues, which fell by 1.8 to 46.7 million euros, mainly because the volume of liquid bulk cargo decreased, resulting in a fall in the number of tanker calls and their gross tonnage. The fall in revenue from liquid bulk cargo was somewhat offset by growth in revenue from cruise ships (due to a rise in the size of the ships) and dry bulk carriers (due to growth in cargo volumes). Charter fee revenue from the icebreaker Botnica grew by 0.8 to 9.7 million euros, mostly thanks to a longer charter period and the indexation of fees. Revenue from the provision of domestic ferry service grew by 0.7 million to 30.2 million euros, primarily through the indexation of contractual fees.

Expenses related to operating activities (operating expenses, personnel expenses, depreciation, amortization, and impairment losses) totaled 79.6 million euros, 0.45 million up on 2018 (0.6 percent) (see Figure 14). Operating expenses were the highest, ranging from 23.5 to 41 million euros, while personnel expenses ranged from 12.4 to 19.9 million euros.

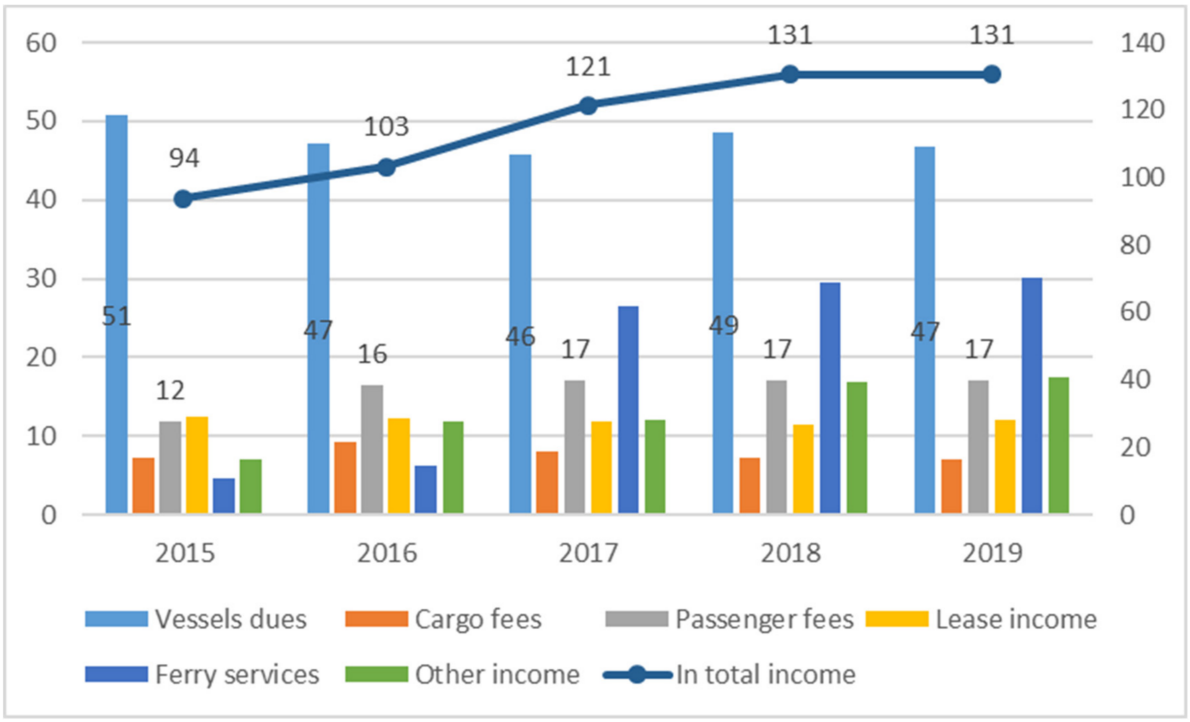

Figure 13. Dynamics of revenue stream from 2015 to 2019, million euros [35].

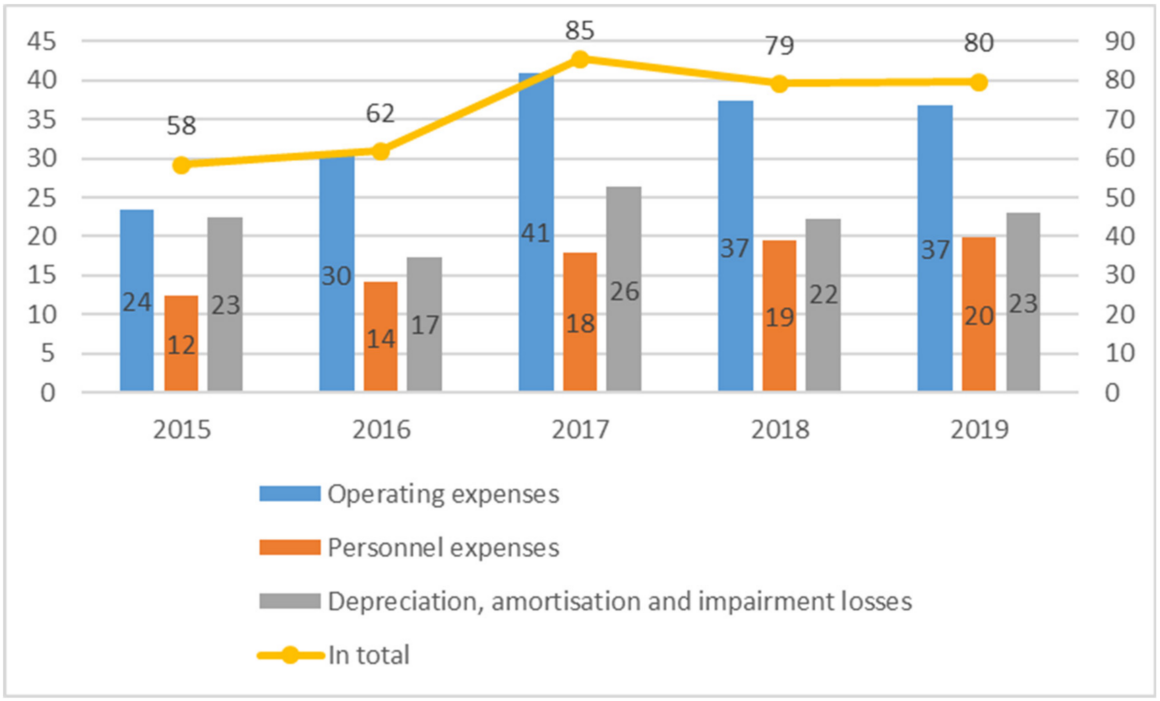

Figure 14. Dynamics of operating activities: operating expenses, personnel expenses, and depreciation, amortization and impairment losses from 2015 to 2019, million euros [35].

Revenue decreased in 2019 in the Cargo harbors segment (1.7 million euros, −4.08 percent), which was counterbalanced by growth in the segment other (1.1 million euros, +12.36 percent) and the Ferry segment (0.9 million euros, +2.99 percent) (see Figure 15). The revenue of the Passenger harbors segment remained more or less stable (−0.01 million euros, −0.2 percent).

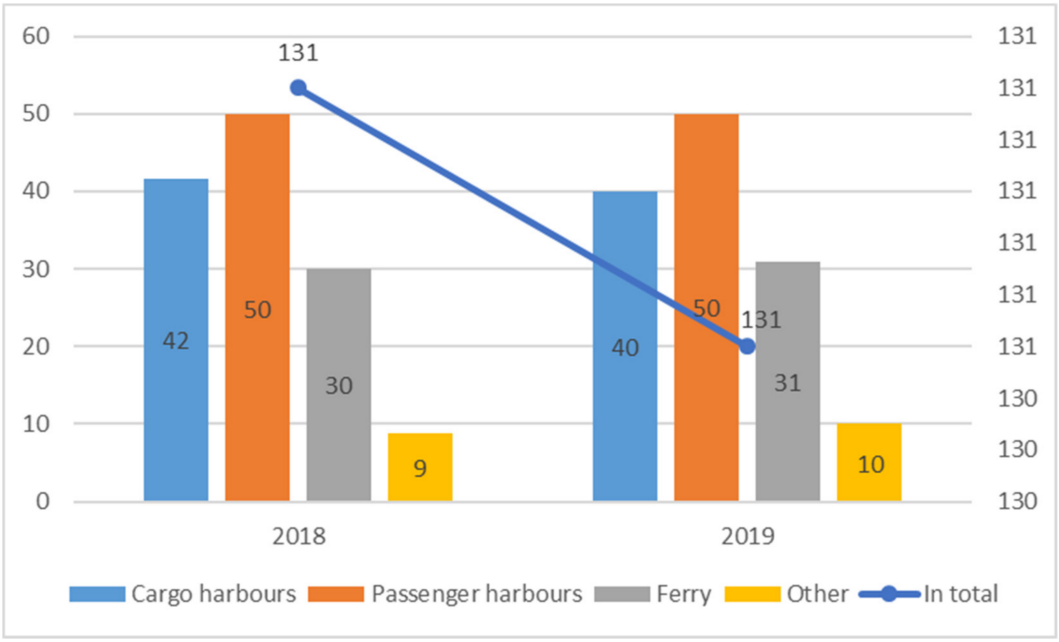

Figure 15. Dynamics of revenue segments from 2018 to 2019, million euros [35].

The development of profit was also influenced by finance income and costs, and income tax on dividends (see Figure 16).

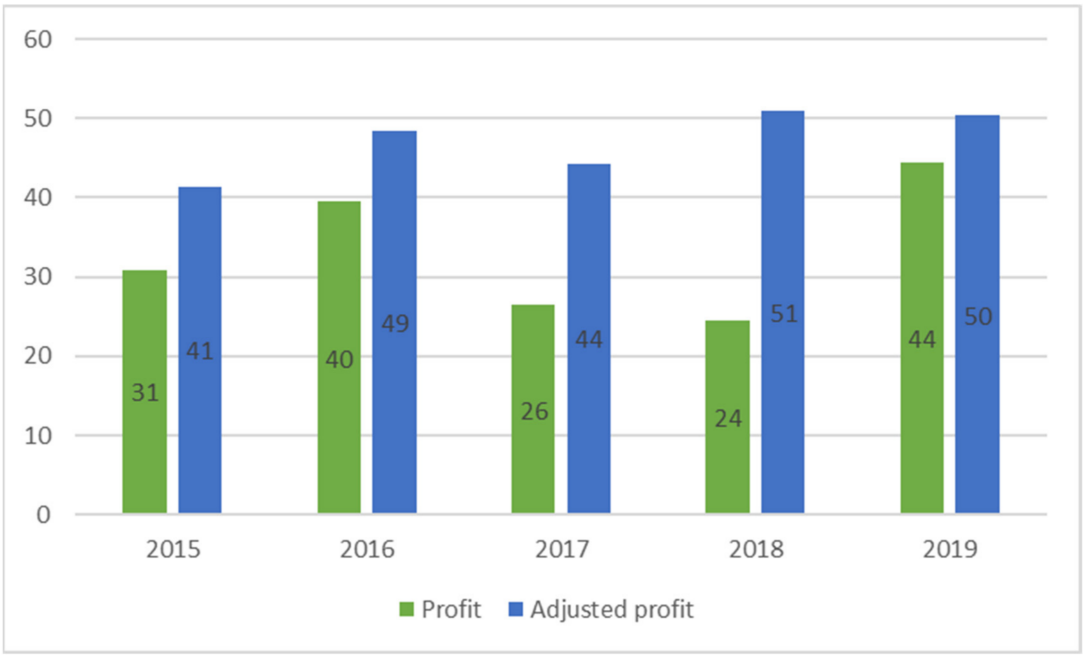

Figure 16. Dynamics of profit and adjusted profit from 2015 to 2019 [35].

Financial income did not change but finance costs decreased by 0.2 million euros (−10 percent), mostly due to a decrease in the average volume of interest-bearing liabilities and expenses on derivative financial instruments. The profit before income tax amounted to 50.2 million euros, a decrease of 0.5 million euros (−0.9 percent) compared to 2018.

The dividend policy of port of Tallinn sets the target to pay the shareholders regular post-tax dividends.

Summarizing the performance results of the Port of Tallinn, it can be concluded that 2018–2019 year were similar, changed evenly without major fluctuations, there was no intensive development.

The turnover of ports of Baltic Sea amounted to 0.6 billion tons in 2019 year, 15 million tons (2.7 percent) up on 2018 (see Figure 17). In terms of cargo types, the biggest change of 2019 was in the volume of liquid bulk cargo, which grew by 12 million tons (5 percent), mainly through growth in the volume of crude oil in Russian ports. The volume of dry bulk cargo grew by 2 million tons (1.6 percent) due to the combined effect of a rise in grain and a fall in coal. The volume of container cargo grew by 3 million tons (3.2 percent) through growth at Russian and Polish ports. The volume of coal grew significantly in the port of Ust Luga in Russia and decreased in the Port of Riga in Latvia. The volume of ro-ro cargo decreased by 1 million tons (−1.7 percent), mainly due to the impact of Russian ports. The volume of general cargo fell by 1 million tons (−4.2 percent), mainly through a decline in the volume of metal in Russian ports.

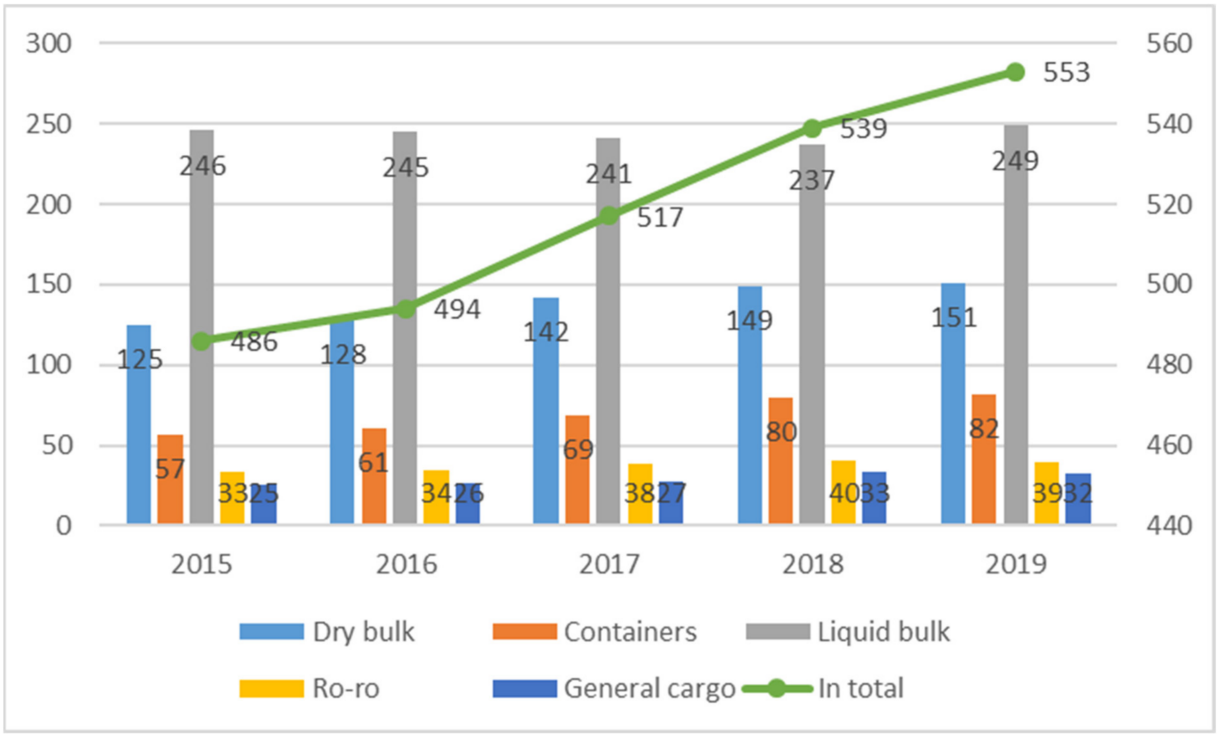

Figure 17. Cargo volume of the largest ports on the eastern coast of the Baltic Sea, million tons [35,52].

The market shares of ports in Baltic region (percent) is shown in Figure 18. Klaipeda Port has the largest market share in the Baltic States, 10 percent in total. The market share of the Port of Ventspils is 4 percent, the Port of Riga is 6 percent, and the Port of Tallinn is 3.6 percent.

Key financial indicators such as net profitability, return on assets (ROA), and return on equity (ROE) changed equally in both ports in Klaipeda and Tallinn, however, slightly better results can be seen in Klaipeda, especially in 2018 (see Figure 19). The net profitability of Klaipeda Port exceeded the result of Tallinn Port by 22.7 percentage points in 2019. Net profitability was a relatively high return of 56.7 percent in 2019, indicating efficient management of the Port of Klaipeda.

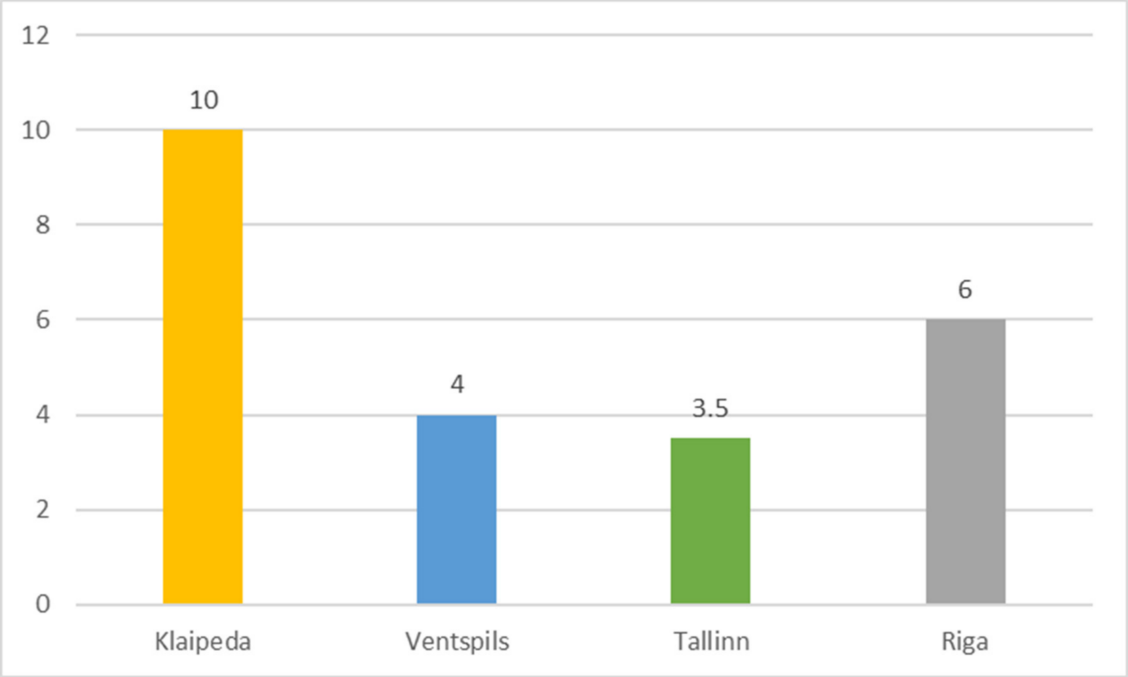

Figure 18. Market shares of ports in Baltic region, percent [35,53].

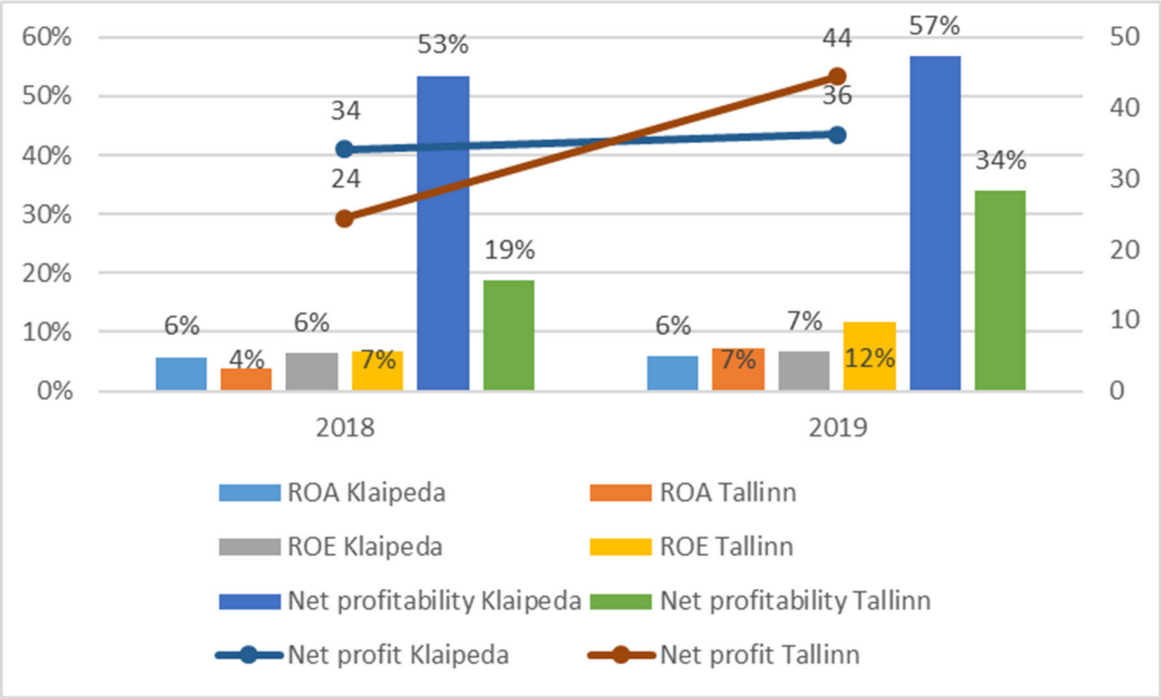

Figure 19. Dynamics of ROA, ROE, and net profitability (percent) and net profit (millions euros) of Baltic ports in 2018–2019 [35].

Container handling in Klaipeda exceeds Tallinn 3 times, respectively TEU 703 thousand (port of Klaipeda) and TEU 223 thousand (port of Tallinn) (see Figure 20). Meanwhile, the Port of Ventspils container handling in the Baltic ports remains the lowest, respectively (about TEU 17 thousand). Although container handling in the Baltic ports has been steadily increasing since 2005, the growth of the Port of Klaipeda has been the highest. In terms of container handling, 2018 year was a record year for the Port of Klaipeda, reaching TEU 750 thousand. Such results show that the development opportunities of the Port of

Klaipeda not only increased, but also lead to a positive vision for future development and growth in all Baltic regions.

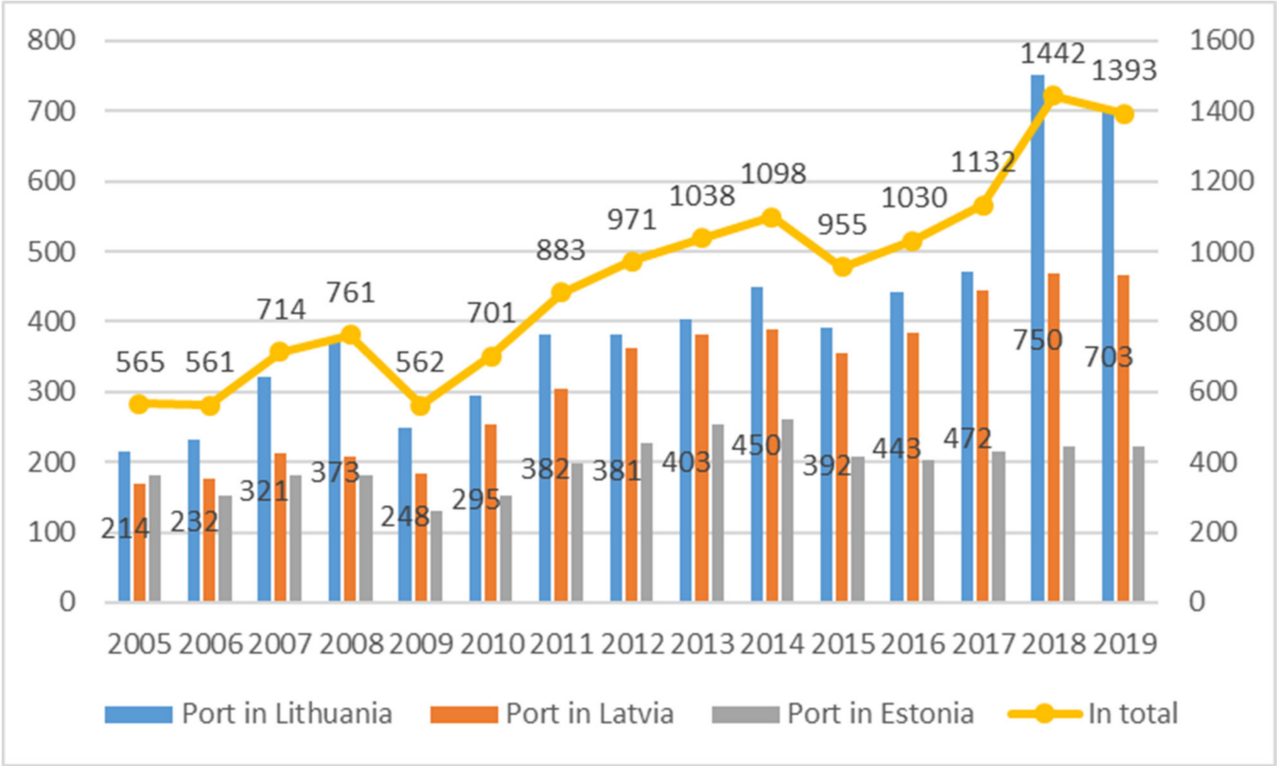

Figure 20. Container handling in Baltic ports (thousands twenty feet equivalent unit 20) [35,54,55].

Container handling in the Baltic region showed that Port of Klaipeda is the absolute leader compared to the Port of Riga and Port of Ventspils (Latvia), and Port of Tallinn (Estonia). Data based on Baltic Port's economic, financial capacity, and performance statistical information illustrated the fact that Port of Klaipeda has consistently grown and expanded, outperformed competitors and has full opportunities to increase its activities, including one of Klaipeda port important companies [35,56]. More efficient operation of shipping companies enables the preconditions for economic growth. However, the development of a socially oriented market economy and the improvement of the well-being of the population is not possible without qualitative financial support for the competitiveness [57] in the shipping industry. Ensuring economic sustainable development in difficult political and economic conditions is one of the priority tasks [58] for all countries, especially in the Baltic region. The SWOT analysis includes "weaknesses" that "due to the shallow depth of the fertilizer loading service, the Port in Lithuania has to buy a service from a competitor and load the fertilizer cargo in order to fully load the vessel", but it is noteworthy that the nearest port development plans provide for the dredging of the port, so this problem will be solved even with perspective opportunities. The SWOT analysis next to the "weaknesses" states that "The terminal has one main customer", but it should be noted that by 2032, a very favorable contract will be signed with the main customer, ensuring the flow of cargo to the terminal. In addition, there is always the possibility of reorienting grain handling without significant investment and thus filling spare handling capacity should it occur. The ports of the Baltic Sea region have a direct impact on the country's sustainability.

6. Conclusions

The Port of Klaipėda is considered to be a leader among the seaports in the Baltic States. In terms of cargo handling volumes, the largest terminals performing cargo loading operations are port's companies. The Port of Klaipėda, unlike other Baltic ports, is less

dependent on cargo flows from Russia, and its cargo structure is more diversified. In terms of bulk and dry bulk cargo volumes transported to/from the Port of Klaipėda, the leading partner countries are as follows: Brazil (10.22 percent), Turkey (7.75 percent), China (7.64 percent), India (6.44 percent), the Netherlands (5.65 percent), and Russia (5.34 percent). In the category of bulk cargo, bulk natural and chemical fertilizers are mainly shipped to Brazil, China, and India, while metal ores and scrap metal are mainly shipped to Turkey and the Netherlands. Russia is an important partner for the largest shipments of fertilizers. The remaining countries make up a small part of the shipments. The major partner of the Port of Klaipėda in the area of transport and cargo transit by land transport is Belarus, whose cargo makes up about 33 percent of the total cargo handled in the Port. The major competitors of the Port of Klaipėda on the eastern coast of the Baltic Sea are Latvian, Estonian, Polish, and eastern Russian ports. Further increase in the volumes of fertilizers in the Port of Klaipėda will be determined by the long-term agreement signed in April 2018 between "Lithuanian Railways" and "Belaruskaliij". SE Klaipėda State Seaport Authority in cooperation with SE Central Project Management Agency signed the agreement for funding the project No. 06.1.1-TID-V-505-01-0003 "Dredging of Klaipėda State Seaport Shipping Channel from PK21 to PK85 (to the depth of 15 m)". EUR 17.3 million from the EU Cohesion Fund was allocated for the project. The largest parts of mineral fertilizers are consumed in Southeast Asia and South America (over 60 percent of the total amount of mineral fertilizers consumed worldwide), which means that the largest share of fertilizer cargo from the Port of Klaipėda and other eastern Baltic ports must be transported by PANAMAX-sized and larger vessels. In 2019, the SC Bulk Cargo Terminal was the most efficient company operating in the Port of Klaipėda in terms of transshipped tonnage per square meter of the exploited area. In 2019, the SC Bulk Cargo Terminal was the most efficient company operating in the Port of Klaipėda in terms of tolls paid per meter of the exploited berth length. In 2019, SC Bulk Cargo Terminal was the most efficient company operating in the Port of Klaipėda in terms of tolls paid per square meter of the exploited area. Based on the projected cargo flows, the geography of their shipping and the relevant vessel parameters, the major berth parameters—depth at the berths, permissible evenly distributed load in the berth constructive zone, the required mooring column holding force and the minimal absorption energy of bounces—were evaluated for given vessel sizes and mooring conditions.

Author Contributions: For research articles with several authors, the following statements should be used Conceptualization, V.G. and R.B.; methodology, V.G. and R.B.; software, V.G. and R.B.; validation, V.G. and R.B.; formal analysis, V.G. and R.B.; investigation, V.G. and R.B.; resources, V.G. and R.B.; data curation, V.G. and R.B.; writing—original draft preparation, V.G. and R.B.; writing—review and editing, V.G. and R.B.; visualization, V.G. and R.B.; supervision, V.G. and R.B.; project administration, V.G. and R.B.; funding acquisition, V.G. and R.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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