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Cross-border employment schemes in the blue and green economy of the South Baltic Region

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Introduction

This study was prepared within the framework of the Seaplanspace project “SEAPLANSPACE - Marine spatial planning instruments for sustainable marine governance”, Interreg South Baltic Programme 2014-2020.

The aim of the study was to identify and analyse existing employment schemes and the related economic development potential of five countries in the South Baltic Sea Region, i.e: Denmark, Germany, Lithuania, Poland and Sweden.

The Baltic Sea has been and remains a key factor shaping the political, cultural, environmental and economic identity of the Baltic Sea Region. The region's best known cities have developed as ports on the Baltic Sea coast or on waterways directly connected to the sea. Many of these cities continue to function as important seaports serving the increasing flows of goods through the Baltic Sea region.

Using marine resources means something different to everyone. The blue economy covers a wide range of sectors and operations, both traditional and emerging. The growing diversity of activities within the Blue Economy creates challenges in terms of their mutual compatibility and competition for marine space and resources. Economic activities carried out within the Blue Economy include, but are not limited to, activities such as:

1) Marine transportation: commercial, passenger;
2) Fishing: commercial and recreational;
3) Aquaculture: breeding of various marine organisms;
4) Sport, tourism and leisure: sailing and other sports practiced at sea, diving;
5) Hospitality and residential real estate;
6) Use of renewable energy: winds, waves, tides, sea currents;
7) Seaports;
8) Industrial and processing facilities;
9) Raw material terminals;
10) Offshore wind farms
11) Extraction of raw materials and minerals;
12) Transmission lines: pipelines, gas pipelines, power and telecommunication lines;
13) Shipbuilding and repairing;
14) Protection of marine environment, culture and history;
15) Military operations;
16) Scientific research.

As it is shown the blue economy covers a wide range of operations that are essential to people's everyday lives. It involves range of businesses from big international companies to local SMEs. Food and energy production, mining, maritime industries, transport and tourism are the main existing marine-related sectors, while there are also emerging sectors such as the production of new kinds of blue bioeconomy products. Circular economy and water protection activities are also intrinsically linked with the blue economy.

According to UNESCO's definition, maritime spatial planning (MSP) is the public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve social, ecological and economic objectives that are determined through a political process (UNESCO). This means that socio-economic and cultural human activities in the sea should be subject to transparent planning and management principles. Responsible maritime spatial planning requires knowledge of how marine waters can be managed and how the environment can adapt to sustainable development. MSP should help to balance competing interests making sure society benefits while protecting the marine environment.

So how can such a large group of interests and stakeholders be reconciled?

First, plans should be prepared by a highly educated group of empowered experts with a strong shared vision and clearly defined objectives about what needs to be achieved. Knowledge and familiarity with Blue Economy development issues should be supported by an excellent understanding of the views and interests of numerous stakeholder groups. Planners need to listen to as many stakeholders as possible, and not just at the beginning but throughout the process. By working with all parties who have an interest in the use of marine resources, planners ensure that marine users build trust, engage in the process, and feel ownership of the plan developed with their assistance.

MSP begins with an analysis of the current situation in the planning area. The work can begin with an assessment of the natural and economic value of the selected marine areas. Then the persons and entities interested in using the planning area should be identified. Important here are the government's priorities for the analysed sea areas and plans of public entities regarding their use.

Gathering a wealth of data and information on the entirety of ongoing and planned activities, from fisheries to shipping lanes, taking into account important natural habitats and areas of oil, gas, and other resource and mineral production, will map out the details to understand the many key issues the plan must address.

When preparing the MSP it is necessary to identify areas of potential conflict, as well as sources of possible synergies of activities and interests of various entities. In practice many activities can be easily combined, whereas others are mutually exclusive. Therefore it is

important to conduct research and analyse different variants of events that may occur in the future and trends in various industries and areas of human activity. It gives the opportunity to develop alternatives and decide on the preferred spatial option, which may involve compromises between different interest groups.

During spatial planning, especially in maritime areas, reaching a compromise requires knowledge of the existing law, the current policies of public authorities, the ability to foresee potential sources of conflicts and the ability to negotiate in order to overcome all obstacles and problems. Reaching a consensus is much easier when stakeholders are involved in the planning process and their voices and conclusions are thoroughly analysed and taken into account when formulating proposals. Developing plans with the participation of all Blue Economy stakeholders will provide broad support during the implementation and management phases of plan implementation in the long term.

Within the framework of this study, interest groups in the form of companies and organisations creating jobs in the blue and green economy, implementing investments in their activities as well as creating added value to the economy in the five countries of the Baltic Sea Region are identified: Denmark, Germany, Lithuania, Poland and Sweden. Selected information on the potential for further economic development in these countries at the interface with the maritime economy was also analysed.

An important role for maritime spatial planning and development of Blue Economy is played by quality of education and matching knowledge and skills with the needs of this complex market. In-depth analysis of the presented data will lead to conclusions about potential jobs and point to places where it is necessary to educate people and improve skills in order to engage in the development of this important sector of the economy.

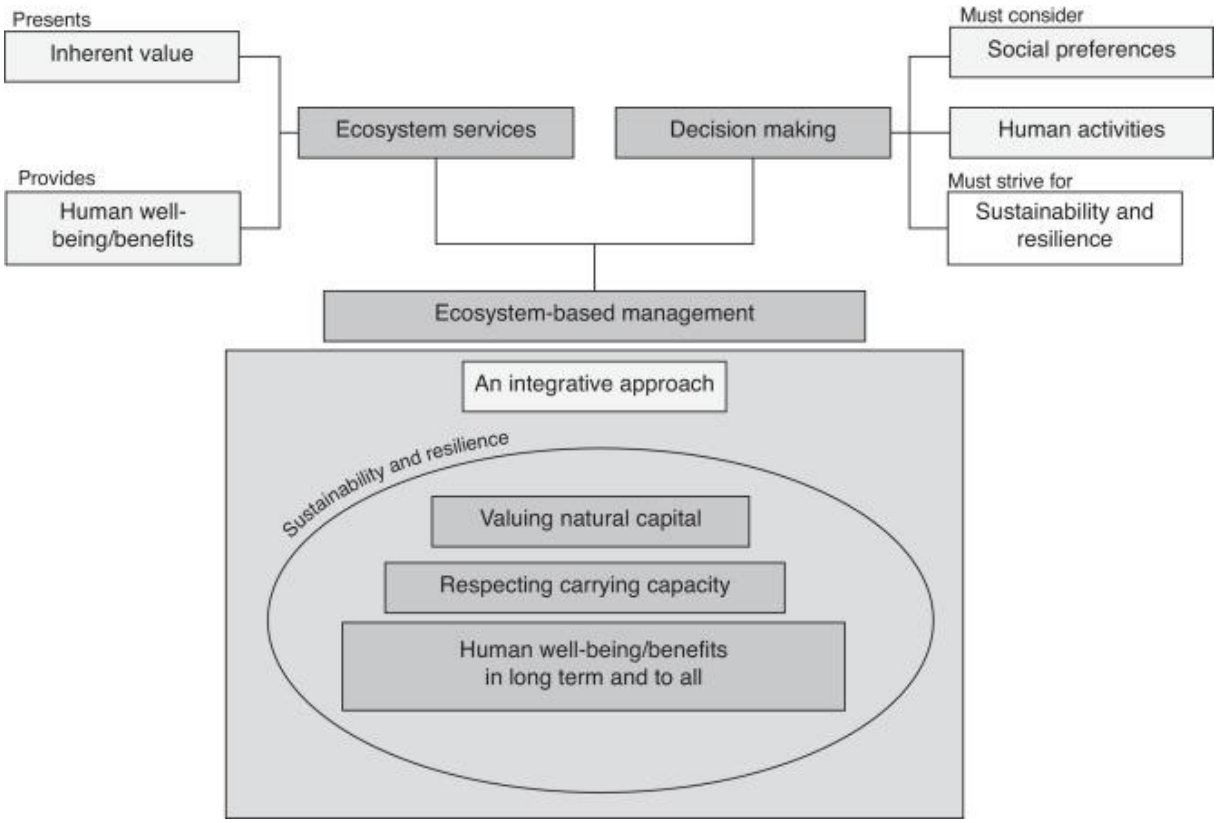
1. Human resource and service ecosystem management in marine areas

Despite the human species presenting a certain level of detachment from the direct relationships with the environment, especially due to cultural and technological issues, we are still fundamentally dependent on the flow of ecosystem services. Ecosystem services can be defined as the benefits natural ecosystems supply to guarantee human well-being. They are the benefits that natural environments supply to human beings. The high biodiversity and geodiversity of the coastal zone allow a wide range of services. But deleterious impacts of human-being to the environment threaten the delivery of these services and, consequently, the human well-being they lead to. The maritime environment and the coastal zone, with its multiple users and impacts, is a case in which an ecosystem-based approach would bring many benefits within the scope of an integrated coastal management strategy. By considering the ecosystem services supplied by the coastal zone, it is possible to make well-informed decisions. The research on ecosystem services and their application within the context of coastal management is an important input to the maritime spatial planning and improvement of human resources management in this context.

The ecosystem services can be included in what is called “ecological economics”, a transdisciplinary science through which different fields of knowledge seek to communicate by means of a common language. There is also a need for a holistic and integrated approach when addressing ecosystem services and sustainable development. From an ecological economics standpoint, economic activity occurs within a system of social relationships, which is limited by environmental parameters and, thus, should respect the carrying capacity limits of natural environments. Sustainable development involves three dimensions: economic development, social development and environmental sustainability. However, while public policies have treated these dimensions as interactive, these are not always seen as being interdependent.

Sustainable development covers three dimensions: economic development, social development and environmental sustainability. However, while public policies have viewed these dimensions as interactive, they are not always seen as interdependent. For this reason, the integrated approach to ecosystem services and the decision-making process should be developed and implemented to ecosystem-based management strategies used in maritime spatial planning. The idea is presented in Figure 1.

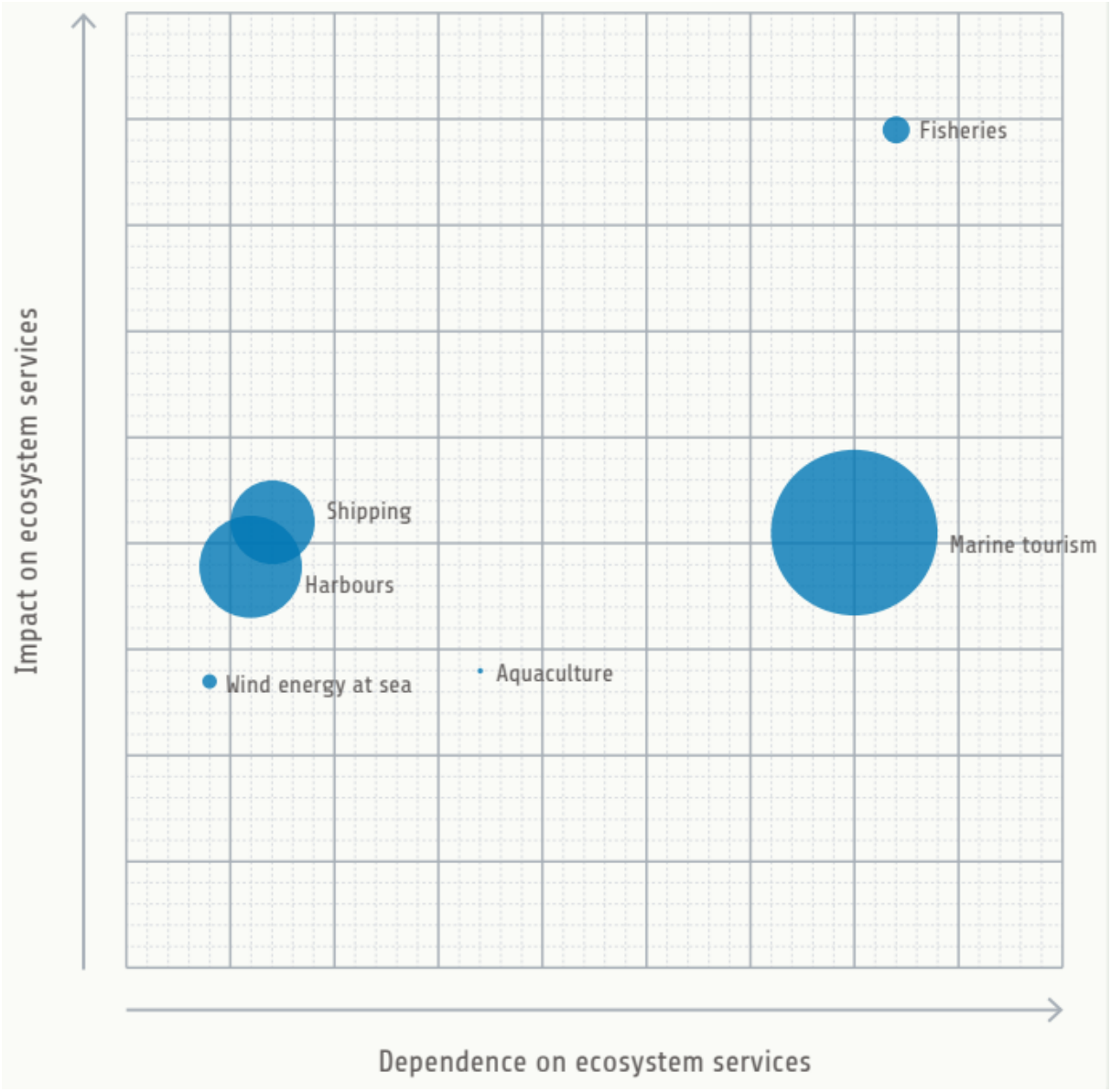
Figure 1. Ecosystem based management



Source: Carla I. Elliff, Ruy K.P. Kikuchi, *The ecosystem service approach and its application as a tool for integrated coastal management*, Natureza & Conservação, Volume 13, Issue 2, July–December 2015, Pages 105-111.

The ecosystem services approach was applied to research made by HELCOM Project in 2018. The holistic analysis of the links between the status of the ecosystem and human well-being, and is not limited to market based information. Finding links between economic indicators, for example 'value added, with the ecosystem services approach, we can learn how human activities benefit from and impact on the environment in a more comprehensive way. The graph shows the results of this method applied in Sweden (Figure 2).

Figure 2. The human activities benefit from an impact on the environment



Source: State of the Baltic Sea – Second HELCOM holistic assessment 2011-2016, Baltic Marine Environment Protection Commission, 2018, p. 31

The bubble size represents the value-added of each activity. The horizontal axis represents the activities dependency on the state of ecosystem services and the vertical axis represents the total environmental impact of human activities on the ecosystem services. Economically and ecologically sound marine management would shift the location of the bubbles downward and increase the size of the bubbles. Any action taken in preparing maritime spatial plans must take into account the holistic approach outlined. In the following section, studies will be presented to assess the effects of human development on marine areas.

2. Employment issues in the blue and green economy

Blue Economy is the concept by which the European Union refers to the use of seas and coasts for economic activities. Blue Growth is the European Union's long-term strategy for the expansion of these activities in a planned way. In addition, Blue Growth implies sustainability to support the sustainable growth of the marine and maritime sectors as a whole. Strategies related to the marine area include commonly a relevant premise, healthy marine ecosystems are more productive (and therefore more conducive to the Blue Economy) than unhealthy ecosystems, so this growth must be carried out considering the conservation of seas and oceans and long-term sustainability. The Blue Economy in the EU represents approximately 5.4 million jobs and generates a gross value added of almost 500 billion euros per year (Gazo, 2021).

Traditionally the activities that have generated and continue to generate Blue Economy are shipbuilding and ship repair, offshore oil and gas, fisheries and Transport Cargo and ferries. A decade ago the European Commission identified five high potential sectors in the Blue Growth strategy and set the objective of strengthening the employment and growth potential of Europe's coasts and seas. The five main sectors identified and enhanced were:

1. Coastal and maritime tourism (coastal tourism, cruise tourism, yachting);
2. Aquaculture (fish, shellfish, marine plants farming);
3. Ocean energy (renewable: wind, waves, tides, etc.);
4. Marine biotechnology (medicines, industrial enzymes, etc.);
5. Seabed mining (mineral resources).

European coasts and seas have the potential to deliver growth and jobs in the coming years. To achieve Blue Growth, highly qualified and skilled professionals are needed. Blue Economy sectors are experiencing difficulties in finding the right employees – and most sectors expect these difficulties to continue soon. The Baltic Sea coast has the potential to provide economic growth and jobs in the coming years. To achieve Blue Growth, highly qualified and qualified specialists are needed. Blue economy sectors struggle to find the right workers - and most sectors expect these difficulties to persist soon. For this reason, it is necessary to constantly monitor market needs in order to better match the educational offer and research conducted by secondary schools and universities.

The conducted survey research allows to identify the following gaps and needs:

- technical skills, searching for inventions and implementing innovations;
- communication and cooperation skills between education, science and industry;
- lack of knowledge about the attractiveness and opportunities for a career in the blue and green economy;

- lack of ocean literacy culture;
- ability to negotiate and solve social conflicts during the preparation and implementation of investment projects off the seacoast.

Looking main causes of this situation you should pay attention to the education system implemented in the Member States. On the one hand, High Schools have been incorporating or are working to incorporate knowledge on the lines set by the EU, so it is possible to find certain marinization of the syllabus, gaining on-site skills, concepts and knowledge related to Ocean Literacy, Blue Schools, European Marine Strategy, or their national transpositions and environmental values of the Natura 2000 marine network. On the other hand, there is the Labour Market that has a demand for basic competencies, experience, fieldwork, accreditations and certifications, sustainability criteria and alignment of its activity with SDGs and European Marine Strategy.

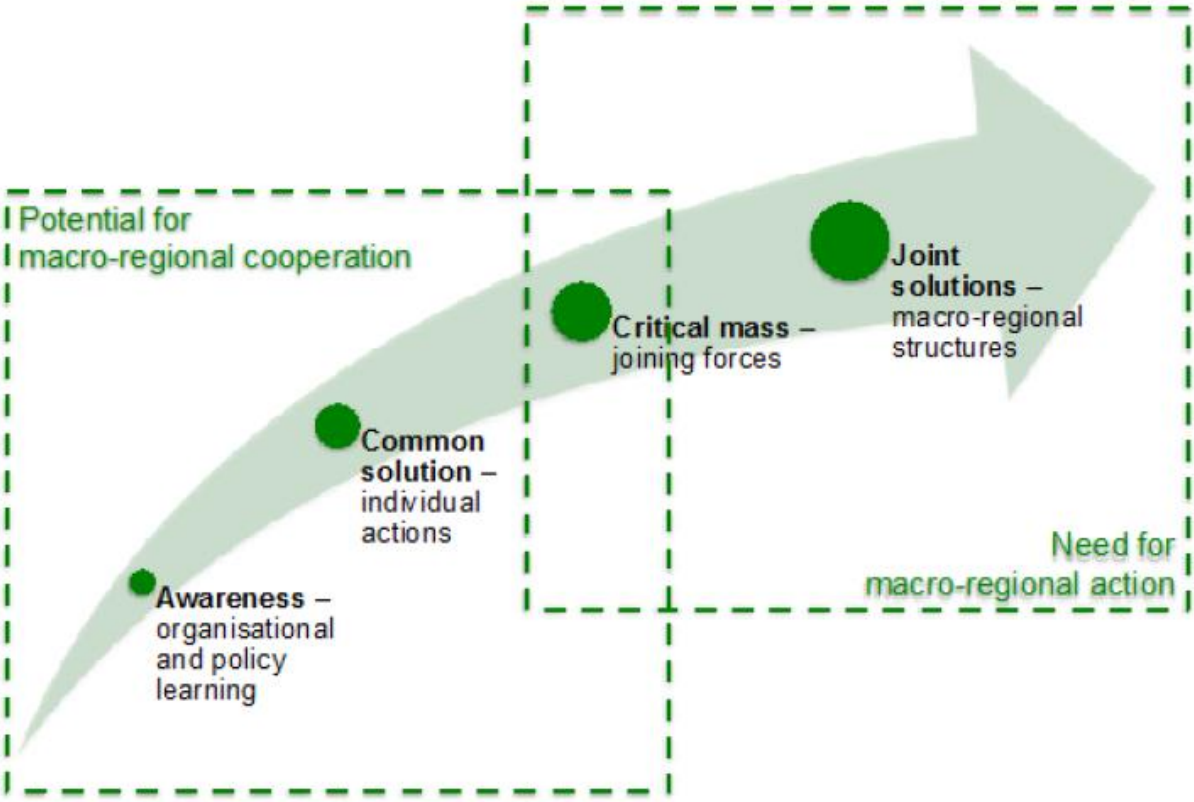
There is a possibility that the problem has the source in the years prior to accessing this labour market, as universities and high schools have not filled the gap. Reviewing curricula of different universities that offer degrees related to Biology, Environmental Sciences, Biotechnology, Biochemistry, Marine Sciences, and masters of specialization in Aquaculture, Biodiversity, Microbiology, Ecology, Management and Restoration of habitats, Oceanography. However, in every one of them, there is a lack of specific training focused on the emerging labour market that calls for Blue Growth. Moreover, in many of them it is not even explained in what marine field the European Union wants to move.

The Baltic Sea is a specific area as many problems are common to the countries located along its coast. Establishing cooperation, identifying best practices, seeking consensus and implementing joint projects are activities that are characteristic of the Baltic Sea Region. Accelerating development and employment in the green and blue economy, forces the greater involvement of the research and education sector in:

- Creation of specific training degrees;
- Development of specialized postgraduate degree offerings;
- Establishing a dialogue to identify training needs with all stakeholders;
- Aligning curricula and scope of education with EU guidelines to ensure expected competencies;
- Aligning the timetables for the implementation of new degrees, masters and careers with the EU's priority blue and green growth sectors.

Many issues need to be solved at the macro-regional level and must be dealt with better results at lower or higher governance levels. Figure 3 provides a quick overview of considerations for identifying issues requiring increased macro-regional cooperation.

Figure 3. Need for macroregional co-operation and action



Source: J. Zaucha, D. Pyć, K. Böhme, L. Neumann , D. Aziewicz, EU macro-regional strategies for the Baltic Sea Region after 2020. A nutshell of beauty and possibilities, Europa XXI, Vol. 38, 2020, pp. 51-76.

3. Economic and social analysis of employment schemes across the Baltic Sea Region

3.1. The general overview

Economic and social analysis of the use of marine waters examines the economic contribution to regional and national economies from using marine waters in their current state. This contribution is measured with economic and social indicators. These indicators describe the importance of the marine activities to the economy, for example by estimating value added or employment, or the direct economic value from the use of the marine environment to the citizens' living in the coastal countries.

The following report provides an overview of the Blue Economy in chosen countries of the BSR. The conducted analyse focuses on the evolution of the Blue Economy for the seven established sectors in terms of employment and gross value added (GVA). Table 1 collects statistics for all countries assessed, and then each country is described separately. The following Blue Economy sectors were analysed in details: Marine living resources, Marine non-living resources, Marine renewable energy, Port activities, Shipbuilding and Repair, Maritime Transport, Coastal Tourism.

Table 1. Employment and gross value added in chosen countries in the Baltic Sea Region (years 2009 and 2018)

Persons employed *(thousand)*	Denmark		Germany		Lithuania		Sweden		Poland	
	2009	2018	2009	2018	2009	2018	2009	2018	2009	2018
Marine living resources	8.6	8.3	43.7	48.3	6.5	7.5	7.9	8.2	28.4	37.6
Marin non-living resources	2.6	2.0	0.3	0.3	-	-	-	-	0.4	0.2
Marin renewable energy	0.2	0.8	-	-	-	-	-	-	-	-
Port activities	3.4	5.7	74.4	123.8	3.9	4.0	4.0	3.9	28.0	31.3
Shipbuilding and Repair	4.5	3.3	39.6	39.7	6.0	4.9	7.0	7.2	29.4	23.8
Maritime Transport	27.1	27.7	109.4	132.6	2.1	1.6	21.6	17.2	4.5	3.9
Coastal Tourism	44.0	77.6	180.5	201.0	6.2	5.9	82.3	81.2	28.0	58.9
Blue Economy Jobs	90.6	125.3	447.8	545.7	24.6	24.0	122.8	117.6	118.6	155.6
National Employment	2 658.0	2 739.0	37 808.0	40 636.0	1 290.0	1 324.0	4 391.0	4 910.0	15 629.0	16 133.0
Blue Economy *(% of national Jobs)*	3.4	4.6	1.2	1.3	1.9	1.8	2.8	2.4	0.8	1.0
GVA* *(euro in million)*	**2009**	**2018**	**2009**	**2018**	**2009**	**2018**	**2009**	**2018**	**2009**	**2018**
Marin living resources	645.0	781.0	1 936.0	2 524.0	84.0	169.0	322.0	418.0	556.0	784.0
Marin non-living resources	5 092.0	1 495.0	54.0	28.0	0.0	0.0	-	-	19.0	9.0
Marin renewable energy	38.0	463.0	-	-	-	-	-	-	-	-
Port activities	390.0	676.0	3 940.0	6 824.0	113.0	166.0	241.0	332.0	563.0	754.0
Shipbuilding and Repair	293.0	296.0	2 250.0	3 159.0	77.0	108.0	287.0	463.0	713.0	593.0
Maritime Transport	2 855.0	4 562.0	12 490.0	11 870.0	62.0	71.0	825.0	1 020.0	186.0	168.0
Coastal Tourism	1 677.0	3 063.0	4 329.0	5 379.0	41.0	78.0	2 543.0	3 280.0	297.0	964.0
Blue Economy GVA	10 989.0	11 337.0	24 999.0	29 785.0	377.0	590.0	4 218.0	5 512.0	2 334.0	3 270.0
National GVA	199 423.0	261 418.0	2 192 834.0	3 012 310.0	24 300.0	40 678.0	276 539.0	417 621.0	281 933.0	434 406.0
Blue Economy *(% of national GVA)*	5.5	4.3	1.1	1.0	1.6	1.5	1.5	1.3	0.8	0.8

*Gross value added

Source: Own elaboration following: The EU Blue Economy report 2020. Annexes, European Commission, 2021

As expected, Germany, due to its enormous economic potential, performs the best in all sectors in absolute terms. However, Denmark is a leader in many areas related to the blue economy among the countries analysed for 2009-2018. During this decade, both in 2009 and in 2018, it had the largest share of people employed in national employment, as well as the share of Blue Economy GVA in the national GVA. In terms of the share of employment in the blue economy compared to total employment, Sweden, Lithuania, Germany and Poland were the next places in 2018. The order of the Blue economy GCA in the total GVA of selected countries was slightly different. In this classification, Lithuania, Sweden, Germany and finally Poland were placed behind Denmark.

Table 2. Blue Economy Compound Average Growth Rates for 2009-2018

Persons employed	**Denmark**	**Germany**	**Lithuania**	**Sweden**	**Poland**
Marine living resources	-0.4%	1.0%	-	0.4%	2.8%
Marine non-living resources	-2.6%	0.0%	-	-	-6.7%
Marine renewable energy	14.9%	-	-	-	-
Port activities	5.3%	5.2%	0.3%	-0.3%	1.1%
Shipbuilding and Repair	-3.1%	0.0%	-2.0%	0.3%	-2.1%
Maritime Transport	0.2%	1.9%	-2.7%	-2.3%	-1.4%
Coastal Tourism	5.8%	1.1%	-0.5%	-0.1%	7.7%
Blue Economy Jobs	3.3%	2.0%	-0.2%	-0.4%	2.8%
National Employment	0.3%	0.7%	0.3%	1.1%	0.3%
Blue Economy *(% of national Jobs)*	3.1%	0.8%	-0.5%	-1.5%	2.3%
Gross Value Added	Denmark	Germany	Lithuania	Sweden	Poland
Marine living resources	1.9%	2.7%	7.2%	2.6%	3.5%
Marine non-living resources	-11.5%	-6.4%	-6.7%	-	-7.2%
Marine renewable energy	28.4%	-	-	-	-
Port activities	5.7%	-	3.9%	3.3%	3.0%
Shipbuilding and Repair	0.1%	-	3.4%	4.9%	-1.8%
Maritime Transport	4.8%	-0.5%	1.4%	2.1%	-1.0%
Coastal Tourism	6.2%	2.2%	6.6%	2.6%	12.5%
Blue Economy GVA	0.3%	1.8%	4.6%	2.7%	3.4%
National GVA	2.7%	3.2%	5.3%	4.2%	4.4%
Blue Economy *(% of national GVA)*	-2.4%	-	-0.6%	-1.4%	0.0%

Source: Own elaboration

Among the employment data observed in the different sectors, the biggest disadvantage was the lack of comparable information from each country on offshore renewable energy. However, based on information from Denmark, the significant potential of this sector can be confirmed. The Compound Average Growth Rate (CAGR) for offshore renewables for the 10 year period was 14.9% for employment and 28.4% for GVA (see Table 2.). With a five-fold increase in installed wind capacity in the Baltic Sea by 2050, these high levels will certainly be maintained and perhaps even increased.

Data from other sectors made many important observations about employment schemes in the Blue Economy. Only Poland experienced an increase in CAGR in Marine living resources during the period studied. No country saw employment growth in Marin non-living resources. Average annual employment growth of over 5% was recorded in Denmark and Germany in the area of seaport activities. The shipbuilding and ship repair sector only saw a slight increase in Sweden, while employment in Germany remained at the same level as in 2009, and there were slight job reductions in the remaining countries. In terms of maritime transport development, Germany and Denmark fared best with 1.9% and 0.2% annual growth respectively. The largest number of people associated with the blue economy find employment in coastal tourism. For all countries analyzed, this is over 42% in 2009 and almost 44% in 2018. A high value of this structure indicator is recorded by Sweden (67% and 69% respectively) and Denmark (49% and 62% respectively). The highest increase of the examined structure indicator was recorded by Poland reaching the level of 38% in 2018 compared to 24% in 2009(see Table 3).

Table 3. Share of Coastal Tourism in Blue Economy Jobs in 2009 and 2018

Country	Denmark		Germany		Lithuania		Sweden		Poland	
Year	2009	2018	2009	2018	2009	2018	2009	2018	2009	2018
Share of Coastal Tourism in Blue Economy Jobs	49%	62%	40%	37%	25%	25%	67%	69%	24%	38%

Source: Own elaboration

3.2. Detail analysis by countries

3.2.1. Denmark

The Blue Economy (established sectors) employs around 125 thousand people and generated over €11.3 billion in GVA in 2018. It is dominated by Coastal tourism in terms of jobs, contributing 62% of the total Blue Economy in 2018. In terms of GVA, Maritime transport is the largest contributor (40%), followed by Coastal tourism (27%) and then Marine non-living resources (13%).

The Blue Economy's share in Denmark's national GVA was the highest among analysed countries over the reporting period. It has raised since 2009 and was in 2018 at 4.3%. In absolute terms, Denmark's Blue Economy GVA increased 3% compared to 2009. A different picture emerges for employment. For the period analysed, the share of employment provided by the Blue Economy has grown by 34.2% compared to 2009 (and by 38% in absolute terms) and currently sits at around 4.6%. The presented values mean that over 4% of all Danish jobs derive directly from Blue jobs.

Denmark is the world's fifth largest maritime shipping nation –surpassed only by Greece, Singapore, China and Japan. In 2018, Danish shipping companies around the world control approximately 2100 merchant ships. Maersk Line is Denmark's and the world's largest container shipping company, with more than 600 ships. Large Danish shipping companies, are also strong players in areas such as product tankers, bulk carriers and service vessels for the offshore industry.

3.2.2. Germany

The German Blue Economy (established sectors) provides about 546 thousand Blue Economy Jobs (see Table 1). Germany is one of the biggest producers of offshore wind energy in the EU. German ports are important high-tech hubs and also a service providers for the offshore wind power sector. Detailed data are currently unavailable but Marine renewable energy is a rapidly growing sector in that country. According to BWO - Federal Association of Offshore Wind Farm Operators the expansion of offshore wind power capacity exceeded that of onshore capacity for the first time in 2019. The industry creates a revenue of nearly €10 billion and directly employs 30 000 people, almost half of which work in North Rhine-Westphalia, Baden-Württemberg and Bavaria. The comprehensive value chain (development, construction, operation) creates additional jobs in many businesses.

Germany's Blue Economy is dominated by Maritime transport, contributing 40% to the overall Blue GVA in 2018. Germany won first place in terms of GVA for Maritime transport, generating 33 % of the EU total in 2018. The sectors as Port activities (23%) and Coastal tourism (18%) are also important contributors to the Blue Economy. In terms of employment, Coastal tourism produced 37% of all Blue jobs, followed by Maritime transport (24%) and then Port activities (23%). Port activities has grown the most: +66.5% in jobs and +73% in GVA compared to 2009. Germany is split over two sea-basins: the North Sea and the Baltic Sea. The Port of Hamburg is Europe's third busiest port. German ports are important high-tech hubs and also a service provider for the offshore wind power sector. The Blue Economy's share of employment has remained relatively steady at around 1.2% in Germany. In absolute terms, Blue jobs increased 22% compared to 2009 values, outperforming the national employment, which increased by 7.5 % over the same period; indicating that Blue job's share increased by 13%.

The German Blue Economy (established sectors) generates around €29.8 billion in GVA. The national GVA has been on the rise over the whole period, increasing 37% compared to 2009. However, the same cannot be said of Blue GVA, which showed some variability throughout the same period. In absolute terms, Blue GVA increased by 19% compared to 2009 while its share towards the national GVA decreased by 13%.

3.2.3. Lithuania

The Lithuanian Blue Economy (established sectors) employs around 24 thousand people and generates over €590 million in GVA. The blue economy in Lithuania is dominated by the Marine living resources sector, which in 2018 accounted for 31.5% of Blue jobs and 28.6% of GVA. Port activities and Shipbuilding and Repair sector also account for a large share, generating 28% and 18% of GAV respectively, while providing 17% and 21% of jobs, respectively. In terms of employment, the number of Blue Economy Jobs decreased by 2.7% in absolute terms (around 658 jobs) compared to 2009, while its share in national employment decreased by 5.2%, from 1.9% in 2009 to 1.8% in 2018. This means that the increase in the number of jobs in the country was higher than in the Blue Economy.

Blue GVA increased by 57% compared to 2009, while its contribution to the national economy decreased by 6.4%. In 2018, the contribution of Blue GVA to the national economy (measured in GVA) was 1.5%, down slightly from 1.6% in 2009. The aquaculture sector, dominated by carp, generated about 14% of the total primary sector. There are about 95 fish processing enterprises with over 4,200 employees, which together with wholesale trade generate about 94% of the total GVA generated by Marine living resources, up from 80% in 2009.

The maritime cluster is concentrated around the port of Klaipeda, the only seaport in Lithuania and an important transport hub. The shipbuilding sector specializes mainly in the construction and repair of smaller and specialized vessels, such as fishing boats and ships used in oil and gas production.

3.2.4. Sweden

The Swedish Blue Economy (established sectors) employs around 118 thousand people and generates over €5.5 billion in GVA (see Table 1.). The Blue economy is dominated by Coastal tourism, which contributed 69% to Blue Economy Jobs and 59.5% to GVA in 2018. The Maritime transport sector is also an important contributor, providing nearly 15% of Blue Economy Jobs and 18.5% of GVA. The Marine living resources sector rank third with 7% of Blue Economy Jobs and nearly 8% of GVA.

In Sweden, both Blue GVA and National GVA increased significantly, by 31 % and 51 % respectively compared to 2009. The share of Blue GVA in relation to National GVA decreased by 13.5 % compared to 2009. In terms of employment, the number of national jobs increased by 12% compared to 2009, while the number of Blue Economy Jobs decreased by 4 %, translating into a 14 % decrease in the share of Blue Economy Jobs in total national employment in Sweden.

3.2.5. Poland

The Polish Blue Economy (established sectors) employs around 156 thousand people and generates over €3.2 billion in GVA. In the analysed years, there was a significant increase in the number of jobs related to Blue Economy as well as the share in Blue Economy GVA, which was confirmed by the CAGR indicators (see Table 2.). The Blue Economy sector is dominated by coastal tourism, which contributed 38% of blue jobs and 29.5% to GVA in 2018.

The main ports in Poland are Gdańsk, Gdynia, Szczecin and Świnoujście. Gdańsk is a major international transportation hub and the fastest growing port in Europe, with plans to double its cargo turnover to 100 million tons per year. Gdańsk is ideally situated as a gateway port connecting the Nordic countries with central, eastern and southern Europe. Port operations, Marine Living Resources, and Shipbuilding and Repair are also important contributors to the Blue Economy, providing 20%, 24%, and 15% of jobs and 23%, 24%, and 18% of GVA in 2018, respectively.

Poland has a significant fish processing and trade sector, one of the largest in Europe. The activity named "Processing and preserving fish, crustaceans and molluscs" contributed to 14% of the total Polish blue GVA in 2018. It plays an important role in supplying the EU with processed fish products such as smoked salmon and trout, canned herring, mackerel and sprat, and ready-to-eat fish products such as fish salads and pickles. Other products include fresh and frozen cod fillets, ready-to-prepare frozen fish fillets, freshwater and diadromous fish such as zander, and fresh and frozen whole fish such as trout and sprat.

4. The economic potential of selected sectors to create new Blue Economy jobs

4.1. Offshore wind in the Baltic Sea Region

The European Union is leading the fight against global warming. EU member states have pledged to increase energy production from renewable sources (RES). During this decade (2021-2030) the share of RES in the EU is to increase from 20% to 32%. The Baltic Sea has a number of assets conducive to the development of offshore wind farms. According to the report "Our energy, our future" prepared by experts from BVG Associates in cooperation with WindEurope, offshore wind farms in the Baltic Sea are to reach a total capacity of 83 GW (see Table 4). The report predicts that the largest capacities will be located in Poland (28 GW), Sweden (19.8 GW), Denmark (7.3 GW), Germany (4.5 GW) and Lithuania (3.6 GW). Making these plans a reality requires the commitment of investors, suppliers, governments and international cooperation among all countries in the Baltic Sea region. Currently, there are over 22 GW of installed offshore wind capacity in European waters, of which only about 2.2 GW is in the Baltic Sea (Denmark 879 MW, Finland 70 MW, Germany 1 074 MW and Sweden 192 MW). A dynamic scaling process is expected to increase these values from 22 GW today to 450 GW by 2050.

Table 4. Location of offshore wind in Baltic Sea, by subregions

Sub-region of country	Capacity allocated (GW)	Offshore wind area (km²)	Total sub-region area (km²)	Offshore wind area as fraction of total area in sub-region
Baltic Germany	4,50	900	14 998	6,00%
East Denmark	5,20	1 040	33 443	3,10%
Bornholm Denmark	2,10	420	11 520	3,60%
West Sweden	7,60	1 520	16 206	9,40%
South Baltic Sweden	9,40	1 880	86 381	2,20%
North Baltic Sweden	2,80	560	52 794	1,10%
South Baltic Finland	11,30	2 260	42 983	5,30%
North Baltic Finland	4,20	840	38 493	2,20%
Estonia	1,50	300	36 438	0,80%
Latvia	2,90	580	28 360	2,00%
Lithuania	3,60	720	6 839	10,50%
Poland	27,90	5 580	29 984	18,60%
TOTAL	**83,00**	**16 600**	**398 439**	**4,00%**

Source: *Vision for the Baltic Sea. Vision for Poland. Development of offshore wind in the Baltic Sea* Region. PWEA Report, 2020

Cooperation between countries on offshore wind energy can result in hybrid projects that can pave the way for a more coordinated and cost-effective development of offshore wind energy across Europe. Approximately 34,000 full-time jobs will be needed during the development and

construction phase of offshore wind farms, while the operation and maintenance of completed wind farms will generate approximately 29,000 new jobs. The demand for labor force will increase not only in sectors directly related to wind energy and industry, but also in public administration, construction, finance, transport, services, etc. This means that the development of offshore wind farms may become a driving force not only for the offshore industry, but also for other sectors of the economy.

The area of the Baltic Sea is almost 400 thousand km2 and the offshore wind energy area occupies almost 16.6 thousand km2 (4.1%). Table 5 shows the extent of spatial exclusions such as biodiversity protection, offshore economic development and national security. Fisheries, shipping lanes, sand mining, telecommunications, pipelines, and other activities could coexist with appropriate policies.

Table 5. Offshore wind use and exclusions in the Baltic Sea by sub-region

SUB-REGION	Percentage of total sea area available for offshore wind	Percentage of total sea area excluded for offshore wind	Offshore wind as a percentage of total sea area
Baltic Germany	7%	93%	6%
East Denmark	8%	92%	3.10%
Bornholm Denmark	19%	81%	3.60%
West Sweden	16%	84%	9.40%
South Baltic Sweden	36%	64%	2.20%
North Baltic Sweden	46%	54%	1.10%
South Baltic Finland	50%	50%	5.30%
North Baltic Finland	22%	78%	2.20%
Estonia	27%	73%	0.80%
Latvia	55%	45%	2.00%
Lithuania	54%	46%	11%
Poland	52%	48%	19%

Source: *Based on: Our energy, our future.* BVG Associates for WindEurope, November 2019

Ensuring that the offshore area can be easily shared with other users is the key to achieving viable offshore wind energy. Offshore wind can coexist with other activities such as aquaculture, some fishing techniques, power generation such as power-to-x (P2X), and storage. Offshore wind energy can also contribute to seabed restoration and marine biodiversity conservation. To enable this, multiple-use options should be clearly identified in each country's marine spatial plans and must be supported by a clear regulatory framework to ensure that all different activities are carried out safely and efficiently.

For sub-regions where offshore wind will cover more than 10% of the sea area, neighboring sub-regions could have an increased share. For example, the amount of offshore wind energy in Poland could be shared with areas north of it, such as Denmark and Sweden. Cooperation between countries will obviously be necessary to maximize these opportunities. Such sharing

could further reduce the overall average LCOE. For example, there are areas of low LCOE in Baltic Denmark that could be used to power western Sweden. There are low LCOE areas in Bornholm that could be used to power Poland.

Countries could also pursue offshore hybrid projects that combine an interconnector with connected offshore wind farms. This would reduce the total area needed for both offshore generation and transmission. Hybrid offshore projects are also attractive because they would increase interconnection between countries, allowing electricity to flow where it is needed, making offshore wind a new source of baseload power. The European Commission has concluded in preliminary assessments that hybrid offshore wind projects would have environmental and planning benefits, as well as potential cost savings. Hybrid projects should always be evaluated on a case-by-case basis. They will not always be more beneficial than a regular wind farm due to different conditions and technical design. However, the most beneficial hybrid projects studied so far can save 300-2500 million Euros over the lifetime of the project, saving 5-10% of the total project costs [U. Weichenhain, S. Elsen, T. Zorn, and S. Kern, "Hybrid projects: How to reduce costs and offshore development space. North Seas Offshore Energy Cluster study," Roland Berger GmbH, Brussels, Belgium, 2019].

Development of offshore wind farms requires that marine spatial planning ensure that a site has broad consent for offshore wind use and that the site has a grid connection to transmit energy to users, so early progress in these areas is particularly important. Offshore wind can share the sea with other activities, such as aquaculture and some fishing techniques. It can also share space with natural protected areas. On the other hand, offshore wind can be excluded from sand and gravel dredging areas, major shipping lanes, cable and pipeline routes, and military uses. However, investments in infrastructure to incorporate current radar and other mitigation technologies and further technological advances over time will help minimize the impacts of offshore wind in these areas.

Governments will need to coordinate with each other on marine spatial planning activities. They will also need to send signals to industry that they understand the pace of development required and that it will be supported. Such signals are particularly powerful when delivered at a pan-European level. They help support a stable market where successful development leads to further certainty and stability.

National governments will need to facilitate national and local permitting authorities and statutory consultants with the resources to assess and obtain permits for a sufficient number of sites to achieve the necessary pace of offshore wind development. This is particularly important in relation to marine spatial planning, which is most beneficial if it influences pre-leasing site decisions.

Governments should support the offshore wind industry by reinforcing the message that using the seas for offshore wind will help us meet our climate goals. They must work to maximize joint use so that offshore and coastal stakeholders are as supportive as possible of offshore wind at this scale [Vision for The Baltic Sea. Vision for Poland, p. 13].

The society located in the Baltic Sea Region must be sure that building offshore wind energy, especially in a wide range, is the right decision for the environment. Both society and industry need comprehensive data linked to the offshore environment: about species and habitats, as well as about the cumulative environmental impact of offshore wind. This also includes the shoreline and onshore impacts of export cabling. Gathering and analyzing this environmental information can take many years. National and international bodies will need to work together and take a strategic approach to the assessment of future offshore wind impacts, both at a project level and research and survey work. The environmental and social acceptance of the development of more wind farms is vital for the energy transition in the region. The offshore wind industry will therefore need to continue the work closely with governments and non-governmental organizations (NGOs).

The development of offshore wind farms in the Baltic Sea region will increase employment in the following entities:

1) Wind turbine manufacturers – according to European Commission assumptions there will be needed 200-300 turbines per year in the Baltic Sea region;
2) Offshore installation suppliers – there will be a need for investment in new vessels capable of installing the expected large turbines and their foundations; it is anticipated that new vessels will be required, each capable of installing turbines or their foundations by the Baltic coast. This may include also new heavy-lift floating vessels for deep-water sites; on the other way, innovations in installation approaches and the use of floating wind turbines, built near-shore or in harbours and towed to the site using cheaper vessels, may reduce the investment requirements. In addition, the current key suppliers transitioning from the oil and gas supply chain can also have the potential to bring their input to the offshore wind supply chain;
3) Sea ports – construction port investment will be needed in all sea basins; with floating wind installations being significant, at least one port in each sea basin will either be capable of building floating wind projects; the focus should be on deploying large scale bottom-fixed sites for Poland and most of the Baltic States; governments and their jurisdictions should support port infrastructure, directly helping to grow construction ports volume capability;
4) Project developers – to enable large investments in the offshore wind farm market, project developers must be sure that key suppliers are investing in the expected

volumes; the project developers need to have confidence that the expansion of their project development teams is profitable; the timeframe needed by project developers is relatively short: five to seven years ahead of installation; project developers should have confidence that grid connections will be in place to supply their power to customers, or that they will be compensated if these connections are not ready; finally, project developers must assess the project cash flows and returns at relatively low risk to enable execution of the projects, often with significant debt financing.

Table 6. Key tasks for national energy and climate plans

Country	Key tasks for national energy and climate plans
Denmark	Should step up its grid enhancement for trade, so interconnection to other countries will be the key activities. It needs to accelerate its international cooperation in order to develop offshore hybrid projects and address the cumulative environmental impacts of large-scale offshore wind
Germany	Should step up in enabling new sites suitable for offshore wind. Crucially Germany must start its grid enhancement, particularly the onshore grid from north to south. It will have to cooperate with its neighbours for interconnection expansion and to build offshore hybrid projects
Lithuania	Should address their interconnection and system synchronisation with central Europe. Timely implemented investments in port infrastructure are major challenges and should be started as soon as possible but not later than 2025.
Poland	Should accelerate the enhancement of its national onshore grid. The use of Poland's interconnection needs large improvements to enable higher electricity trade levels with other Central and Eastern Europe countries. It needs to have clear streamlined permitting rules which allow the deployment of large offshore wind volumes
Sweden	Should enable sites for offshore wind by solving the current exclusions due to military radar issues. It needs to cooperate internationally to address the possible environmental impacts of large-scale offshore wind deployment in the Baltic Sea

Source: *Vision for the Baltic Sea. Vision for Poland. Development of offshore wind in the Baltic Sea Region,* PWEA Report, 2020, p. 20.

Preparing, implementing and updating an offshore spatial plan is a challenge for planners and all stakeholders in such a document. When making a detailed analysis of the development potential, employment schemes, as well as opportunities for increasing the number of jobs within the green and blue economy, the increasingly dynamic changes in the development of the economy and technology in the world should be taken into account. On this basis, some important suggestions can be formulated, which should influence the shape and quality of the future maritime spatial development plans.

First of all, an increase of the area for future development of offshore wind energy, which may significantly contribute to the attainment of the Green Deal goals, should be considered. The areas allocated so far for the development and exploitation of hydrocarbons should be considered, which should enable the parallel development of the offshore wind energy. This coexistence of both functions will allow these areas to be used in accordance with the best economic interest and future conditions and needs.

Works on updating the plan and adjusting it to the current economic situation may be of a continuous character and the plan itself should be updated at least every 5 years. This change is mainly influenced by rapid technological development and dynamically changing legal and regulatory environment.

Not only economic but also ecological conditions influence the availability of marine resources for the development of the blue economy. In this regard, a more flexible approach to the issue of bird migration and the width of related corridors should be seriously considered. The minimum width of migration corridors currently is set at 4 kilometres. Such an approach seems unreasonable and may hamper development plans for offshore investments. A more practical approach is to conduct extensive and thorough environmental research on migration and wintering of migratory birds and then, based on the results of this research, determine the width of migration corridors. In this way, the need for biological balance could go hand in hand with opening new marine areas for development and job creation.

Development of offshore wind energy market always generates demand for additional jobs both in the energy sector (generation and transmission of electric energy), as well as in other sectors of the economy - construction, finance, transport, services, etc. To determine the job creation potential, the example of Poland can be used, where offshore wind farms with a capacity of 28 GW are to be built by 2050. Therefore, it is expected that about 34,000 full-time jobs will be needed, while in the operational phase (servicing of completed wind farms) it will be about 29,000 jobs in the investment phase (during the development and construction of offshore wind farms). The creation of new jobs in offshore wind sector will stimulate the need to build new competences in the labour market, which will have a positive effect on the entire sector of the economy – building a knowledge-based economy. The changing structure of electricity generation force workforce movements between various sectors of the economy, but their pace and scale depend on the pace of investment in new generation capacity, mainly related to renewable energy sources, including offshore wind energy.

Gross value added can be defined as the surplus of a company’s revenues over expenses incurred on goods and services that are necessary to conduct current operations. Gross value added indicates how a company, through the transformation of goods and services from other companies into a new product or service, generates a new value in the economy. In Poland, the total effects in the investment phase measured by the value added will amount to EUR 12 bln, and the average annual effects in the operational phase – EUR 3.5 bln.

The development of the offshore wind sector means a significant increase in revenues to the state budget. The main sources of these revenues include: corporate income tax (CIT), personal income tax (PIT), indirect taxes such as VAT and excise duty, as well as property

taxes and other public levies. It is estimated that the cumulative tax effects during the investment phase (2022-2033) in Poland could be EUR 3.6 bln, including CIT, PIT, VAT, excise tax and social security contribution. Then, in the operational phase, between 2025 and 2058, the financial impact on the state budget could be about 300 million euros per year. Therefore, the amount of money coming into the state budget will be another benefit for the individual countries of the Baltic Sea region during the realization of offshore wind investments.

4.2. Sea ports activity

Maritime transport can be divided into transport infrastructure and shipping, which includes both passenger and cargo shipping (freight). These two sectors are interrelated because shipping uses transport infrastructure. Transport infrastructure includes ports, as well as activities carried out in connection with ports, such as dredging, cargo handling, and construction of water projects. Maritime transport can be seen as including shipbuilding and repair industries.

In 2020, transhipments at seaports in the Baltic Sea fell by a total of nearly 55 million t (5.9%), resulting in a total volume of 867.9 million t. The dominant position in the market was maintained by Russian ports, which handled a total of 241.5 million t of cargo (down 5.8%), where liquid bulk cargoes (128.7 million t), mainly exported crude oil, dominated. This was followed by Swedish ports (169 million t), Polish ports (103.8 million t) and Finnish ports (94.4 million t).

In Polish ports, the year 2020 brought multidirectional changes. Transhipments in Gdańsk decreased by 8%, which was mainly affected by lower liquid fuel transhipments. Also, ports in Szczecin and Świnoujście recorded a decline (by 3.4%), which was caused by a decrease in the volume of bulk cargo (coal, ore). However, in Gdynia it was a year of increased reloading. A significant increase in the volume of grain compensated for the decline in coal and coke. The Port of Gdansk handled 48 million tons of cargo in 2020. Despite the correction of 7.9%, the year 2020 should be considered stable, and the Port of Gdansk in such a difficult period was in the group of 20 largest European ports, ahead of the port of Genoa and the port of Dunkirk, and in January entered the podium as the 3rd largest port on the Baltic Sea. Port of Gdansk Authority also made a net profit of 65 million.

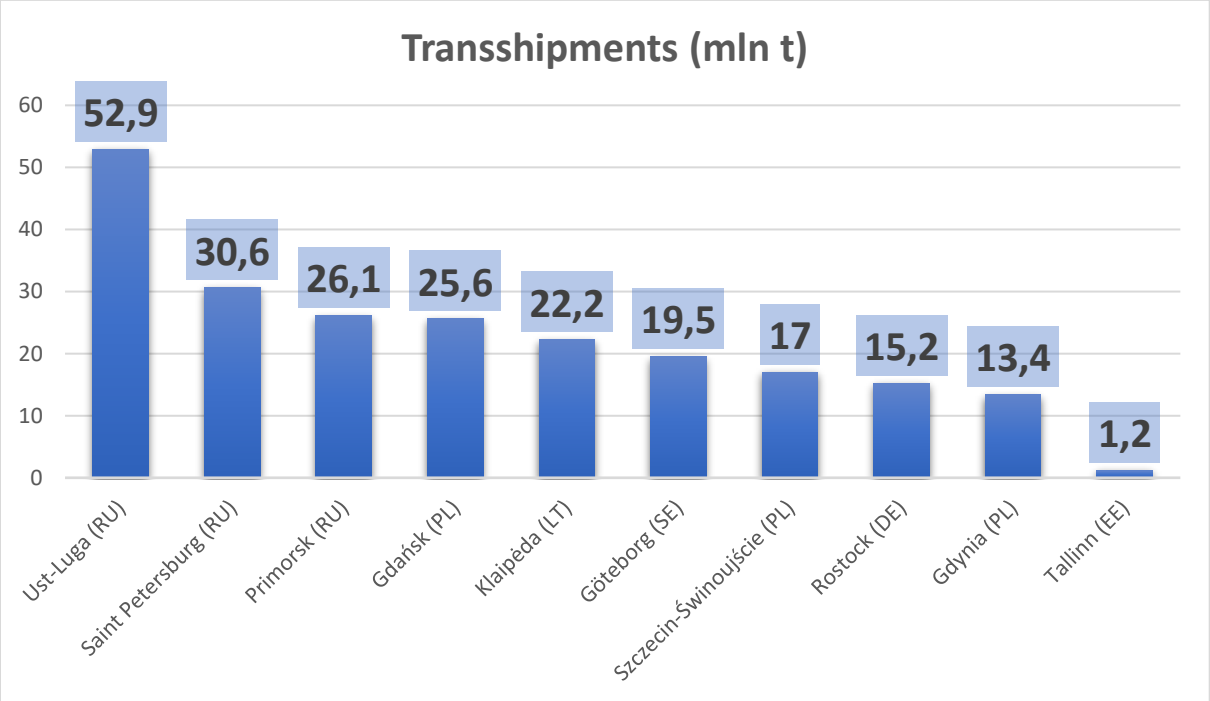
The year 2020 was a record year for the Port of Gdynia in terms of transhipments. Despite the pandemic, a year-on-year increase of 2.9 per cent was recorded. In terms of growth dynamics in 2020, the Port of Gdynia was ranked second among ports on the Baltic Sea. The Port of Klaipeda recorded the highest growth (+3.31 per cent). In second place was Gdynia (+2.94

percent), and in third place was St. Petersburg (+0.01 percent). The other Baltic ports recorded a decrease in transhipments in 2020.

Revenues of basic maritime industries, according to the Central Statistical Office (CSO) data for 2018, exceeded PLN 42.2 billion (1.2% of the national figure), plus work for more than 126 thousand people. As representatives of maritime business emphasize, a multiplier of 3 to 6 can be applied here, because so many people and companies live indirectly, for example, from shipbuilding activities or ports in the "hinterland" of the country. In 2018, only the management boards of sea ports in Poland paid the state budget PLN 40.6 billion in due taxes: VAT, excise duties and customs duties. This is almost 10 percent of the total revenue in the budget, in addition, these revenues are increasingly important.

The volume and value of cargo handled by ports has a simple translation into taxes paid by their management boards and private operators, including through the possibility of Poland retaining 25% of customs duties when goods are first cleared in an EU country. This is a very tangible example of one of the "benefits" of developing maritime economy for the whole country, not just the Baltic regions.

Figure 4. Top 10 largest ports on the Baltic Sea (1st half 2021)



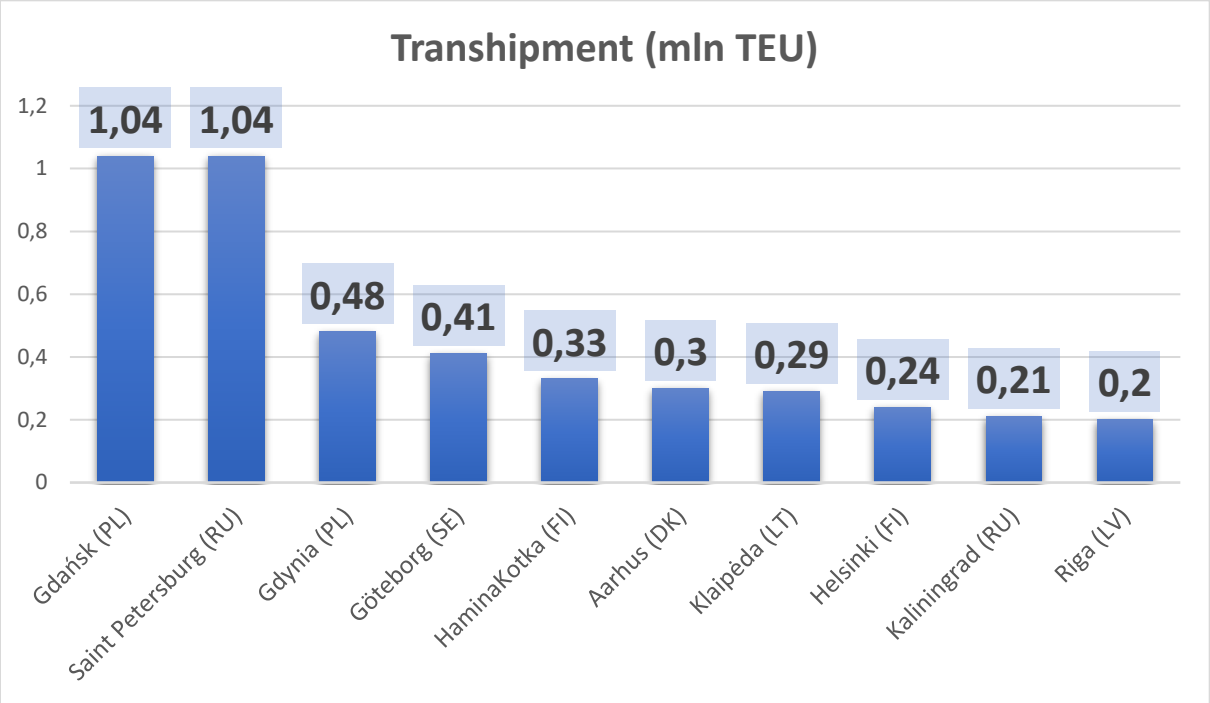
Source: Portowy Bałtyk. Namiary na Morze i Handel, 2021

Trade has also seen significant declines recently (2020/21). Estimates indicate that the value of global trade fell by 8.3%. As with GDP, the results of the second quarter of 2020 were severe for the global economy, with global merchandise exports declining by 16.4% (quarter-on-

quarter). Only the Chinese economy, among the G20 countries, recorded significant growth (16.4%) during this period.

In contrast, the first half of 2021 saw an improvement as declines were replaced by modest increases. Forecasts indicate that the current year should end with GDP growth of 4.8% for the EU and 6% for the global economy. Importantly, positive developments are expected in all European countries.

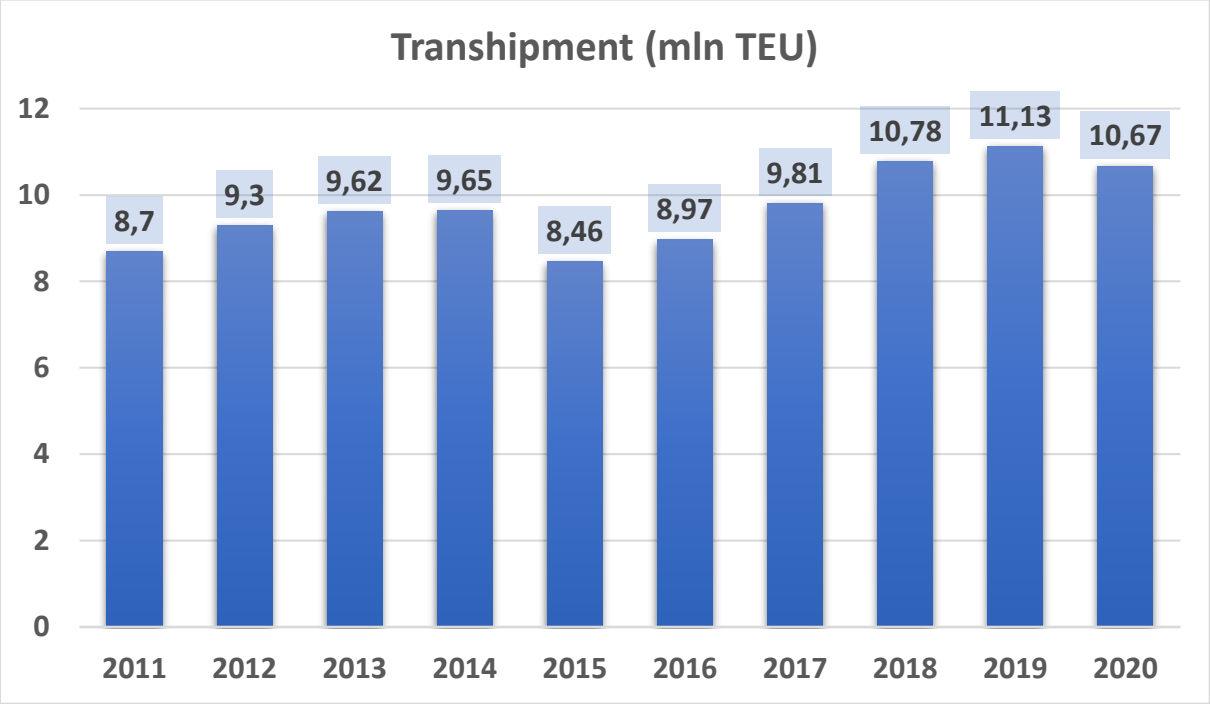
Figure 5. Top 10 container ports in the Baltic Sea (1st half of 2021)



Source: Portowy Bałtyk. Namiary na Morze i Handel, 2021

A good illustration of the recovery in global trade is the situation in the global container market, which has gone from a state of collapse in mid-2020 to a state of boom, with supply constraints becoming an issue. This is evidenced by changes in the amount of container ship capacity remaining idle, which exceeded 11% in Q2 2020, only to fall to 1% today. Rising demand has simultaneously pushed up freight rates. Based on the World Container Index, there has been a 334% increase over the past year.

Figure 6. Container transhipment in the Baltic Sea ports 2011-2020



Source: Portowy Bałtyk. Namiary na Morze i Handel, 2021

After a difficult 2020, the first half of 2021 brought stabilization (0.03% growth) in port transhipments in the Baltic Sea, helping to achieve a result of 446.4 million t. However, different directional changes in transhipments were recorded in individual countries. Among the gainers were Poland (increase by 5.5 million t), Latvia (2.9 million t), Denmark (2.2 million t), Estonia (2.1 million t), and Germany (0.9 million t). On the other hand, decreases in volume were recorded in Russia (down 4.4 million t), Finland (3.9 million t) and Sweden (2.9 million t) and Lithuania (2.2 million t).

4.3. Maritime Transport

Current research shows that among all maritime sectors, shipping is still by far the largest generator of gross value added in the region. Equally important, the sector creates a significant number of Blue Economy Jobs. The main factors and challenges for the development of shipping in the BSR are:

- Digitalisation and high tech: smart sensors, big data and automation systems, maritime clouds, computer power;
- Up-scaling of vessels sizes, and cargo volumes per port;
- Governmental actions in favour of autonomous shipping;

- Environmental regulations;
- Oil price developments.

As of the writing of this report, obtaining consistent data on the blue and green economies for the countries analysed is a very difficult task. However, given the systematic but slow changes, the authors of this report use data from different periods. This allows at least capturing the main trends and discussing the most important processes taking place in the maritime economy. It is further important to note that many processes were severely affected by the outbreak of the Covid-19 pandemic, as well as all the restrictions that accompanied the pandemic.

Socio-economic data for the maritime transport sector includes both value added at factor costs (GVA) and the number of people employed in maritime and coastal freight and passenger transport. However, it should be noted that the figures for Germany and Denmark often refer to all maritime transport and are not related only to activity in the Baltic Sea. Furthermore, many countries do not report shipping statistics when the data "allow the identification of statistical units" (EU 2009). This refers, for example, to such cases where the number of entities is too small to ensure data anonymity. In such cases, data are marked as confidential by countries. Taken together, these issues affect regional totals.

The total value added for the region from freight transport is about €5.1 billion and from passenger transport about €2.5 billion. There were an estimated 50 million international ferry passengers in the Baltic Sea in 2018. It is also known that about 25% of shipping in the Baltic Sea is under the flag of one of the Baltic States, according to HELCOM data from the Automatic Identification System (AIS).

For value added from sea and coastal freight water transport, Germany has the highest value added with 4.1 billion euros, but this includes all marine shipping and is not specific to the Baltic Sea. Finland is next with €426 million. Latvia and Lithuania have the lowest values. For the value added from maritime and coastal passenger water transport, the numbers are more evenly distributed, with Sweden having the highest value added, followed by Finland and Denmark. The total number of people employed is 22,300 for freight transport and 24,500 for passenger transport. There were an estimated 42 million international ferry passengers in the Baltic Sea (HELCOM 2015).

Despite the good health of the Blue Economy, more needs to be done to increase jobs and economic performance in the Baltic Sea Region. First of all, it is necessary to develop digitalization and green shipping, which can bring tangible benefits to the shipping sector along

the entire value chain. In particular work needs to be undertaken to develop a common system for collecting and sharing cargo data from different transport modes.

Education and training programs in schools and universities need to be developed to match the needs of the Green and Blue Economy. This will lead to an increased supply of skilled labour available at all levels of management. Development of research and implementation of inventions should lead to an increase in the number of ships in the Baltic Sea with e-navigation compatible devices and with many automated functions, especially augmentation.

Implementation of the above-mentioned actions will lead to more environmentally friendly shipping and port operations and lower CO2, SOx and NOx emissions from ships. In addition, a harmonized infrastructure network for alternative fuel bunkering and shore-side electricity supply should be developed. The maritime industry must focus on producing high-end, specialized ships and marine equipment using hybrid, electric, and in the future, hydrogen power.

4.4. Maritime Tourism

A narrow definition can be used for marine tourism in the Baltic Sea, which includes trips made within the following countries and regions: Denmark, Estonia, Finland, the German Baltic Sea provinces of Hamburg, Mecklenburg-Vorpommern and Schleswig-Holstein, Latvia, Lithuania, the Polish Baltic Sea regions Północno-Zachodni and Północny, and Sweden. For the area thus defined, the tourism industry in the Baltic Sea Region (BSR) is an economic powerhouse as the key performance indicators confirm. In 2016 the BSR tourism industry:

- generated 88 million international arrivals (+10.4 percent from 2014),
- registered 227 million overnight stays (+8.9 percent from 2014),
- of which 54 million overnight stays by international visitors were recorded – equal to 24 percent of all overnight stays (+9.4 percent from 2014),
- directly provided Bleu Economy Jobs for more than 638,400 (+6.5 percent from 2014).

The foundation of this strong position of the BSR tourism industry is confirmed in the European comparison. In 2016, three destinations from the BSR ranked in the top ten destinations of UNWTO (UNWTO, 2017), and these were: Germany, the Russian Federation and Poland. Although all three countries have only a portion of their destinations located along the Baltic Sea coast, there is a clear indication of the importance of coastal tourism to overall domestic tourism. According to the data collected, in Germany 17 percent of all overnight stays are recorded in the coastal provinces of Hamburg, Mecklenburg-Vorpommern and Schleswig-Holstein, while in Poland 43 percent of all overnight stays are generated in the two coastal regions of North-Western and Northern.

Based on the above information, it can be concluded that coastal and marine tourism is a mature and well-developed area of blue growth in the BSR. The Baltic Blue Growth Agenda considers coastal tourism coastal tourism as very important in economic terms.

When analysing the contribution of direct employment by the tourism industry to total employment in the BSR, a positive development trend can be identified. Between 2014 and 2016, direct employment in the BSR tourism industry increased by 6.5 percent to a total of more than 650,000 directly provided jobs. The German Baltic Sea coast with more than 180,000 employees can be identified as the main labour markets, closely followed by Sweden with 173,000 employees in the tourism industry. The contribution of the direct GDP generated by the BSR tourism industry as a share in the overall GDP indicates the importance of the sector for the economic development of the respective regions.

In 2016, tourism GDP as a percentage of total GDP ranges from a low of 1.8 percent in Lithuania to a high of 4.3 percent in both Finland and Latvia. In Lithuania and Latvia this figure corresponds to the share of employment (1.8 percent in Lithuania respectively 4.2 percent in Latvia), while in Finland the share of employment is much lower (2.0 percent). This relationship indicates that the Finnish tourism industry is probably more efficient compared to the mentioned countries.

Comparing the employment share with the GDP share provides a preliminary indication of the efficiency of the tourism industry in a country or region. If the employment share and the tourism GDP share show approximately the same values (as in Denmark or the three Baltic countries), this indicates a well-developed market - with potential for further efficiency gains. In markets where the GDP share is much higher than the employment share (as in Finland), productivity gains have already been achieved. By contrast, in tourism markets where the share of employment is much higher than the share of GDP (as in Germany), productivity growth is not being realised, which may at the same time indicate strong growth potential, but at a later stage.

In order to provide a reliable picture of the development of the tourism industry in the BSR, data are presented for Poland as a whole, as well as for the two Polish regions of North-Western and Northern Baltic Sea related (hereinafter: "Polish Baltic Sea Coast"). There are good reasons why Polish tourism decision makers should pay attention to the development of this industry. Between 2014 and 2016, the number of arrivals increased by 20 per cent (Polish Baltic Sea Coast: 17.1 per cent), which exceeds the 10.4 per cent increase recorded in the BSR, with the share of international overnight stays also close to the total share of the BSR

(PL: 19.6 per cent; BSR: 23.9 per cent). The slightly lower number of international arrivals on the Polish Baltic Sea Coast at 17.9 per cent may be a cause for concern.

The impact of the Polish tourism industry on the economy shows potential for further growth. With 2 percent (Polish Baltic Sea Coast: 2.1 percent) of total employment in the tourism industry and projections of employment growth to 2.5 percent by 2025, the sector is a potential employment driver. The Polish tourism industry's contribution to GDP increased slightly to 1.9 percent. Considering both employment and GDP, it can be concluded that the Polish tourism industry as a whole has already realized the potential for efficiency improvements.

Looking at the Polish tourism industry from an overall perspective, it can be noted that Poland is one of the few BSR regions that have been able to improve its international competitiveness. This is evidenced by the fact that Poland ranked 58th place (out of 133 countries) in the 2009 edition of the Tourism Competitiveness Index of the World Economic Forum, it moved up to place 46 (out of 136 countries) in the 2017 edition of the index.

The main strengths of the Polish tourism industry can be seen in the areas of price competitiveness, health care infrastructure, and international openness. Areas for improvement can be found in the infrastructure of ports and airports, the quality of natural resources, as well as in the prioritization of the tourism industry by policy makers.

The tourism industry is a service industry that relies on the availability of a high quality, skilled and motivated workforce. Despite the fact that even in the tourism industry there is a higher degree of automation, it is still mainly people who have to meet the expectations of travellers and tourists. Therefore, focusing on the qualifications of the workforce as well as the way customers are treated are appropriate measures for the competitiveness and attractiveness of the BSR tourism industry.

In addition, the framework conditions for the workforce in the BSR tourism industry (for example, hiring practices, wages, participation of women) have an impact on the availability of the workforce. In most BSR countries a labour shortage can be observed in all industries, which puts the BSR tourism industry in competition with other business sectors. Sweden, Denmark, Poland, Latvia and Lithuania are examples of functioning labour markets providing opportunities for further growth.

An in-depth analysis of the economic effects and employment schemes in the tourism sector of the Baltic Sea Region leads to the following conclusions on core drivers and challenges for the development of the BSR’s coastal and maritime tourism:

- Concentration of tourism in a few destinations (e.g., cruise ports or seaside resorts) requires better development of (and connections to) inland destinations and new attractions away from city centres;
- Demographic changes and new demand patterns require new, specific tourism products;
- Digitalization opens up new opportunities for selling and creating tourism products;
- Local stakeholders must benefit from coastal tourism, not suffer from it;
- Sustainability awareness and quality of experience are becoming more important.

In the member states of the European Union, increasing emphasis is being placed on the implementation of action plans to reduce the negative impact of industry on the environment. The effects of these actions will favour the development of tourism, which will contribute to increasing the attractiveness of this sector, both for small and medium-sized enterprises and for consumers. Therefore, when preparing maritime spatial development plans, every effort should be made to ensure sustainable growth of tourism in the Baltic Sea Region, making it a safe and secure place for future generations.

4.5. The fish and shellfish fishery industry

The fish and shellfish fishery is a sector engaged in the harvesting of living resources. The small-scale fleet uses vessels shorter than twelve meters, while the large-scale fleet includes vessels larger than twelve meters. Data are from the annual report on the EU fishing fleet published by the Scientific, Technical and Economic Committee for Fisheries (STECF 2017) for all countries except Russia. Due to the smaller number of vessels and/or companies in Germany and the Baltic States, data that were considered sensitive (for deep-sea fleets) were not provided to STECF. This has an impact on the analysis at regional level.

The number of active vessels in the Baltic Sea was estimated at 6,192 in 2015. (STECF 2017), and 6,500 in 2014 (STECF 2016a). The Finnish fleet was the largest (1,577 vessels). Of the EU Member States, the marine fisheries of Estonia, Finland and Latvia are fully dependent on the Baltic Sea region, while the vessels of the other EU Member States, including Denmark, Germany, Poland and Sweden, are also active in other marine fishing regions. Only vessels operating in the Baltic Sea are included in the statistics (Figures 3.4 and 3.5). The value of landings in the Baltic Sea region totalled €217 million in 2015, compared to €218 million in 2014. The Polish, Swedish and Finnish fleets had the highest total values of fish and shellfish landed by national fleets from Baltic Sea waters, while the Estonian and Lithuanian fleets had

the lowest total values. The value of landings is similar in magnitude to the value of estimated revenues.

Gross value added for the Baltic Sea area amounted to EUR 116 million in 2015 compared to EUR 95 million in 2014. The highest values were for Sweden and Poland, and the lowest for Lithuania and Germany. In terms of employment, the commercial fishing sector related to the waters of the Baltic Sea employs an estimated 9040 people. It should be noted that full-time equivalent employment is nearly half of this number (4704). Poland, Estonia and Finland have significantly higher numbers of people employed in their fleets operating in the Baltic Sea region compared to the other countries. Employment also occurs in related sectors such as fish and shellfish processing (see HELCOM 2018). The spatial distribution of fish catch in the Baltic Sea is illustrated in Figure 3.6 by the spatial distribution of commercial landings of cod, herring and sprat.

As at the end of 2020, the Polish fishing fleet comprised 823 vessels (4 fewer than in 2019), with a total gross tonnage (GT) of 32.4 thousand (0.2% higher than in 2019) and a power of 80.4 thousand kW (0.2% higher than the previous year). As in the previous year, the Polish fishing fleet at the end of 2020 included 2 trawlers and 124 cutters and 697 boats (4 units less than in 2019). For trawlers, the home port remained Gdynia. The majority of cutters (72.6%) were stationed in the Pomeranian Voivodeship, with the remainder in the West Pomeranian Voivodeship. In contrast, fishing boats were stationed in all coastal provinces: the Pomeranian (46.6% of the total number of Polish fishing boats), Western Pomeranian (43.6%) and Warmian-Masurian (9.8%).

In 2020, 130.0 thousand tons of fish (accounting for 67.9% of the total catch weight) were harvested from the Baltic fisheries, which was 10.9% less compared to 2019. The deep-sea fishery, which amounted to 61.5 thousand tonnes, was 25.8% higher than the year before. Apart from the Baltic Sea, Polish fishermen in 2020 conducted fishing activities only in the basins of the North and Central-Eastern Atlantic. The species structure of the catch, as in previous years, was dominated by sprat caught exclusively in Baltic fisheries. In 2020, 60.5 thousand tonnes of this fish were caught, which accounted for 31.6% of the total weight of organisms harvested. Among the organisms caught in the Baltic Sea and lagoons, in addition to marine fish, species typical for fresh and brackish waters were also obtained (freshwater and bi-environmental fish), whose total weight in 2020 amounted to 1.8 thousand tonnes.

In 2020, the Polish fishing fleet harvested 1.4 thousand tons of marine invertebrates (squid, crabs, shrimp). The catch of these organisms was conducted exclusively in deep-sea waters and accounted for 2.3% of the total catch from these fisheries. In comparison, in 2019, marine invertebrates (squid and shrimp) came exclusively from the Northeast Atlantic and accounted

for 1.7% of the weight of Polish catches from this basin. [Source: Maritime economy in Poland in 2020. GUS].

The fish processing industry in Poland, which employs 18,000 people, has the highest share in the revenue structure of the maritime economy. Its sales amounted to PLN 13.6 billion in 2018. We should also add wholesale and retail sales of fish, worth nearly PLN 2.4 billion. However, the industry faces a number of threats. The most long-term one is the shrinking of fish stocks. According to the Food and Agriculture Organization of the United Nations (FAO), as much as 30 percent of the world's fish resources are overfished, and 60 percent are caught "at the highest possible level. This situation also applies to declining fish catches in the Baltic Sea, which are covered by the EU's Common Fisheries Policy regimes, which assume its sustainable development.

The problem of providing raw material is partially solved by fish farming in sea farms (aquaculture), which, however, is more expensive. The Polish fish processing industry relies for more than 75 percent on sea fish imports (data from the Sea Fisheries Institute), mainly farmed salmon from Norway and herring and mackerel from Denmark and Germany.

Poland makes full use of the deep-sea fishing quotas allocated by the EU as a subject of multilateral negotiations, "by catching or exchanging quotas". We fish very little outside the Baltic Sea, as we have only two, deep-sea fishing vessels. In 2018, our own catches and quota exchanges exceeded a total of 49,000 tonnes, i.e. 1/5 of the total supply of fish for processing. Despite raw material constraints, the fish processing industry in Poland increased its sales revenue by six times between 2002 and 2018. This is a result of Poland's accession to the EU, the opening up of markets, as well as the ability to take advantage of sectoral operational programmes and opportunities to source raw material.

4.6. Interactions, interdependences, and synergies between Blue Economy sectors

Completing this report required an in-depth study of the scientific and research literature, as well as a review of the grey literature related to the development of the blue and green economy. Findings indicate that a strategic management perspective that supports the adoption of several management theories, such as stakeholder relationship management and marine spatial planning, allows for a better understanding of the phenomenon under study and fosters the development of green and sustainable strategies implemented by significant players in Blue Economy and related sectors.

Tables 7 and 8 shows the multitude of conflicts and synergies that can emerge between different businesses and activities included in the investigated BE sectors. The grey literature review represents a key insight source for the purpose of this study, providing a more industrial perspective and allowing the achievement of a more comprehensive and balanced view on the topic. This type of analysis also enables the research to benefit from more recent and updated data and information, increasing the timeliness of the final result.

The natural interdependences and relations between the Marine living resources sector, the Bioeconomy and the Marine renewable energy sector have been found. Then indicated the important links and connections between main actors player supporting the development of synergies among sectors and the development of collaborative strategies in the overall Blue Economy value network.

The intense network of interactions described here is a physiological feature of the Blue Economy: with coasts, seas and oceans as a focal point for their activities, different operators necessarily have to interact with each other, as they often conduct their activities in common areas or use common resources. The scale of interactions that can take place between sectors and significant actors is a reason for an in-depth studies. Most conflict profiles can be considered as opportunities that can be transformed into synergistic relationships. However, it is necessary to recognize each other's expectations and needs and then find a consensus that allows for conflict-free cooperation. It is expected that a maritime spatial plan can be a tool that helps to identify potential sources of conflict and, through the negotiating competence of interdisciplinary teams, to transform them into sources of synergy.

The use of different areas of the Blue Economy can lead to clear synergies that further enhance the positive effects of such activities. The most important of these are shown in Table 7. These primarily include integration in specific services, use of the same facilities for different activities, linking of tourism and aquaculture activities, and use of existing infrastructure to meet the needs of different stakeholders.

As shown earlier, there are many synergies in activities concerning areas within the Blue Economy. On the other hand, it should be taken into account that in the Blue Economy sector, in case of some activities, there may also be conflicts related to the existing competition, risk of decreasing attractiveness for tourists of the areas where the wind farms are located, overlapping of locations or negative visual effects. In addition - even activities that favour Blue Economy solutions on the one hand, may be dangerous for another part of the sector - such as the threat to fish from pipelines and cables. It is also characteristic that of the 60 identified negative relationships between blue economy sectors, at least 20 of them are location overlaps

or collision risks. This points to the need to improve staff skills and the quality of marine spatial plans.

The knowledge of existing interactions between various branches of the Blue Economy, both positive and negative, is particularly useful during the preparation of maritime spatial plans. Already at the stage of the plan it is possible to programme the development of future relations between the stakeholders carrying out their operational activities in the same area, as well as to search for ways of preventing possible conflicts in the future.

Recognising the synergies that exist between the many branches of the Blue Economy encourages the building of interdisciplinary teams to creatively explore new areas of collaboration. In this way, many new professions can be created, increasing employment opportunities and enhancing the attractiveness of careers that can be pursued in the Blue Economy. The opportunity to establish international contacts in the South Baltic region and to link one's career to it can be particularly important for the younger generation.

Table 7. Potential synergies between Blue Economy sectors

Specification	Offshore wind energy and marine renewables	Shipping and ports	Coastal and Maritime Tourism	Oil and gas	Pipelines and cables	Fishing	Marine aquaculture	Marine aggregates and marine mining	Conservation
Offshore wind energy and marine renewables	Potential integration of marine turbines with other marine renewable facilities	OWFs depend on nearby ports with the capacity to provide logistic services (es construction/ maintenance)	Recreational activities can be done near OWFs as they could take advantage from the exclusion of other activities in the area such as fishing or shipping	Potential use of the same facility for both OWE and oil/gas extraction	Potential integration of OWFs with marine grid systems	Increase of fish stocks near OWFs	OWFs can be co-used as an aquaculture location	X	OFWs may create artificial reefs and increase biodiversity in the area Conflicts: Potential negative impact on wildlife
Shipping and Ports	X	X	Ports generate touristic traffic	X	X	X	Operators can benefit from the presence of nearby ports	X	X
Coastal and Maritime Tourism	Facilities can be excursion sites	Shipping transport increase wealth economic development	X	Coexistence with local sectors	X	Fishing can represent a form of tourism	X	Tourism opportunity	X
Oil and Gas	Potential co-location of extraction facilities and marine renewable energy facilities, synergies in terms of supply chain and R&D	Synergies occur in supply and transfer of oil and gas in port structures	X	X	Oil and Gas sector generates the main demand for pipeline construction	X	Potential co-location of extraction facilities and aquaculture sites	X	Potential creation of ideal habitats for different marine species
Pipelines and cables	Development of wind farms and integrated offshore grids	X	X	X	X	X	X	X	X
Fishing	Creation of artificial reef may increase biodiversity	X	Fishing can be a touristic attraction	X	X	X	Co-employment of resources and know how	X	X
Marine aquaculture	Co-location of OWFs and aquaculture sites	X	Potential aquaculture-related touristic activities	X	X	Potential cooperation by sharing knowledge and resources	Cooperation between different aquaculture activities	X	Opportunity to create sustainable aquaculture activities
Marine aggregates and marine mining	X	X	X	X	X	X	X	X	X
Tidal and wave	Synergies in research and development activities, supply chain sharing and grid connections.	X	Potential increase in visitors at project locations	Potential common use of infrastructure and supply chain	Dependence of ocean energy from the submarine cables sector	X	Potential of co-location	X	X

Source: Own elaboration following: Vottero B., Tropea C., Satta G. (2021); X – no interaction found; OWFs – Offshore Wind Farms.

Table 8. Potential conflicts between Blue Economy sectors

Specification	Offshore wind energy and marine renewables	Shipping and ports	Coastal and Maritime Tourism	Oil and gas	Pipelines and cables	Fishing	Marine aquaculture	Marine aggregates and marine mining	Conservation
Offshore wind energy and marine renewables	Competition for the installation of facilities in the same area	Proximity with shipping routes increases risk of collisions	OWFs can change the coastal landscape and discourage tourism in the area	X	Competition for the installation of facilities in the same area	Risk of collision with the turbines and risk of damage to the facility due to the usage of fishing gear	Aquaculture equipment hinder maintenance operations	The installation of OWFs in sea areas licensed for marine aggregate extraction is not allowed.	Potential negative impact on wildlife
Shipping and ports	Risk of detours, collisions. Offshore Wind Facilities can interfere with radar technologies and determine risks of collision with boats	X	Safety issues related to marine traffic	Risk of damage to pipelines due to anchors or collisions	Risk of damage to pipelines due to anchors or collisions	X	Risk of detours, collisions	X	Potential negative impact on wildlife, air quality and sea pollution
Coastal and Maritime Tourism	Negative visual impact	Location overlapping	X	Visual impact and environmental issues	Negative impact on marine cultural heritage	Location overlapping	Negative impact on nearby ecosystems and water quality, potential negative visual impact	X	Mass tourism can harm local ecosystems Synergy: eco-tourism
Oil and Gas	Location overlapping	Shipping prohibition near the extraction facility	X	X	X	Displacement of fishing operations during extraction activities	Location overlapping	X	Negative impact in marine wildlife, risk of oil leakage
Pipelines and cables	Location overlapping	Potential restriction of shipping in specific areas	Temporary beach closure during installation activities	X	X	Risk of fish entanglements	X	Location overlapping	Risk of fish entanglements and negative implications in terms of noise, and disturbance of marine life
Fishing	Potential negative impact on fish species	Overlaps between shipping routes and fishing areas, risk of oil and wastewater spills	X	Risk of oil leakage and its con sequences on fish stocks, exploration and drilling activities may disturb fish populations	Anchoring and trawling is forbidden in specific areas where pipelines and cables are not submerged	X	Pollution from aquaculture sites can alternate marine ecosystems	Alteration of the sedimental characteristics of the seabed	Invasive fishing techniques can harm non-target fish species, mammals, seabirds and juvenile fish specimens

Table Continued...

Specification	Offshore wind energy and marine renewables	Shipping and ports	Coastal and Maritime Tourism	Oil and gas	Pipelines and cables	Fishing	Marine aquaculture	Marine aggregates and marine mining	Conservation
Marine aquaculture	X	Obstacle to navigation, leakage of oil or wastewater can impact on aquaculture	Negative visual impact, decrease in seawater quality impacting indirectly on tourism	Risk of oil leakage and consequences on environment and health, indirectly affecting tourism	Potential release of contaminants during the installation procedures can damage aquaculture activities	Introduction of diseases from fish stocks, risk of degrading of water quality and harness wild species	X	Seabed dredging activities can release hazardous contaminants, thus affection	Potential restrictions on farmed species
Marine aggregates and marine mining	X	Location overlapping and risk of collision	Sand extraction activities can determine a negative impact on beach quality	Location overlapping	Location overlapping	Dredging activities can impact of fish and mollusc populations Synergies: dredging activities can attract fish species	X	X	Dredging activities can harm marine archaeological sites and damage ecosystems. Synergies: dredging activities moves the sand, setting nutrients free and increasing biodiversity.
Tidal and wave	Location overlapping	Location overlapping	Visual impact	Location overlapping	X	Potential displacement of fishing activities from areas of project development and during the installation phase	Location overlapping	X	Potential negative impact on wildlife

Source: Own elaboration following: Vottero B., Tropea C., Satta G. (2021); X – no interaction found; OWFs – Offshore Wind Farms.

Conclusion

The Blue Economy is the concept by which the European Union addresses the use of its seas and coasts for economic activity and Blue Growth is the European Union's long-term strategy for expanding these activities in a planned, integrated way. The Blue Economy in the EU provides around 5.4 million jobs and generates gross value added of almost €500 billion per year.

The characteristics of the selected areas of the Blue Economy for the five Baltic States presented in the study indicate, on the one hand, the high potential and, on the other hand, the highly differentiated nature of the development of these areas by individual countries. This has an impact on the size and structure of employment and consequently on the size of the added value in the Blue and Green Economy developed in the South Baltic Region.

The areas of Blue Economy activity of individual countries can be characterised as follows:

- Marine renewable energies: Denmark, Germany - very intensive development phase;
- Marine living resources: Germany, Poland, Denmark - growing trend;
- Port activities: Germany, Poland - growing trend;
- Shipbuilding: Germany, Poland - stagnation and specialisation stage;
- Maritime Transport: Germany, Denmark, Sweden - high maturity, clearly dominated by Germany;
- Maritime and coastal tourism: Germany, Sweden, Denmark, Poland - growing trend, except for Sweden;
- Aquaculture: Denmark - growing trend, domination among analysed countries.

The largest employment growth in the Blue Economy was recorded in Germany, Denmark and Poland, with Denmark having the largest share of Blue Economy employees in relation to total employment in the country's economy. Dynamic job growth is expected between 2022 and 2030, mainly driven by offshore renewable energy and tourism.

Highly skilled workers and professionals are needed in this sector of the Blue and Green Economy, yet most areas of the economy expect to find it difficult to recruit them. There is therefore an urgent need to identify market needs and then to tailor and develop appropriate education and research programmes in schools and universities.

The Blue Economy should be treated as a system in which individual areas of human activity constitute its subsystems. Logic, but also experience already gathered, indicates the occurrence of interdependencies between these subsystems, generating possible synergies and conflicts. Such interdependencies appear, for example, between living marine resources (aquaculture sector), marine renewable energy (energy production from offshore platforms) and bioeconomy (micro and macroalgae for pharmaceutical and cosmetic applications. Such interdependencies should be the subject of detailed analyses for all subsystems of the Blue Economy.

Offshore wind energy will be the most important area of the blue economy from the point of view of Polish economic interests. The largest capital groups are conducting preparatory work for multi-billion investments, which will bring the following results:

- Increase in employment in the energy sector;
- Increase in added value;
- Stimulation of the necessary north-south onshore grid investments;
- Increase in the share of renewable energy in the energy mix of the country;
- Acquisition of new professional and investment competences;
- Cooperation with countries with advanced offshore wind energy;
- Creating conditions for research on marine biology by building research platforms for scientists, as e.g. realized in Germany (Alpha Ventus).

Cooperation with manufacturers of wind turbines may lead to the activation of ports where the production of components will be located. It should be added that Denmark obtains almost 50% of its energy from offshore installations and German companies (Siemens) have innovative solutions in this field.

Development of offshore wind energy in the South Baltic region requires coordination of legislative, social, educational and business activities. Maritime spatial planning should be an important factor integrating and securing needs of as many stakeholders as possible and respecting sustainable development principles. In this respect it is necessary to have a wide range of experts continuously improving their competences.

It is important to emphasise the contribution of the huge universities from the countries participating in the Seaplanspace project, in particular the University of Gdansk and other universities in the Pomeranian region, to the development of the Blue and Green Economy. The universities prepare and implement appropriate educational profiles for the needs of the maritime economy at all levels of study. At the same time, university authorities and academics are actively involved in organisations and projects for sustainable development and the blue economy, such as The Baltic Sea Region University Network, ScanBalt and others.

The challenge, also for universities, is to close identified and important gaps related to the desired education for the needs of the blue economy, concerning:

- the mismatch between educational provision and the needs of the labour market, particularly with regard to technological development and innovation
- challenges in communication and developing cooperation between education and industry
- lack of knowledge about the attractiveness of careers in the blue economy.

On the basis of the research that has been carried out, the data that has been collected and the analyses that have been carried out, the importance and role of the blue and green economy in economic development and in safeguarding the sustainability of the high quality marine environment for future generations can be unequivocally confirmed. This issue seems to be so important that the possibility of building the Blue Education System of Baltic Regions should be considered. Institutional stakeholders, public funders and the necessary resources from the EU structural and cohesion funds should be mobilised for this project. It is conceivable that the education programme, in the forms agreed upon in the South Baltic Region, could be implemented cyclically by selected institutions in each of the five Baltic Sea states. This seems to be necessary for the purpose of fostering innovation, educating Blue Growth cadres as well as improving the maritime spatial plan.

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