



Linking maritime education with the changing job market for a new generation of Baltic Sea experts

FORESIGHT OF THE SOUTH BALTIC MARITIME LABOUR MARKET 2017



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UNIVERSITY OF ROSTOCK, GERMANY

UNIVERSITY OF SZCZECIN, POLAND

GDYNIA UNIVERSITY OF BUSINESS AND ADMINISTRATION, POLAND

POLISH CHAMBER OF MARITIME COMMERCE, POLAND

GDANSK UNIVERSITY OF TECHNOLOGY, POLAND

KLAIPEDA UNIVERSITY, LITHUANIA

KLAIPEDA SCIENCE AND TECHNOLOGY PARK, LITHUANIA

LINNAEUS UNIVERSITY OF KALMAR, SWEDEN

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1. INTRODUCTION

Authors: Gerhard Graf, Frank C. Hansen, University of Rostock, Germany

The Baltic Sea Region is an area that is intensively used, not only for shipping and related services but for many other activities such as the exploitation of natural and energy resources or recreation. The maritime sector is an important driver of the present and future economy and is of great significance for employment in coastal regions (“Blue Growth concept”). But despite the meaningful opportunities, this region also has to cope with severe challenges. The increasing utilisation of this ecologically vulnerable region requires common regulations and management for sea and land based activities. Further challenges result from the globalisation of markets and the consequences of global warming, for example for coastal protection or for the utilisation of renewable energy sources. In parallel to these challenges, innovative technologies are rapidly evolving and new maritime related fields are emerging (e.g. blue biotechnology). These factors result in a rapidly changing maritime sector, which in turn has consequences for the labour market and its educational requirements.

Based on the perception that despite the need for highly qualified personnel, many graduates face unemployment or work in non-maritime related jobs after their studies, the Generation BALT project aims to improve higher education in the South Baltic Region (SBR) to better match the supply and demand of the labour force in the maritime sector. Experts have confirmed our view that present educational programmes are often too narrowly specialised and miss the interdisciplinary approach needed to solve complex tasks. Moreover, educational programmes preparing for jobs in the changing maritime sector should be future-oriented. Generation BALT will give recommendations for improvement of these educational programmes and develop and run a pilot supplementary study programme based on the results of the present study.

This Foresight Study identifies promising segments of the maritime sector with respect to future development prospects and labour force needs and desired skills based on expert opinions (Chapter 3). It also provides analyses of the labour markets including political framework conditions (Chapter 4) and of the educational offers and identified gaps in maritime related studies (Chapter 5). Results are presented for the SBR region as a whole and for the single regions compared. The countries of the SBR have their own histories, varying levels of development and they face different labour market conditions. Comparison of the region specific analyses results provides answers to the following questions: What are

the similarities and differences between the regions? What are their strengths and weaknesses? Can we find best practice examples? At present maritime related education in the SBR is fragmented. This study can help students to find specific courses in the maritime sector to better target their careers.

At the end of this Foresight Study we present conclusions and provide specific recommendations for different target groups (Chapter 6). The results of this study have been used for planning the Generation BALT Maritime Sector Training Programme and will serve as the basis for further activities to harmonise and optimise higher education in maritime-related fields and increase job opportunities in the SBR.

This study was part-financed by the European Union (European Regional Development Fund) within the measure “Integration of Higher Education and Labour Markets” of the South Baltic Programme 2007 – 2013.

2. MATERIALS AND METHODS

Author: Kamila Mianowicz, University of Szczecin, Poland

This Foresight Study contains analysis and forecasting for the South Baltic Region (SBR) maritime sector and covers the following:

- Professionals' evaluations regarding prospected segments of the maritime economy on the basis of a questionnaire - Chapter 3
- A diagnosis of the employment structure, present economic situation, trends in the maritime sector and prognosis regarding the segments' potential for development - Chapter 4
- Present maritime educational offers at higher education institutes and a diagnosis of missing fields of education - Chapter 5
- Recommendations for better linking maritime education with the labour market - Chapter 6

The study is based on reports and working papers containing data on the maritime sector in six regions of South Baltic: Sweden, Mecklenburg-Vorpommern (Germany), West Pomerania and Pomerania in Poland, Lithuania and the Kaliningrad Region (Russian) (Tab. 1, Fig. 1). Regional reports were prepared on the basis of data from local statistical offices and databases and information delivered by educational and employment offices. All the data were verified and elaborated. Reports, project information, press releases and conference talks were used as well, and a full lists of references can be found at the end of every regional report. Additional external sources of information are given in brackets and listed in the references.

Table 1. Regional reports about the maritime sector in regions of the SBR

GENERATION BALT WORKING PAPERS	
South Baltic Region	MICKEVICIENE R., <i>EU policy on higher education and maritime labour market.</i> POLISH CHAMBER OF MARITIME COMMERCE, <i>Maritime and Inland Waterborne Economy. Sectors: Classifications, Value Added, Structures.</i>
Sweden	BRESSLER I., LEGRAND C., <i>Foresight. Marine/Maritime segment: general situation, labour market, educational offer, policies and strategies.</i>
Mecklenburg-Vorpommern	GÖRS M., HANSEN F.C., <i>Foresight study. Germany - Mecklenburg-Western Pomerania.</i>
West Pomerania	MIANOWICZ K., STRZELECKA A., <i>The labour market of the maritime sector in West Pomeranian Voivodeship.</i> BRZOZOWSKA K., KIERZEK A., DANISZEWSKA G., <i>Higher education in Poland.</i>
Pomerania	DWOJACKI P., RUSZCZYK-CZAJOR L., SZYMAŃSKI M., <i>Maritime segments and labour market - Pomeranian region.</i> GÓRSKI Z., KOZAK J., <i>Pomeranian Voivodeship – Poland. Higher Education Offer.</i>
Lithuania	MICKEVICIENE R., PAULASKIENE T., PAULAVIČIENĖ S., BAUŽYTĖ R., <i>Foresight study: analysis of framework conditions, maritime labour market and education offer in the Republic of Lithuania.</i>
Kaliningrad Region	<i>Results of the analysis of training in the most promising directions of development of the maritime industry and compliance with their level of skill requirements in the future (taking into account the dynamic development of relevant industries) in the Kaliningrad region.</i>

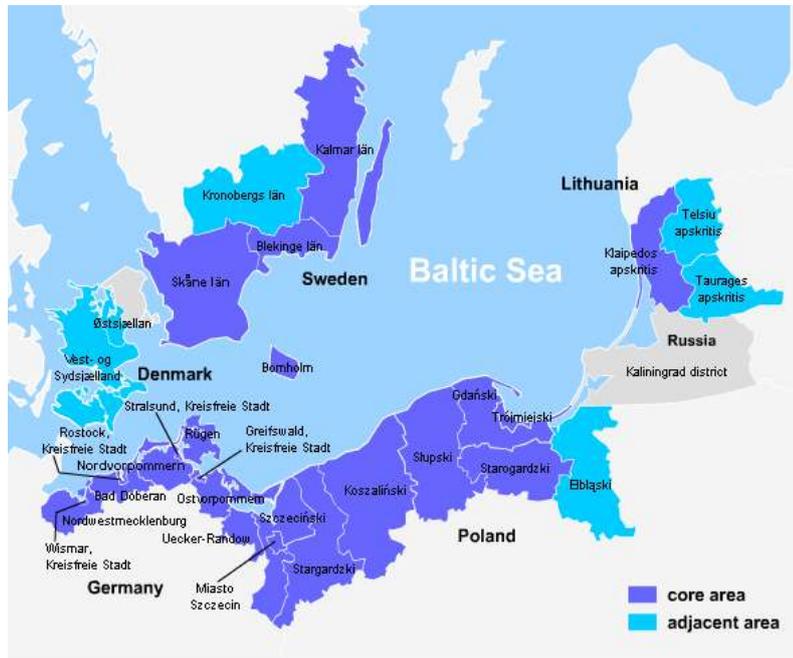


Figure 1. Map of the South Baltic Region. Source: [1].

The segments of the maritime sector covered in this Foresight Study were defined and selected based on the classification of the EU Directorate General for Maritime Affairs and Fisheries. Framework conditions such as educational policies, maritime economy policies, concepts and studies were taken into consideration.

Chapter 3 is based on a questionnaire analysis. A statistical analysis of obtained results was conducted using measures of position (median, quartiles) and the coefficients of correlation rank (Kendall's τ). The segments taken into consideration were grouped, classified and ranked. Quantitative analysis was supplemented by qualitative data review.

Chapter 4 is a compilation of regional reports describing the situation of the maritime sector. Quantitative and qualitative data were analysed, supplemented and synthesised. A comparison of regions was performed for six groups of maritime activities: manufacturing, transport, resources, service and other operations, leisure and tourism, and research and development. The results served then as a basis for making prognoses of maritime sector development.

Chapter 5 contains the summarised results of the regional reports on maritime educational offers. A comparison of the courses available in particular regions of the SBR allowed the identification of missing fields of study. Results of the educational offer analysis

were the starting point for preparation of the comprehensive training programme of the Generation BALT Project (including the Maritime Sector Training Programme).

Chapter 6 summarises and synthesises results of the Foresight Study and formulates recommendations for maritime higher education, political decision makers and employers operating within the maritime sector. Recommendations were made in order to link maritime education with the changing job market for a new generation of Baltic Sea experts.

References:

[1] South Baltic Programme,
<http://en.southbaltic.eu/index/?id=f90f2aca5c640289d0a29417bcb63a37>

3. QUESTIONNAIRE ANALYSIS

Author: Marek Szymański, University of Business and Administration, Gdynia, Poland

Professionals and experts working in different segments of the maritime sector in all regions of the South Baltic gave their opinion on the prospects of maritime segments future development. Based on the results of the questionnaire we can conclude that a significant development of offshore industries can be expected. The offshore wind energy segment received the highest evaluation as a potential employer.

3.1. Introduction

Collective expertise offers the advantage of reflecting general trends and tendencies and showing the attitude of specialists toward specific problems. When asking the question "What segments of the maritime sector are the most promising?" to a representative group of maritime experts, an intuitive picture of the future economic situation can be glimpsed. A combination of this picture with other sources of hard information (e.g. statistical data) can provide a solid basis for making prognoses about the sector's development in the next several years.

Professionals and experts working in different segments of the maritime sector in all regions of the South Baltic answered the following questions:

1. Which maritime segments are most promising / will develop / emerge within the next five years?
2. Which maritime segments will create the highest demand for skilled experts within the next five years?

Survey participants were asked to refer to 17 segments listed according to the guidelines of the EU Directorate General for Maritime Affairs and Fisheries:

- Watercraft industry (shipbuilding and repair)
- Marine equipment
- Offshore supply
- Offshore wind energy
- Exploration and exploitation of the seabed
- Hydro engineering
- Coastal protection and construction
- Fisheries and aquaculture
- Seaports and logistics

- Maritime services
- Recreational boating
- Coastal tourism
- Maritime area management and administration
- Adjustment of law concerning maritime areas
- Innovative maritime industries

The respondents judged the probability of development as well as the potential demand for qualified specialists in the maritime economy segments on an ordinal scale covering four degrees: “not promising”, “slightly promising”, “promising” and “very promising”. The scale restricts the available operations and the size of obtained results to measure position (median, quartiles) and coefficients of correlation rank (e.g. Kendall’s τ). The other commonly used measures (mean, standard deviation, Pearson’s correlation coefficient) may not be applied to the variables measured at the ordinal scale. To overcome this limitation, we transformed the ordinal scale data into numerical data, following the “interval interpretation” of ordinal scale data and calculated variables from that, which we called quasi-variables. The names are preceded by the prefix quasi- (e.g. quasi-mean).

Calculation of the value of quasi-variables was made by replacing the phrase with the ordinal scale of consecutive numbers from 0 to 3, where 0 corresponds to the assessment of “not promising” and 3 to that of “very promising”. This operation re-arranged the primal ordinal scale data into interval values, on which statistics were performed.

The similarity of objects evaluated in the maritime industries was calculated using Kendall's rank correlation coefficient. Kendall's τ was used to identify similarities between segments. Some segments can be considered as different with regard to their prospects or demand for skilled experts, but they can be similar with regard to offering complementary goods and services. A high correlation coefficient can indicate such relations.

261 persons from the countries of the Baltic Sea basin participated in the survey (although not all responded to all questions). The development capacity of segments of the maritime economy in the Baltic Sea basin as well as the expected demand for skilled professionals in the next five years were rated by a partial number of respondents (119-189). No evaluation was displayed in cases of omission of relevant sections of the questionnaire or selection of the option "no opinion".

3.2. Overall assessment of maritime economy segments

The offshore wind energy segment received by far the highest evaluation for future development. Only 12% of the surveyed do not believe in the possibility of development for

this sector (collective response of “not promising” and “slightly promising”). More than 50% of respondents rated this sector as “very promising”. The offshore wind energy segment reflects as a rarity among the listed segments in the survey – no other segment obtained as many positive assessments concerning its likely prospects for development. Only three of the segments were rated as “very promising” by more than 30% of the respondents.

None of the segments received more low marks (“not promising” and “slightly promising”) than higher ones (“promising” and “very promising”). Even the lowest evaluated segment - the watercraft industry - received more positive assessments (55% of respondents) than negative ones concerning its potential for development.

The offshore wind energy segment had the highest value of quasi-average ratings (2,37) concerning its prospects for development. The lowest quasi-average value corresponded to the watercraft industry (1,6); slightly better (1,66) were the assessments for two judicial-legal segments: maritime area management and administration and the adjustment of law concerning maritime areas.

Fig. 2 presents the distribution of assessments for individual segments (lower axis) and their quasi-average (upper axis). Rated segments are organised in ascending order according to the value of the quasi-average.

The offshore wind energy segment also received the highest evaluation as a potential employer. More than 50% of respondents assessed the potential need for qualified specialists within this segment as very high. The quasi-mean score of demand for work in the wind energy sector exceeded 2.0.

Projections for workforce demand in the wind energy segment in comparison with similar projections for the remaining segments highlight its uniqueness. As with assessments of development potential, only three of the segments (including offshore wind energy) received the highest assessment (i.e. “high demand”) from more than 30% of respondents. It can be easily seen that these are exactly the same segments that were also evaluated highly in terms of prospects for development: seaports and logistics, offshore supply and exploration and exploitation of the seabed.

The lowest assessments concerning the demand for highly skilled professionals were attributed to judicial-legal segments such as ‘maritime area management and administration’, ‘adjustment of law concerning maritime areas’ as well as fisheries and aquaculture. In the case of the first two, the ranking is the effect of a low assessment of possibilities for development, and the third segment – although its development potential did not receive high evaluations either – could additionally be seen as one not requiring a high level of skills.

Fig. 3 presents the distribution of assessments for individual segments concerning the future demand for qualified specialists (lower axis) and quasi-average ratings (upper axis). Rated segments are organised in ascending order according to the value of the quasi-mean.

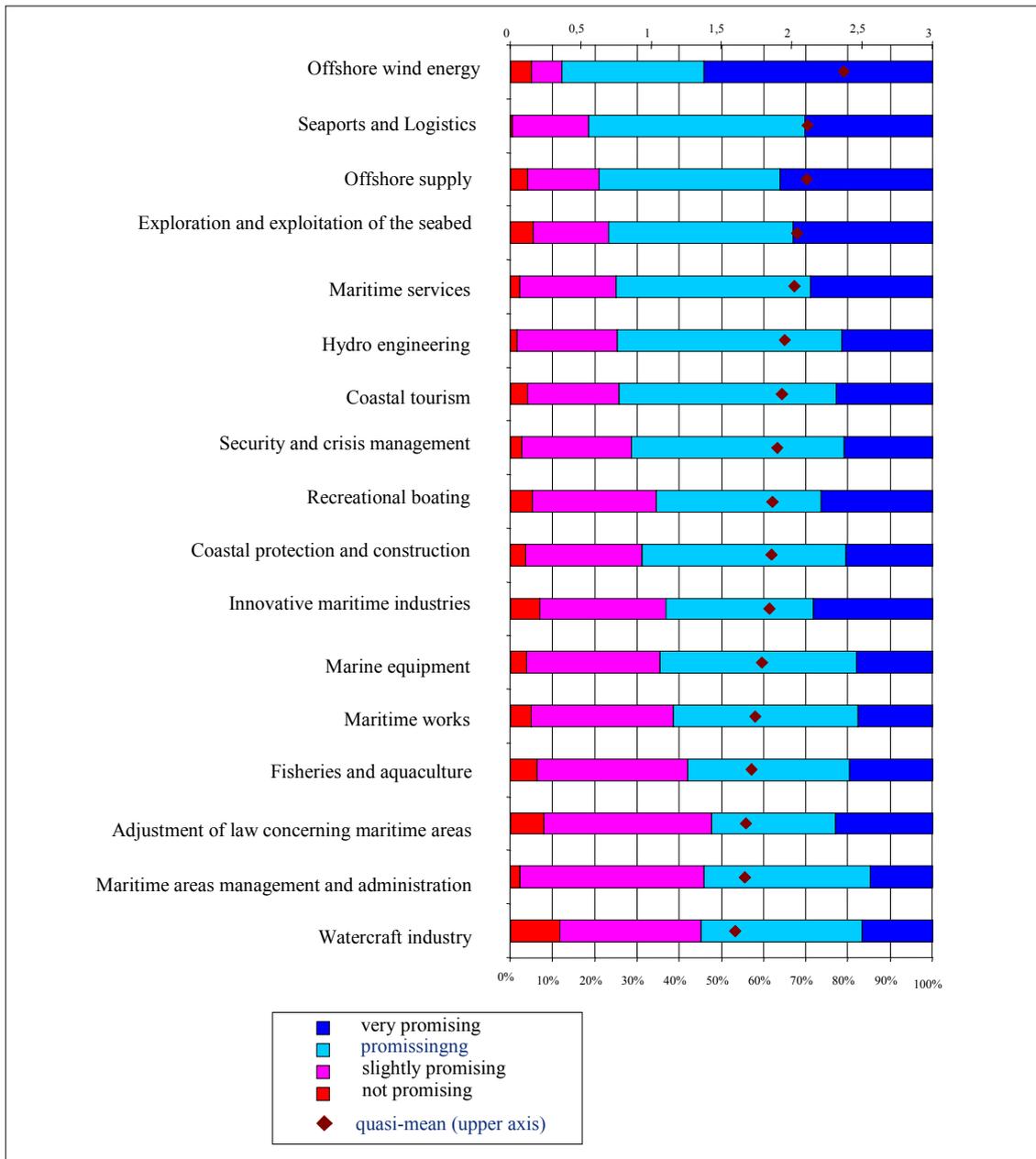


Figure 2. Distribution of survey participant evaluations and quasi-mean ratings for future development of different maritime segments

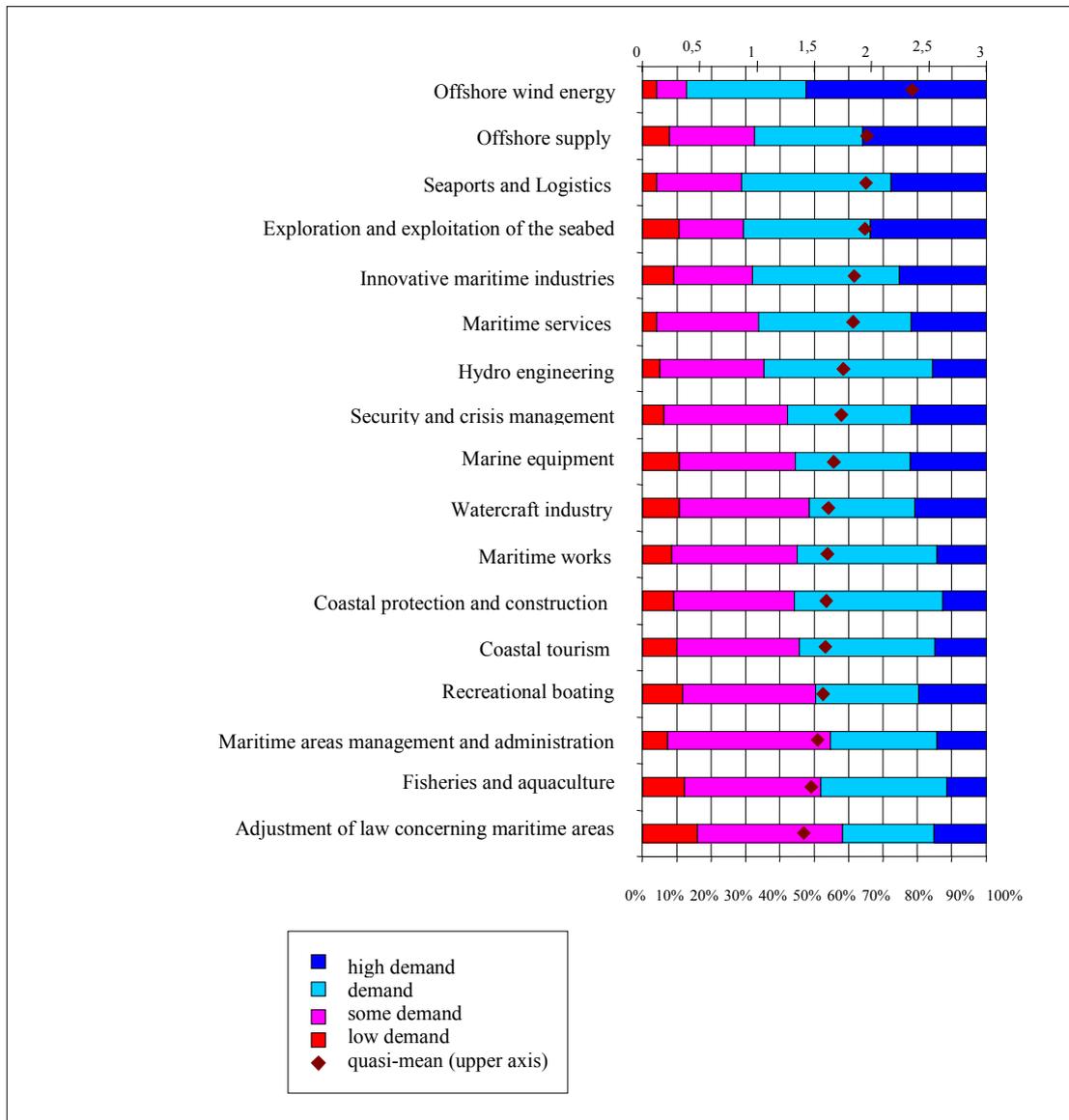


Figure 3. Distribution of survey participant evaluations and quasi-mean ratings for demand for qualified workers in different maritime segments

3.3. Relationships between maritime economy segments

Some correlations may be found in the assessments given by the respondents and their strength may indicate the existence of synergies between certain segments. This would indicate that the development of some segments may be conditional upon the development of others. Hence, these relationships may influence the assessment of attractiveness of each segment. In particular, if an originally unattractive and non-developing segment shows

strong ties to another, it is likely to become much more attractive and the possibilities of development much higher.

Fig. 4 presents the groups of segments with the largest (over 0,6) correlation values between evaluations of development potential in the views of the respondents. The strength of the relationship between segments is symbolised by lines of different thickness. Five groups of segments can be extracted with similar characteristics concerning development potential; they are presented below.



Figure 4. Correlations between maritime industry segments (line thickness indicates strength of correlation).

1. Traditional maritime affairs. This group comprises five parts: seaports and logistics, maritime services, marine equipment, maritime works and watercraft industry. Among these segments, the first two are characterised by highly similar respondent assessments (Kendall rank correlation coefficient of 0,952) and high evaluations for both the prospect for development and the demand for qualified specialists. The other three segments are less well connected to each other and to the abovementioned pair and have much lower evaluations for both development potential and demand for specialists. Nevertheless, the group may be considered attractive due to the size and potential for development of the first two segments.
2. Administration and management. The group consists of three segments: adjustment of law concerning maritime areas, maritime area management and administration, and security and crisis management. The relationships between evaluations given for the potential development of these segments are clear: the strongest can be seen between the first two (with Kendall's τ at 0,79). However, neither the assessment of development potential nor the assessment of demand for qualified specialists is particularly high for any of the sectors in this group. For both of these assessments, the best quasi-averages are for the security and crisis management segment (1.89 and 1.73 respectively), though these values cannot be considered high. As a result, the group can be considered to be composed of unattractive sectors, without clear standouts.
3. Exploitation of marine resources (not fisheries). This group consists of three segments: offshore supply, offshore wind energy and exploration and exploitation of the seabed. The central segment in this group is the latter; its assessment is correlated to the assessments that the other two received for development potential. The relationship between the offshore supply segment and the exploration and exploitation of the seabed segment is complementary while the relationship between the offshore wind energy segment and the exploration and exploitation of the seabed segment seems to be unrelated. All three segments making up this group obtained high ratings concerning both their development potential and future demand for qualified specialists (according to quasi-averages they rank among the top four for both categories).
4. Coastal management. This group consists of two segments: hydro engineering and coastal protection and construction. The Kendall ratio for the correlation of assessments for both segments is almost 0,75. For both segments, neither the assessment for development potential nor that concerning the demand for qualified professionals is especially high (quasi-means of 1,85 - 1,95 for development potential

and 1,6 - 1,75 for specialist demand), which leads to qualification of this group as average.

5. Tourism and recreation. This group consists of two segments: recreational boating and coastal tourism. The correlation between their assessments reaches 0,9. The group does not seem especially attractive, with both segments receiving similar and rather low marks (quasi-means of 1,86 and 1,2 in the development prospects category and 1.57 and 1.59 in the demand for a specialist workforce category).

3.4. Regional comparison between maritime economy segments

The differences in assessments of the maritime economy segments between the Baltic Sea countries are reflective of the varying role of the Baltic Sea in these countries' economies. The highest assessments were granted by respondents from Sweden (quasi-mean of 2,15 for development prospects and 2,16 for specialist demand) while Russians gave the lowest ones (1,69 and 1,32 respectively). This, however, does not mean that all segments were given lower assessments by Russian respondents. Expectations regarding the economic use of the Baltic Sea differ between countries. While offshore wind energy received high marks from most countries, Russians granted it quite low scores. On the other hand Russians have high expectations for the development of hydro engineering, more than any other national group.

Regional differences – ranking of maritime segments

The assessments given to particular segments point to certain links between them, which gives hope that the development of one will affect the growth of the other. A group of three segments – offshore wind energy, offshore supply and exploration and exploitation of the seabed – can be considered an especially attractive and promising group. These mutually related segments were highly evaluated by the respondents in both questionnaire categories.

Regional specificity analysis highlights other segments or groups of them, which may also be locally interesting, e.g.: tourism in Poland or the fishing industry in Russia. Tab. 2 presents the ranks for maritime segments according to countries for both development prospects and specialist demand scales¹. Especially attractive segments (first six positions in **both scales simultaneously**) are highlighted.

¹ The lower the number, the higher the quasi-mean. The same numbers in a national rankings indicate the same quasi-means.

Table 2. Position of identified segments in national rankings by quasi-mean

Segment	Position in rankings									
	Sweden		Germany		Poland		Lithuania		Russia	
	Development prospects	Specialist demand								
Watercraft industry	14	8	17	16	15	12	5	2	13	13
Marine equipment	8	8	8	8	13	13	7	5	14	17
Maritime works	16	8	11	10	14	11	5	10	14	5
Offshore supply	12	2	1	2	6	7	12	15	11	13
Offshore wind energy	2	4	2	1	1	1	2	4	10	3
Exploration and exploitation of the seabed	13	3	3	3	3	4	15	14	3	9
Hydro engineering	11	8	13	6	5	5	9	11	2	9
Coastal protection and construction	5	7	10	13	7	9	13	12	7	5
Fisheries and aquaculture	4	14	16	17	16	16	14	13	1	1
Seaports and logistics	3	6	7	7	8	10	3	3	3	4
Maritime services	14	5	4	5	10	8	1	6	11	7
Recreational boating	8	15	12	14	2	2	16	16	17	15
Coastal tourism	7	16	5	12	4	3	17	17	16	16
Maritime area management and administration	16	8	14	11	11	15	10	7	9	8
Adjustment of law concerning maritime areas	1	1	15	14	12	17	11	9	3	11
Innovative maritime industries	8	17	6	4	17	14	4	1	6	2
Security and crisis management	13	8	9	9	9	6	8	8	8	11

While other segments (not as attractive as those highlighted) are relatively poorly evaluated, the assessment of any particular segment is higher than the middle point of the scale used in the test. Fig. 5-10 present differences between respondents from individual countries and how they assess maritime segments. All 17 segments were divided into three groups by decreasing overall quasi-mean for development prospects. The variables for development prospects and demand for skilled workers are presented in separate figures.

Baltic offshore industries

Quantitative data. Research on the future prospects for development of various maritime economy segments and their potential demand for qualified specialists delivered some interesting insights. The assessments given to particular segments point to links between some of the segments, which gives hope that the development of one will affect the growth of the other. One group, consisting of three segments, appears as especially attractive: offshore wind energy, offshore supply and exploration, and exploitation of the seabed. These mutually related segments were all highly evaluated by respondents in both questionnaire categories.

Qualitative data. Most of respondents indicated engineering as a leading area of qualifications needed in the future. ‘Traditional’ watercraft industry qualifications prove to be useful not only for shipyards diversifying their activities, but also for the development of offshore industries and some other segments. Based on the results of the questionnaire we can conclude that a significant development of offshore industries can be expected. Foremost, offshore wind energy and offshore supplies are expected to generate demand for skilled staff.

Environmental impacts

Environmental issues are not defined as particular to any individual segment. Rather, they should be considered as framework components to be taken into account within business decision-making processes.

It should be noted that environmental issues appeared when discussing various segments: watercraft industry, offshore supply, offshore wind energy, exploration and exploitation of the seabed, hydro engineering, fisheries and aquaculture, tourism, maritime area management and administration. Environmental engineering was suggested for classification as a separate segment.

Multi-skilled and open minded

Some of the participants’ general comments allow us to begin shaping a picture of the graduate profile: ‘Marine education will be re-oriented’, as one of respondents commented. In the future, the workforce is expected to possess attributes such as *entrepreneurship and innovative skills* and competences to *assimilate information and transform it into knowledge and innovation*. Furthermore, a crucial expectation was formulated: *advanced education in different areas, in parallel with practice*.

Postulates such as these correspond well with the general requirements contained in European and regional strategies and which refer to a knowledge-based economy, unique know-how and high value added within business as well as non-business activities. Maritime education in the South Baltic Region is no exception to these general trends.

Innovative maritime industries or innovation within existing industries?

The research did not reveal any creative ideas for radical innovations (i.e. brand-new segments and/or skills and qualifications). It is possible that this is the result of a lack of extremely visionary participants in the survey!

However, innovative concepts such as e-engineering are indeed taking place in the context of design and construction, competitive and resource efficient transport systems, environmental engineering, smart grids associated with wind energy farms, shale gas exploration and LNG logistics, and ICT solutions supporting the activities in the analysed segments. However, these concepts are today still part of a process of incremental change which is likely to still last several years.

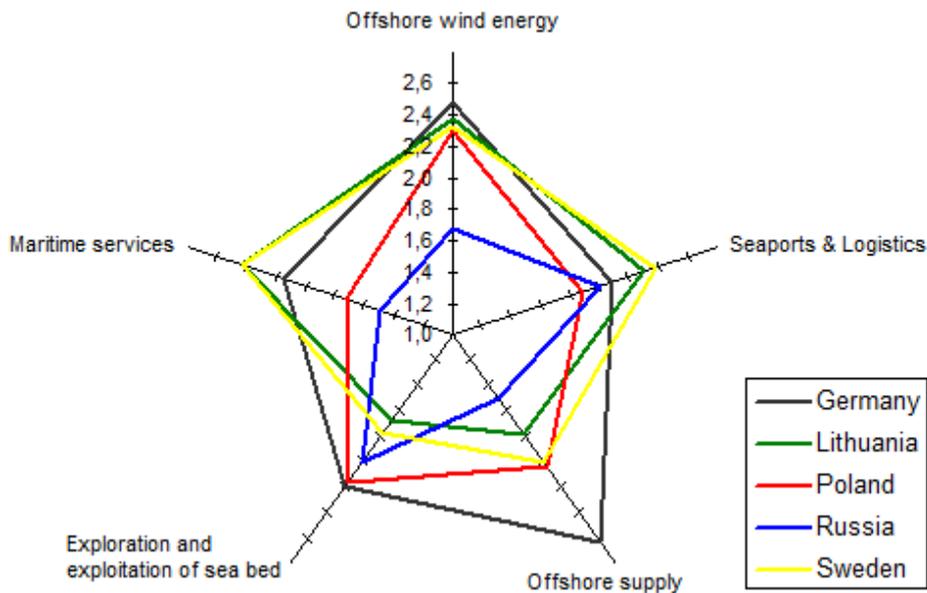


Figure 5. Quasi-mean of answers to the question „Which maritime segments will most develop in the next five years” (first group of segments).

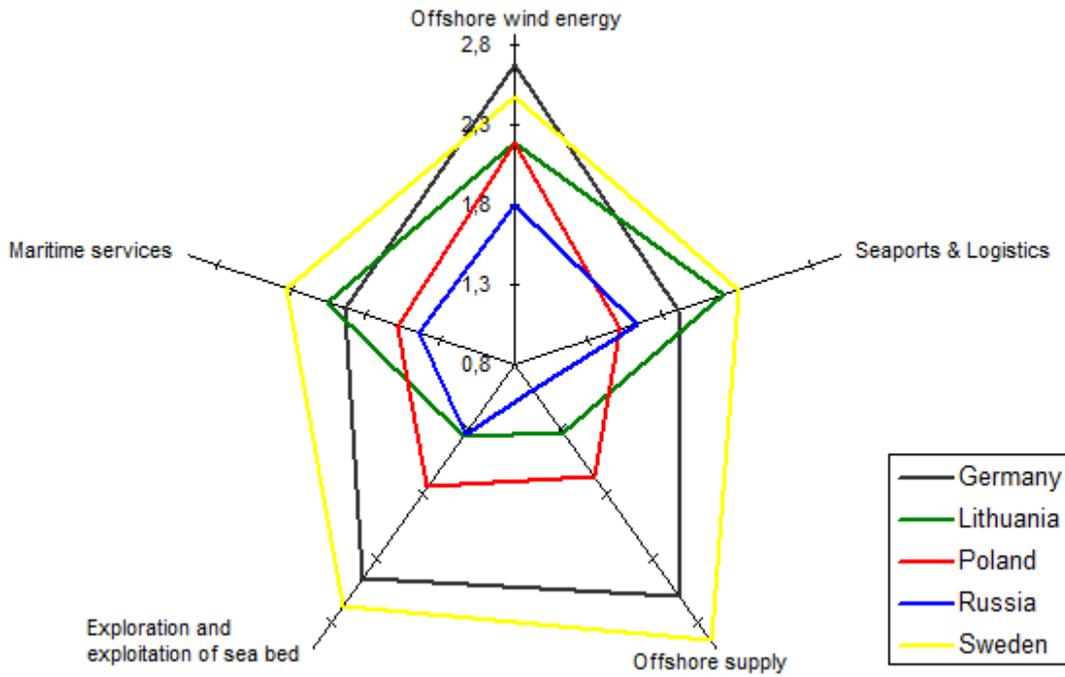


Figure 6. Quasi-mean of answers to the question „Which maritime segments will create the highest demand for skilled experts in the next five years?” (first group of segments)

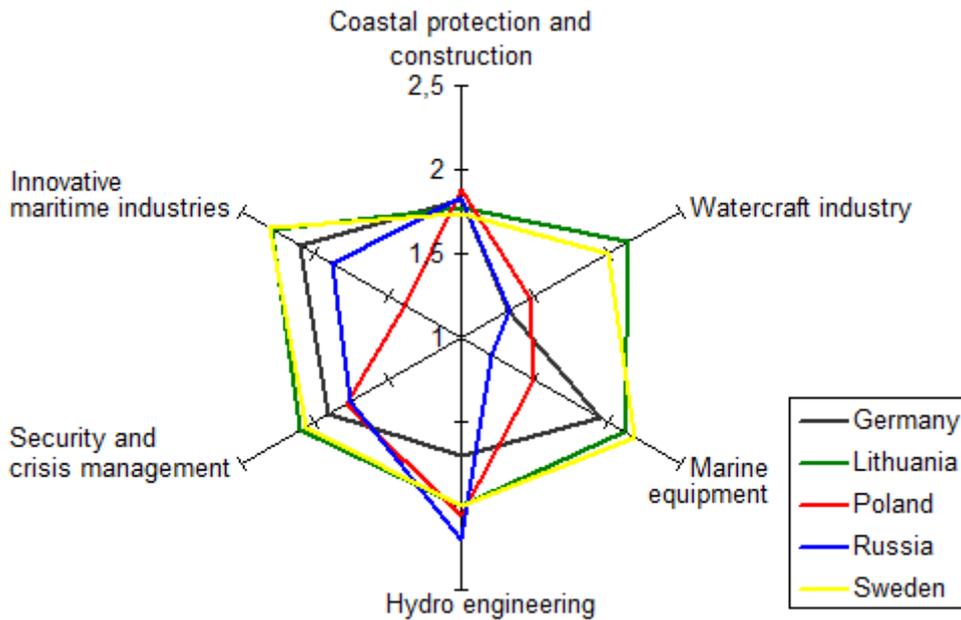


Figure 7. Quasi-mean of answers to the question „Which maritime segments will develop the most in the next five years?” (second group of segments).

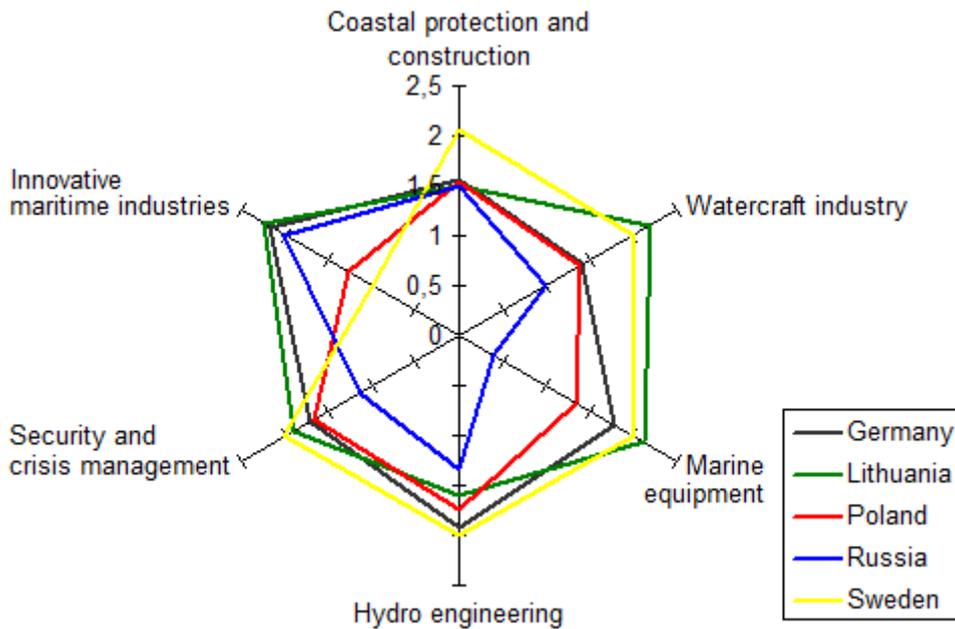


Figure 8. Quasi-mean of answers to the question „Which maritime segments will create the highest demand for skilled experts in the next five years?” (second group of segments).

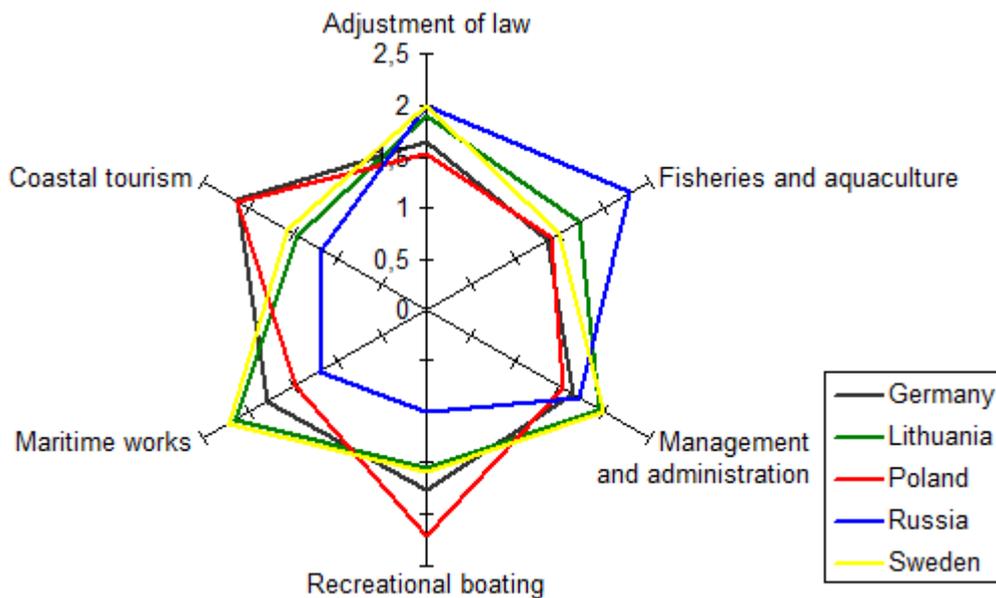


Figure 9. Quasi-mean of answers to the question „Which maritime segments will develop the most in the next five years” (third group of segments).

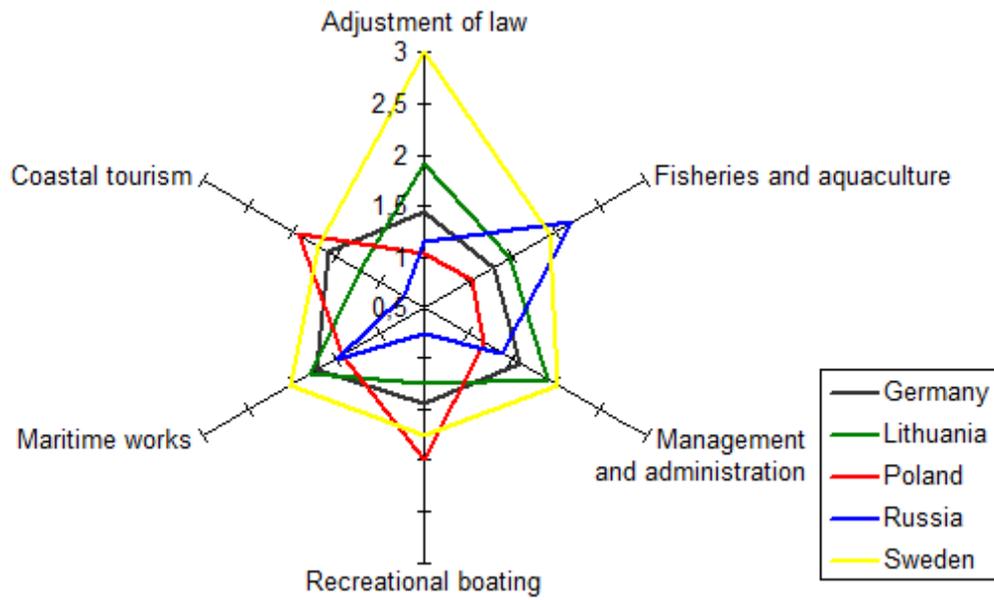


Figure 10. Quasi-mean of answers to the question „Which maritime segments will create the highest demand for skilled experts in the next five years?“ (third group of segments).

4. MARITIME LABOUR MARKET IN THE SOUTH BALTIC REGION

Authors: Kamila Mianowicz, Agnieszka Strzelecka, Karina Tessar, University of Szczecin, Poland

*Analysis of the current maritime economic situation in the regions as well as the general attitude towards upcoming changes and development possibilities reveals a strong dichotomy in the South Baltic Region: an innovative, productive and future-oriented **west region** (Mecklenburg-Vorpommern, Sweden) and an **east region** that is still strongly rooted in the past and trying to find its place in the new reality (Poland, Lithuania). The maritime sector has recently suffered from the global economic crisis and has experienced significant changes in production and service structures. Changes have been observed in the traditionally understood maritime segments that are stimulating the economic development of the newly emerging ones. Global competitiveness, growing awareness of environmental issues, requirements to ensure safety and security as well as new developing technologies all affect the maritime sector and drive it towards new solutions.*

4.1. Introduction

The maritime labour market plays a key role in the economy of the South Baltic Region (SBR). Sustainable development of the region's maritime sector is a priority for the countries surrounding the Baltic Sea. It can only be achieved by reconciliation of the economic, social and environmental dimensions of marine resource utilisation. It is not easy though, especially in times of growing international competition, a dynamically changing global economic situation and rapid technological progress. Maintaining our undeniable competitiveness in the promising segments of the maritime sector is vitally important from the socio-economic point of view. But what are the promising segments in the maritime sector? And where is the maritime sector of the South Baltic Sea Region at the present time?

A diagnosis of the present economic situation is the primary basis for making predictions and selecting the most promising segments. This prognosis also includes goals defined by the European Union and regional development strategies.

The information summarised in this chapter was collected by the regional Generation BALT project teams in order to obtain a glimpse of the current SBR maritime sector situation. This Foresight Study describes the most promising fields of maritime

activities. Detailed regional data are presented in the regional reports (listed in Chapter 2) and other sources of information are given in brackets. It should be underlined that despite discrepancies in the data collected in the regional reports, it was nonetheless possible to get a consistent and coherent picture of the SBR maritime sector.

4.2. Labour market in the South Baltic Region

The present situation of the labour market in the South Baltic Region is a result of the cross-interaction of several factors, namely the socio-demographical structure, technological development, historical conditions and political decisions. Recent political changes have been of significant importance for the region's economy: the collapse of the Eastern Bloc and subsequent integration of the countries into the structures of the European Union provided the impulse to open the labour market and increase international competition. Almost all areas of South Baltic Region (with the exception of Sweden) have recently suffered from an outflow of workforce, with particularly young and open-minded people opting to emigrate.

Moreover, all these areas face increases in their elderly population and low birth rates as well as a growing level of education, computerisation and automation contributing to lowering the workforce demand in production, manufacturing and service/operation. Finally, we are dealing with the effects of the global economic crisis resulting in a slower development pace and placement of many development projects and plans on hold (for example in Lithuania).

All these factors have had a strong influence on the unemployment rate but their impact varies in the SBR. The SBR benefited from a strong economy in 2006-2007 (2008), which translated into decreasing unemployment rates (Fig. 11). The years 2007 and 2008 were critical - in Lithuania, Kaliningrad, West Pomeranian and Pomeranian Voivodeships the unemployment rate was at its lowest value; it has since then started growing, particularly dramatically in Lithuania (from 4,4% in 2007 to 17,9% in 2010). Only in Mecklenburg-Vorpommern did the unemployment rate decrease over the period 2008-2010. The highest average unemployment rate in 2006-2010 was in the West Pomeranian Voivodeship, the lowest in Sweden.

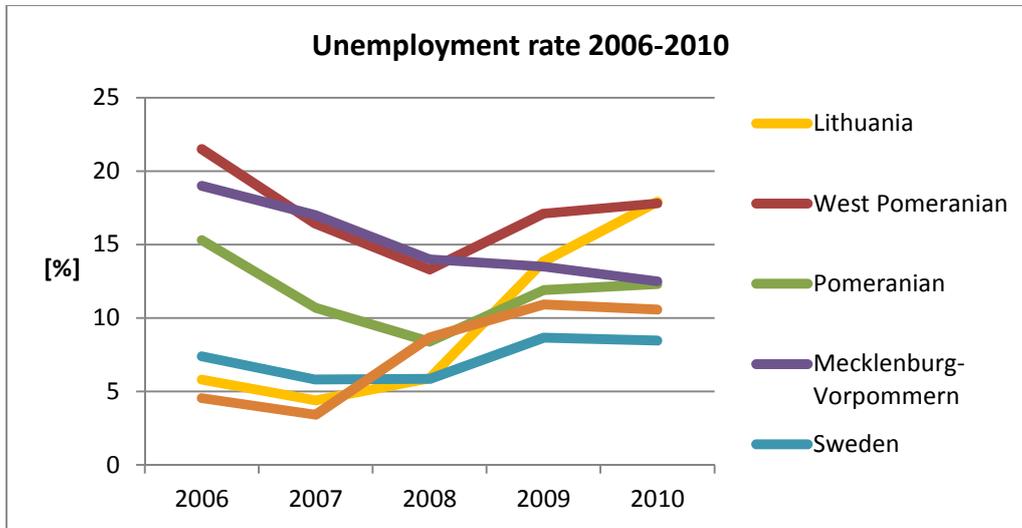


Figure 11. Unemployment rate in SBR countries in 2006-2010. Data sources: Sweden: [2], [3], Kaliningrad: [4], other regions: regional reports

A relevant and alarming fact here is that young, well-educated people have recently begun facing major problems with job hunting. The unemployment rate in the group aged < 25 is especially high in Lithuania (31% of all unemployed persons), but the situation is also difficult in the West Pomeranian Voivodeship (unemployment rate in the 15-24 age bracket: 23,7%) and Pomeranian Voivodeship (19,5%). Problems finding a job in the SBR particularly affect graduates from the humanistic and economic fields. There are several professions that are strongly threatened by unemployment: journalists, archivists, librarians, business managers, lawyers and economists. On the other hand, engineers and other specialists in technical fields (e.g. IT specialists, constructors) are still in high demand in the SBR as a whole.

Moreover, graduates very often do not have any work experience and their soft skills, such as communication (also in foreign languages), technical know-how, project management skills, intercultural competences and mobility, are below the level of potential employer expectations. These soft competences and skills are often of crucial importance, especially in the context of growing self-employment rates and increasing economic activity from micro- and small enterprises, which is currently observed in Poland and Sweden for example.

The spatial patterns of employment structures in Mecklenburg-Vorpommern, Pomeranian and West Pomeranian Voivodeships, Sweden and Lithuania are comparable. There is a trend of increasing unemployment rates from the coastline towards inland areas:

key centres (big cities, ports and harbours) are located along the coastline and offer a major portion of the jobs in the various segments of the maritime sector.

4.3. General information on the maritime sector

The maritime sector comprises all the economic activities that are conducted directly and indirectly on the sea, including coastal areas and supporting activities in land. There are several classifications of the maritime sector proposed by authorities, non-governmental organisations (NGO) and other institutions in the SBR, more or less detailed and more or less complete. For the purposes of this report, a simple generalised structure was adopted which groups all the segments in seven fields of main maritime activities (Tab. 3). All the segments are connected with each other and supplemented by complementarities such as supporting governmental structures or infrastructures.

The same factors influence the maritime sector development in all regions. European Union policies, globalisation and increasing international competitiveness are of the greatest importance (for example European shipyards are barely competitive in a context of subsidised shipyards in eastern Asia). Additionally, the emphasis on environmental issues by the European Union brings new dimensions and challenges to the maritime sector. Non-traditional segments are growing in importance, favouring economic activities that are innovative, environmentally friendly and more independent from global trends. Moreover, there is huge economic potential hidden in the offshore regions and sea bottoms, which will be explored and exploited in the close future.

Table 3. Groups of maritime sector segments as proposed by the Swedish Maritime Forum (modified).

Group	Segments (according to Chapter 3)
Manufacturing	Watercraft industry (shipbuilding and repair) Marine equipment Offshore supply Coastal protection and construction Innovative maritime industries
Transport	Seaports and logistics
Resources	Offshore wind energy Exploration and exploitation of the seabed Fisheries and aquaculture
Service and other operations	Maritime services Maritime works Maritime area management and administration Adjustment of law concerning maritime areas Security and crisis management Hydro engineering
Leisure and tourism	Recreational boating Coastal tourism
Public segment	Maritime area management and administration
Research and development	<i>Research and development*</i>

There are several international and European Union policies that already have and will continue to have a strong impact on the economic activities conducted within the maritime sector segments (see frame). The new European Union strategy on the "Blue Growth Economy" underlines the importance of marine areas and acknowledges the role of coastal regions for innovation and new ideas in the economy. This strategy defines several focus areas expected to develop

International policies and conventions (selected):

1. *The Helsinki Convention and The HELCOM Baltic Sea Action Plan* [5]
2. *European Union Strategy for the Baltic Sea Region* [6]
3. *Council of the Baltic Sea States Strategy on Sustainable Development 2010-2015* [7]
4. *European Commission's Blue Growth opportunities for marine and maritime sustainable growth* [8]
5. *Marine Strategy Framework Directive* [9]
6. *EU Water Framework Directive* [10]
7. *OECD green growth and sustainable development* [11]
8. *EUROPE 2020* [12]
9. *International Convention for the Prevention of Pollution from Ships* [13]

dynamically in the near future: blue energy, aquaculture, maritime, coastal and cruise tourism, marine mineral resources and blue technology.

4.4. Maritime networks

Networking helps to strengthen the cooperation and communication within the maritime sector and plays a crucial role in fostering the economic development of the maritime segments through joint competences and synergistic effects. Particular maritime segments do not always have the critical mass to operate alone. Currently there are several organisations and structures pursuing the idea of networking at regional levels: the Maritime Allianz Ostseeregion e.V. (MAO) in Mecklenburg-Vorpommern is the most successful example, the Polish Maritime Cluster still experiences highs and lows. "The Programme for Integrated Science, Studies and Business Centre (Valley) for the Development of the Lithuanian Maritime Segment" aims to create a cluster of maritime knowledge-based economies by consolidating the existing potential and promoting integration of maritime research, academic studies and business.

As of now, it seems that networking works efficiently within particular segments, although the inter-segment initiatives often do not go beyond declaration and development of strategies. Almost every segment of the maritime sector has its own association, represented and active in the structures of the European Union.

4.5. Maritime sector in the South Baltic Region

Given the seaside location of all regions of the SBR, the maritime sector is of great importance for their economic situation. Although they all use the same water body - the Baltic Sea - unfortunately a cohesive and consistent vision of the maritime sector is far from complete. All the countries differ in terms of strategic segments, maritime policies and level of development. A very simplified statement, but still true, is that among all the countries it is Mecklenburg-Vorpommern which focuses on innovation and technology, Sweden is considered to be the marine environmental leader but lacking in strategy for the maritime sector, while Lithuania and the Pomeranian and West Pomeranian Voivodeships are in the transition phase from traditional maritime segments to innovative ones.

The differences between regions are clearly seen when comparing employment in selected segments of the maritime sector (Fig. 12). In Sweden and Mecklenburg-Vorpommern the majority of the workforce is employed in manufacturing, service and other operations, the share of transport is much lower but still significant, and the field of resources (limited to fishing) occupies the last position. The dominance of manufacturing

and service stems from the leading role of new technologies and high specialisation of production, for example in shipbuilding.

There is a completely opposite situation in the West Pomeranian Voivodeship, where 46% of employees work in resources, mainly in fishing and fish product processing companies. Manufacturers and service providers are currently in a difficult economic situation due to the 2009 bankruptcy of the biggest employer in the region, Szczecin Shipyard. This had a significant impact on the region's economy and contributed to substantial growth in the unemployment rate. The Western Pomeranian Voivodeship is still dealing with the effects of the shipyard bankruptcy and no successful solution has yet been found.

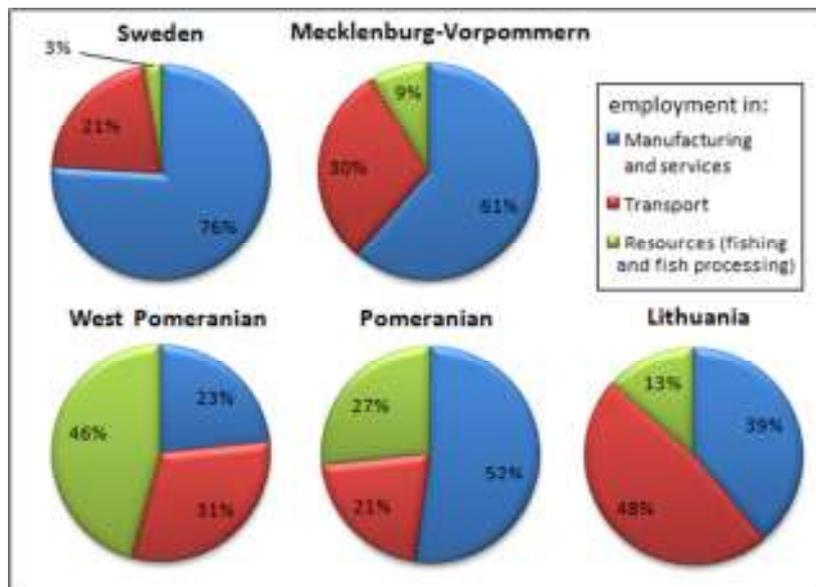


Figure 12. Employment share of three segments of the maritime sector: manufacturing and services, transport, and resources (fishing and fish processing) (2009-2011).

Manufacturers and service providers in the other Polish region - the Pomeranian Voivodeship - survived the global crisis and political misjudgements with less harm and have managed to significantly contribute to the employment situation. Employment in transport is currently low but local development strategies aim at creating in Gdansk a transportation hub of intercontinental importance, which will systematically grow in coming years.

The majority of employees in the Lithuanian maritime labour market work in transport, with transportation of goods having the leading role in Klaipeda's and the whole

country's maritime sector. Manufacturing and service, although substantially contributing to employment, do not bring significant turnover.

4.6. Current situation of the maritime segments

4.6.1. Manufacturing

MANUFACTURING groups all segments related to the production of durable goods for the purposes of coastal and offshore activities. It comprises shipbuilding and ship repair (including suppliers), offshore and coastal constructions such as port facilities, shore protection measures, wind farms and many others employing hydro engineering techniques.

The hallmark segment of the SBR – the **watercraft industry** - has been changing its profile due to international competition since at least a decade. There is particularly strong competition from the Korean and Chinese shipbuilding industries, which are state subsidised and therefore able to maintain very low prices for new ships - especially for large container vessels. There is also a lack of secure financing strategies and guarantee schemes, which has additionally slowed or even stopped (as it happened in West Pomerania in 2009) the development possibilities of the SBR shipbuilding and repair segment.

In order to support and restore the significance of this segment on the international scale, the European initiative LeaderSHIP 2015 [14] "*Defining the Future of the European Shipbuilding and Repair Industry - Competitiveness through Excellence*" has been active since 2003 (see box).

Future development of this segment will focus on the fields in which the innovation is crucial and special knowledge and know-how is essential. To support its development, there is a need to invest in R&D units and

LeaderSHIP 2015 [14] goals:

1. Maintain and further develop a strong position in selected higher-value market segments
2. Ensure world leadership in product and process innovation
3. Develop a strong customer orientation
4. Further improve the networked industry structure
5. Optimise production processes and increasingly focus on knowledge-based products

Meeting safety and environmental requirements will involve:

1. International Maritime Organization (**IMO**): replacing the existing fleet of single hull oil carriers by double hull constructions before 2015
2. International Convention for the Prevention of Pollution from Ships (**MARPOL**) [13]: more environment friendly running of ships, lowering the emission of pollutants
3. International Convention for the Control and Management of ship ballast water and sediments (**BWM**) [15]

enhance the cooperation between business and research. Moreover, despite a slight shift of the European development strategy towards increasing economic competitiveness, environmental issues have been

growing in importance for at least the last decade and increasingly demand innovative solutions. This push for innovation and specialisation is likely to have a strong positive impact on the shipbuilding and repair industry in the SBR in coming years. It will stimulate the development of new technological solutions and offer new chances and job possibilities through modernisation of the outdated fleet. While limited funds are anticipated for fleet replacement, opportunities for development of environmental technologies are expected to be strong and to create a favourable economic environment for suppliers and ship repair.

New laws and regulations, new development strategies and the reliable assessment of Europe's stronger and weaker sides, clearly define the most promising fields in the shipbuilding and repair industry:

- **innovative construction of optimised hull forms and propulsion systems that are energy efficient and produce low emissions, and**
- **specialised ships for tourism (cruisers) and passengers and vehicles for transportation (RoRo-ships), ice conditions, army, research, and offshore activities.**

An example of the successful and rapid adjustment of the shipbuilding industry to the new economic reality can already be found in the most developed regions of the SBR. In Germany, the development of this segment is supported by the German Research and Development Programme and aims at building more environmentally friendly vessels with increased safety and reliability. The majority of ships built in 2010 are ferries, passenger ships, RoRo-ships and yachts (90% of total produced tonnage), while only 5 years ago the structure was completely different (Fig. 13). This shift toward passenger vessels, recreational boats and advanced ships for example for offshore purposes, gives the Germans a leading position in the world market in the industry for specialised and innovative watercraft. However, keeping this position in the future will require efforts and investments in research, development and education.

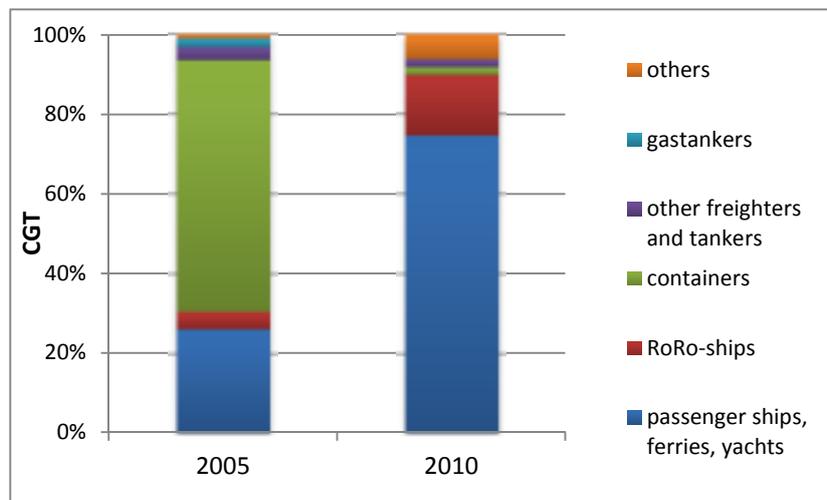


Figure 13. Split in the portfolio of German shipbuilding orders in 2005 and 2010.

Currently there are 64 shipyards employing 18.500 people in Germany, of which 5 are located in Mecklenburg-Vorpommern. This region is host to the second largest yard for yacht building in Germany with ca. 530 employees. It is estimated that over 13.000 people work for the regional shipbuilding industry (including maritime suppliers), which represents almost 50% of all employees in the maritime related segments and ca. 2,5% of the total employment.

Specialisation in watercraft production is also the case in Sweden. Although no merchant ships are currently being built, this country is an important producer of military vessels (corvettes and submarines) and pleasure boats. However, the main focus of Swedish shipyards is nowadays in repair, maintenance and conversion. It is estimated that almost 8.000 employees work in this segment (including technical suppliers).

Military vessels are also built and repaired in the Kaliningrad region. There, the shipbuilding and repair industry is represented by several dozen companies producing small and large civilian vessels. In local shipyards, ships with launching weights of up to 12.000 tons can be built. In the future, the segment may further develop thanks to a project taking on the construction of shipyards for the building of offshore vessels for the fishing industry, a project that began in 2011.

Although for many years Lithuanian shipyards were more active in ship repair and conversion (e.g. 195 vessels repaired in 2010), within the last decade new building output has been growing every year (e.g. 9 vessels built in 2010). The main direction of Lithuanian shipbuilders is building "turn-key" vessels of different types: tugs, supply vessels, ferries, fishing trawlers, jack-up and transformer platforms for renewable energy and other

special purposes. Research and experimental development for this segment is supported by the activities of the Lithuanian Intermodal Transport Technological Platform (LITTP), established in 2007. The shipbuilding and ship repair industry is considered to be one of the most important segments, but it has recently experienced an outflow of workforce (by 28% since 2003) and a decrease in turnover (by 14% since 2009) as a result of the global economic crisis.

The global economic crisis strongly affected all Polish shipyards in the Pomeranian and West Pomeranian regions and led to several bankruptcies and considerable deterioration of the society's economic activity. Currently the production of vessels is conducted in the only big shipyard that survived the global crisis, Gdansk Shipyard. In 2010, employment in shipbuilding and ship repair in Pomerania was at 77% and in West Pomerania at 53% of the employments levels of 2005, with the major drop in 2009. Significant here is that the number of companies operating in this segment has been stable for the last couple of years. This tendency results from an increasing role of micro- and small enterprises (including self-employment) taking over the market after traditional shipyards. Small companies are able to adjust their offer to the changing market demands in terms of specialists and production techniques (not only for watercraft purposes) and successfully expand toward foreign markets (e.g. Island, Norway, France, China). The production of merchant fleet has been partially replaced by repair activities and production of pleasure boats, yachts, offshore and subsea constructions and spare parts or, as was the case in the New Szczecin Shipyard (West Pomerania), has stopped and not been replaced. The lack of exploitation of the former shipyard's industrial potential is one of the main economic problems in the region, the second one is the "brain drain" of skilled and highly qualified shipyard workers. After the closure of the shipyard, over 3.000 people lost their jobs. It is estimated that 500 were taken over by Genfer Lloyd, offering them the possibility to work for the shipbuilding industry in other shipyards in the country or abroad (mainly in Germany and Scandinavia).

4.6.2 Transport

TRANSPORT comprises shipping, passenger transportation, logistics, cargo handling and multiple additional port services related to transportation. The Schengen Agreement between European Union countries significantly simplifies and boosts the transportation of goods and passengers and makes transportation an important platform for building coherence and cohesiveness across the SBR. Unfortunately, transparency in the shipping labour market is limited due to the changing of flags in merchant vessels (for example 100 vessels have changed flags in Sweden in the last 5 years). There is an attempt to increase the

transparency of this segment by implementing the international registration system, which has already been partially applied in Denmark. It is currently under discussion in Sweden and is expected to be applied in other countries as well.

Main ports in the SBR. There are many ports in the SBR (Fig. 14) but only a handful are of interregional importance. Apart from their functions as shipping and cargo handling centres, they support passenger transport on several international ferry routes. There are nine main companies operating in the Baltic Sea (Tab. 4), connecting 14 of the region's ports to each other and to other parts of the Baltic Sea. Only in Sweden there are ca. 30 Mio passengers travelling over seas every year, but only a minor part of this figure concerns the SBR.



Figure 14. Main ports in the South Baltic Region.

One of the most popular ferry routes - Ystad-Świnoujście - supports ca. 0,5 Mio. passengers annually. The intensity of passenger traffic is strongly correlated with the development of tourism and increases during the summer season. As the global economic situation has a strong impact on passenger transport, since 2009 the whole region has experienced some downturn in the annual number of passengers.

Many smaller ports and harbours provide services on regional and local scales. It is worth underlining that only a few maintain their functions as fishing harbours. Many previous fishing harbours have transformed into tourist centres.

Table 4. Main ferry routes in the South Baltic Region.

Country (main quarter)	Company	Routes in the South Baltic Region
Finland	Finnlines [16]	Helsinki-Rostock, Gdynia-Helsinki,
Sweden	Stena Line [17]	Gdynia-Karlskrona, Trelleborg-Sassnitz, Trelleborg-Rostock
Poland	Pollferries [18]	Gdańsk-Nynäshamn, Świnoujście-Ystad, Świnoujście-Copenhagen, Świnoujście-Rønne
	Kołobrzaska Żegluga Pasażerska [19]	Kołobrzeg-Nexø
	Unity Line [20]	Świnoujście-Ystad, Trelleborg-Świnoujście
Denmark	DFDS Seaways [21]	Sassnitz-Klaipeda, Klaipeda-Kiel, Karlshamn-Klaipeda
	Faergen [22]	Sassnitz-Rønne, Rønne-Ystad, Rønne-Køge
Denmark, Germany	Scandilines [23]	Rostock-Gedser, Helsingør-Helsingborg
Germany	TT-Line [24]	Travemünde(Lübeck)-Trelleborg, Trelleborg-Rostock

Shipping and cargo handling in ports

Due to a favourable geographical situation (location at the border of the North and Baltic Seas) shipping has always been vitally important for the Swedish and German economies. It is estimated that in Sweden ca. 102.500 people (~2% of total employed persons) are employed in segments directly linked to shipping and related segments (excluding fishing). Of these, 13% work onboard Swedish ships. In addition, there are ca. 50.000 people working in road and rail transport and in companies offering supporting services for transportation related to maritime shipping, which makes for a total of 152.500 employees. In Sweden, ca. 90% of the tonnage and 60% of the product value of international goods transport is performed by sea. These values come mainly from short sea shipping, which gives this country the seventh position in Europe (with 148,7 Mio. tonnes in 2010) and the second position in Baltic Sea goods transport (Tab. 3). This is the case despite the fact that since the 1960's Sweden has experienced a substantial decrease in its contribution to

the world shipping tonnage. Only Germany keeps a strong (3rd) position in international shipping, leading in short sea shipping in the Baltic Sea (Tab. 5). The German fleet consists of 3.750 ships and 85 Mio. in registered tonnage and the fleet of container ships is the biggest in the world. The substantial cargo handling in German seaports (ca. 300 Mio tons in 2011) is expected to double by 2025. While the main portion of the transportation activity takes place in the North Sea region, Mecklenburg-Vorpommern, with its three large ports in Rostock, Wismar and Stralsund, is a very important transportation hub connecting the Baltic Sea with the Atlantic Ocean. It is estimated that ca. 10.000 people work in this segment in the whole region, which amounts to 30% of employment in the maritime related industry and 1,5% of total regional employment. Rostock is the most important port on the German Baltic Sea and the only deepwater port, with an annual (2000-2010) cargo traffic amounting to over 20 Mio tons [25]. It is estimated that 12.000 people work there, directly and indirectly connected with transportation and port services. Currently there is a joint research project conducted by the port (Research Port Rostock) aiming at the optimisation of maritime logistics.

Table 5. Top ten in Europe: Baltic Sea goods transport in 2010.

	Country	Gross weight of goods [million tonnes]
1.	Germany	88.1
2.	Sweden	85.1
3.	Netherlands	73.5
4.	Finland	57.0
5.	Denmark	35.1
6.	United Kingdom	30.2
7.	Belgium	23.8
8.	Poland	19.0
9.	Lithuania	16.9
10.	Latvia	16.5

The transport of goods is one of the most important segments of the SBR's maritime sector with respect to employment rate and turnover and contributes substantially to the national economies. For example, in Lithuania it contributes over 60% of the total turnover in maritime related segments and 1,5% of total turnover, with the employment share reaching 40% and 0,8% respectively. Lithuania, with the only port of international significance in the northernmost ice free Baltic Sea (Klaipeda), does not contribute

substantially to Baltic Sea shipping and takes ninth position in terms of gross weight of goods (Tab. 5), although the amount of cargo handling in the port has doubled since 1999 (from almost 15 to over 31 Mio tons in 2010). Over 75% of the operated cargo was for export. In 2014 the LNG terminal will come into operation, which will increase the significance of the Klaipeda port.

Poland (Pomerania and West Pomerania) has a similar contribution to the Baltic Sea goods transport (Tab. 5) and a similar structure in terms of import-export ratio. Unlike in Lithuania, since 2004 there has been a significant fluctuation in the amount of cargo handled in Polish ports (especially in the West Pomeranian region). Gdansk and Gdynia together cover over 65% (~39 Mio tons) of the total (deep sea and short sea) cargo traffic in Polish ports, while Szczecin-Świnoujście covers 30% (~18 Mio tons). A growing importance of the port in Gdansk has been observed since 2007, when the new Deepwater Container Terminal (DCT) was established. As of now, the DCT is the largest container terminal in the SBR. Future investments, supported also by EU funds, aim at improving its position in world rankings among container terminals and eventually creating a "second Hamburg or Rotterdam". [26, 27]

In Russia (Kaliningrad region) the main cargo handled in the port complex consists of, among others, oil and oil-products, which are 77% of the export turnover. Many of the companies have intentions of developing the oil terminals for trans-shipment, which is why a potential flow of goods at the level of 10-15 million tons per year is possible. The total turnover of the port of Kaliningrad is expected to increase due to its growing capacity. There are plans to increase it from over 33 million tons to potentially 182 million tons in 2030 (including the designed deep-sea port). In contrast to oil, the Kaliningrad region cannot be considered as a leader in gas transport because there is no gas trans-shipment via marine transport.

Since at least a couple decades there has been a strong trend of decreasing employment rates in the shipping and cargo handling segments, mainly due to more effective streamlining, workforce management and significant improvements in logistic procedures. However, due to the overall size of these segments, they still produce a great demand for workers. The region can pursue opportunities to develop this development through **short sea shipping** and creation of sustainable systems for **intermodal** (or multimodal) **transport** corridors. The Central European Transport Corridor (CETC-ROUTE65) can increase the availability and competitiveness of the region as it connects Sweden, Poland and Germany with Central and South Europe. Moreover, mobility may also benefit from the construction of the cargo and passenger automobile-railway-ferry complex that is

being completed in the port of Baltiysk (Kaliningrad region) and construction currently under way of new transfer terminals in Kaliningrad.

4.6.3. Resources

RESOURCES groups all the segments that are based on the exploration and exploitation of any kind of resources available in the Baltic Sea - fish and seafood, mineral deposits, gas and crude oil, and sources of renewable energy (such as wind).

Sea fishing in the SBR is currently in a phase of transformation from traditional fisheries to modern, environment friendly and sustainable fisheries. EU Common Fisheries Policy determines catch quotas on the Baltic Sea, which has resulted in the relative decrease of catches in this water body. At the same time, production of seafood seems to be growing. This phenomenon has been observed in Mecklenburg-Vorpommern, with a noticeable growth of aquaculture. Currently there are 25 commercial aquaculture installations providing jobs for 324 people. In this region, aquaculture is a systematically developing segment of the maritime sector, supported by scientific and educational activities at the University of Rostock. Moreover, aquaculture is of a special importance in the EU blue growth strategies for the next couple of years. It is defined as one of most promising segments of the maritime sector in terms of development as it is currently the fastest growing animal food-producing segment in the world and responds to the trend of growing concerns about health. Moreover, mariculture can be a source of drugs or ingredients used in cosmetics and can serve as a source for bio-energy production. However, this segment is at the beginning of its developmental path (experimental phase) so employment is still expected to be low in the short-term horizon. Its importance for SBR employment is not expected to be significant as the ecological character of Baltic Sea as well as EU regulations limit the possibilities of mass aquaculture production.

In Sweden, only 2,4% of persons working in the maritime sector (excluding marine tourism, land transport and transport supporting services) are employed in fishing and aquaculture, which is equivalent to 0,05% of the total national workforce. In Lithuania this ratio is much higher - ca. 11% and 0,18% respectively. Turnover in this segment barely exceeds 8% of the total maritime sector turnover and equals 0,19% of national turnover. A focal point for fisheries is located in Klaipeda, where 1,47% of employed persons work in this

EU Blue growth [8] focus area:
"Aquaculture has the potential to grow by providing more quality merchandise to consumers willing to choose fresh, trustworthy products, increasingly including those that are sustainably or organically produced. Moreover it can help coastal communities diversify their activities while alleviating fishing pressure and thus helping to preserve fish stocks."

segment and bring 1,43% of turnover.

Very dynamic policy-related changes have been observed recently in Poland. In 2010, 35,5% of all catches came from water bodies outside the Baltic Sea, while only 5 years earlier these were just 0,8% (Fig. 15a). This shift resulted in a significant growth (by 25%) of total catches of fish and shellfish: from 140 in 2007 to over 175 thousand tons in 2010. In parallel, the introduction of fishing quotas and multiple EU programmes supporting the withdrawal of old, exploited and environmentally unfriendly vessels has resulted in a smaller cutter fleet and a reduction of catches on the Baltic Sea. The EU programme "Scrapping of fishing vessels" (2004-2007) significantly contributed to a reduction of the cutter fleet in all Polish regions (by 55-60%) and a decrease of employment in sea fishing, especially in West Pomerania. In this region, employment in 2010 was four times lower than in 2000.

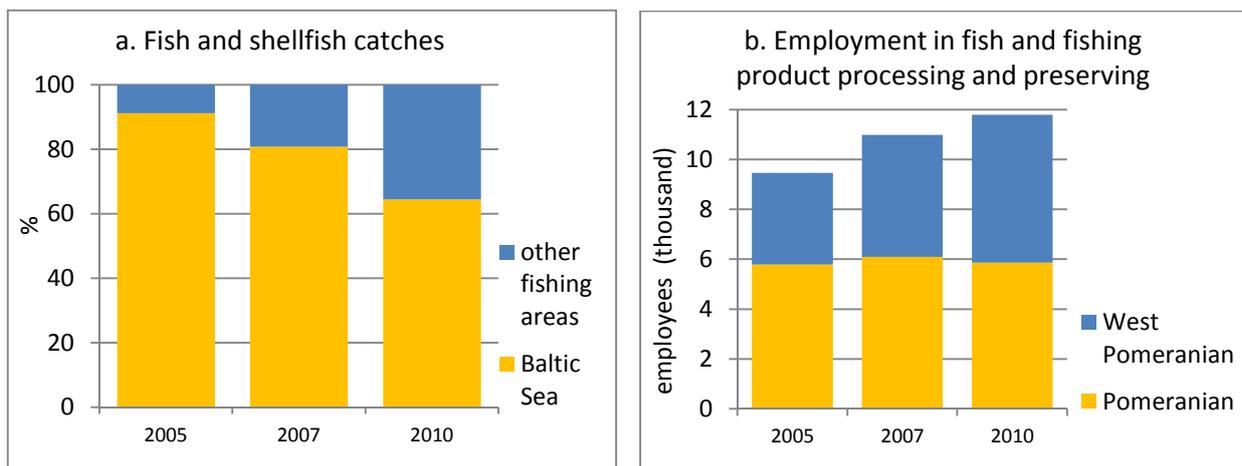


Figure 15. Fish and shellfish catches (a) and employment in fish processing companies (b), Poland.

On the contrary, the segment of fishing and fish product processing and preserving has been developing dynamically over the last decade, particularly in the West Pomeranian region. In 2010 there were in both Polish Baltic regions ca. 330 companies employing almost 11.000 people. The employment rate in West Pomerania increased by 60% since 2005, from ca. 3.500 to almost 6.000 employees in 2010, while in the Pomeranian region it remained stable (Fig. 15b). The companies primarily provide services on the local scale but have strong potential to expand and increase sales of fish and fish products, both domestically and abroad.

Fish processing is also important for the economy of the Kaliningrad region, where there are about 60 fish processing plants. Food fish production reaches 600 thousand

tons per year. It is also worth noting that Kaliningrad is the origin of 40% of all Russian canned fish. The fishing industry in this area hires almost 1.800 employees. However, the region's fishing is not considered very competitive on an international scale because the majority of the fleet is in a state of disrepair.

Limited resources of coal, oil and gas and the push to mitigate climate change, promoted and supported by the EU, provide impulse to search for and use sources of renewable energy. Since over two decades ago and with renewed intensity since 2000, **wind energy** has been the fastest developing field of the environment-friendly energy segment. Since recently, it has expanded toward offshore areas. By 2010, European offshore wind energy production amounted to 3GW annually. In ten years it is expected to equal an annual 43 GW, which corresponds to a growth ratio of nearly 1,5 GW per year. According to the EU Blue Growth Strategy, by 2030 the annual installation of offshore capacity could exceed that onshore. Currently (2010-2013) there are two EU projects aiming at an exchange of expertise and a faster and better development of offshore wind energy in the Baltic Sea: "South Baltic OFF.E.R" and "WEBSR2".



Figure 16. Offshore wind farms in the South Baltic Region. Source of data: Poland [28], Germany [29], Lithuania [30], other regions: regional reports

In terms of wind energy production there is a huge difference between two parts of the BSR: the western part - already intensively exploiting this source of energy - and the eastern part - taking its first steps in this direction. Mecklenburg-Vorpommern leads in wind energy production. It is estimated that 2.000 people are employed in 40 companies operating in the wind energy segment in this state. There are more than 1.300 onshore power plants producing ca. 1.500 MV (as of December 2010) and covering up to 45% of electric power consumption in the region. Although there is only one offshore wind farm in the German Baltic Sea (48 MV), the next 21 are already in the design or construction phases (Fig. 16) and are expected to produce 10GW of energy by 2020. Currently in Germany 6% of energy is generated by wind farms. This share is expected to reach 25% of total energy production in 2020. Regarding the expansion plans, a drastic increase in the availability of jobs can be expected.

Six more offshore wind farms are located along the Swedish Baltic Sea coast (Fig. 16). There are also new offshore parks planned and Swedish enterprises and consortiums are already making efforts to get permissions for further investments in 2015. A giant offshore park south of Karlshamn (500-700 windmills) is expected to produce 7-8 TWh, which corresponds to 5% of Sweden's total electricity consumption. Two other offshore giant parks are planned in Kalmarsund and between Sweden and Germany in the longer-term horizon. If the necessary permits are given, they may produce an output of almost 3 TWh.

Lithuanian and Polish regions have just started exploiting their potential in wind energy production. One large and four smaller areas have been designated for wind farms in Lithuania (Fig. 16). Following a referendum in which Lithuanians decided not to construct new nuclear power plants, offshore wind energy development has begun to look like a very real project. In investigated areas there is a possibility to build up to 7GW of offshore wind power. The tendering procedure is not clear yet but the Lithuanian government will launch tenders in early 2013. The electricity grid can be mentioned as the main limiting factor, so grid extension as well as offshore interlinks are necessary.

Thanks to a long shoreline and a significant area of territorial sea, the potential for offshore wind energy in Poland is estimated at 20 GW [31]. Three areas have been designated for future offshore wind farms (Fig. 16), while six of the ten largest Polish onshore wind farms have been built in the West Pomeranian region during the past couple of years. It is expected that development of the offshore wind energy industry, now possible thanks to recent regulatory changes, will provide ca. 9.000 jobs in the next 12 years in the Pomeranian and West Pomeranian regions, both in construction and services [6]. The construction of parts and structures for the windmills constitutes an attractive alternative to

the traditional shipbuilding industry and is currently being pursued by local and national authorities. Some successes have already been achieved and the production of steel structures (foundations) will take place in the shipyard in West Pomerania. It must be underlined that given the poor state of Polish electrical infrastructure (e.g. transmission lines), full development of the wind energy sector can only be achieved when a proper standard (e.g. high voltage electricity grids) is secured.

The wind energy segment could be considered as promising in the Kaliningrad region, which has the most powerful wind farms in Russia. There is potential to build new wind turbines that may cover 30% of the region's current electricity needs. However, although the current installed capacity of over 5 MW is the highest in Russia, it meets only 1% of the energy requirements of the region and in light of the construction of the Baltic Nuclear Power Plant, wind energy in the region has no prospects.

Information on wind energy in Denmark can be found as an Appendix to this report.

The long-term future aim for the wind energy segment is to develop autonomous, intelligent, safe and low-cost systems for exploration and production of resources and for inspection and servicing underwater constructions. This concerns offshore **exploitation of oil, gas and mineral resources** as well. Expansion in the exploration and exploitation of offshore deposits is anticipated, as these resources are limited on land and technological progress facilitates underwater exploration and exploitation. This segment appears promising in the long-term horizon. Although technological development will proceed fast, employment prospects in the close future are not expected to be very high.

4.6.4 Service and operation

SERVICE AND OTHER OPERATION is the most diverse group, covering a variety of economic activities, namely coastal protection and management, environmental impact assessment, law adjustment concerning maritime areas, dredging works and dredged material management, installation of cables and pipelines, security and crisis management, technology transfer, brokers and agents, financing, insurance, pilotage, etc. Many of the segments gathered in this group are in close connection with other maritime sector fields, for example shipping and port services can only be successfully fulfilled thanks to regular dredging works, the construction of offshore and onshore facilities has to be preceded by an assessment of the investment's environmental impact, the shipbuilding industry to a great extent depends on the bank loans, etc.

As part of an integrated coastal zone management (ICZM), **coastal protection** and **coastal engineering** are of special importance for the southern shores of the Baltic Sea, which are exposed to the increasing abrasive activity of marine waters. The coastal landscape is subject to constant changes, therefore its management and protection pose multiple challenges for highly qualified personnel, including engineers. This applies in particular to the heavily damaged cliff zones that can be found for example in the island of Rügen or the West Pomeranian region. This segment of the maritime sector is growing in importance due to the expected sea level rise tied to global climate change, and as a result, the more severe coastal abrasion. Coastal engineering is already one of the most important maritime industry segments in Mecklenburg-Vorpommern and is considered to be among the most promising ones also in other regions.

Dredging works and dredged material management are required to maintain high standards of navigation within the fairways, harbours and ports. Utilisation is one of the ways of dealing with unpolluted dredged sediments. Currently, the EU project DredgDikes [32] deals with the use of dredged material in dike constructions, with large-scale field testing, an actual pilot dike and a best practice guideline. But if dredged material is contaminated, for example with heavy metals or organotins, it must be stored and secured in special dumping sites designated specifically for this purpose. Every country has its own laws regulating the upper limits of pollutants. This issue is of special importance as in the close future several dredging works are foreseen in parallel with regular port maintenance works, for example the deepening of the waterways across the Szczecin Lagoon in the West Pomeranian region and the fairway to the port in Rostock [33]. It is alarming, however, that Poland has no strategy for how to deal with contaminated materials. Moreover, there is a lack of technological solutions aiming at the decontamination of polluted dredged material. However, this opens up possibilities for new jobs in the labour market in the close future.

Dredged material management is one of the problems requiring **adjustment of the law** concerning maritime areas. European Union environmental regulations along with the need to take greater care of the Baltic Sea marine ecosystem put on the BSR the obligation to create new regulations or adjust the existing legal requirements. This has an impact on the maritime sector in terms of creating demand for products and services and requiring highly qualified staff, first to develop legislation at the national level, then to implement it in practice.

The increasing number and intensity of maritime economic activities is expected to enhance the need and importance of **maritime monitoring and surveillance**. **Security** issues will also play an important role, as the safe functioning of multiple offshore facilities will require increasing efforts to protect them from external threats (e.g. piracy, terrorism).

Economic expansion towards the sea will increase the interference of maritime activities with the environment, therefore **environmental monitoring** will be of crucial importance to maintain and restore the marine ecosystem balance and manage the use of multiple marine resources.

LEISURE AND TOURISM belong to the fastest developing segments of the maritime sector. They comprise all the tourist activities that are performed at sea and along the coastlines, in particular coastal tourism, cruise tourism, marinas, yachting and other water sports. The growth of this segment is taking place regardless of the poor environmental conditions of the Baltic Sea waters, namely pollution and eutrophication (see frame).

It is estimated that ca. 152.000 people in Sweden work in the tourism industry, of which 50% is related to coastal and marine areas. This figure, added to the number of employees in the traditionally understood maritime sector results in over 220.000 persons employed in the maritime industry. In Lithuania there are 381 companies providing tourist and recreational services and employing over 3.770 persons. There is a prevalence of micro- and small enterprises, hiring up to 10 people. Given this fact, it can be concluded that they offer services mainly on a local scale. These companies do not bring a significant turnover - in 2010 it amounted to only €52 Mio., which corresponds to 0,11% of total national turnover. No exact data are available for the other regions of the South Baltic concerning employment in maritime tourism but it can be agreed that this segment is one of the most important for the region's labour market.

The ageing of society is anticipated to have a strong impact on the structure of tourist activities in the region, namely a significant increase in cruise tourism. Luxury cruisers are considered to be the most promising in terms of economic growth in the SBR. For example, the number of passengers travelling on board cruisers and cruise liners in Lithuania has increased by 50% since 2005 (Fig. 17).

"Overfishing, land-based pollution, rising sea temperatures, the presence of hazardous compounds and adapting to climate change are causing widespread impacts to leisure activities" - EU Regional Strategy for the Baltic Sea Region [6]

"The Baltic Sea region is the fastest growing cruise market in the world" – Consultancy within Engineering, Environmental Science and Economics (COWI) [34]

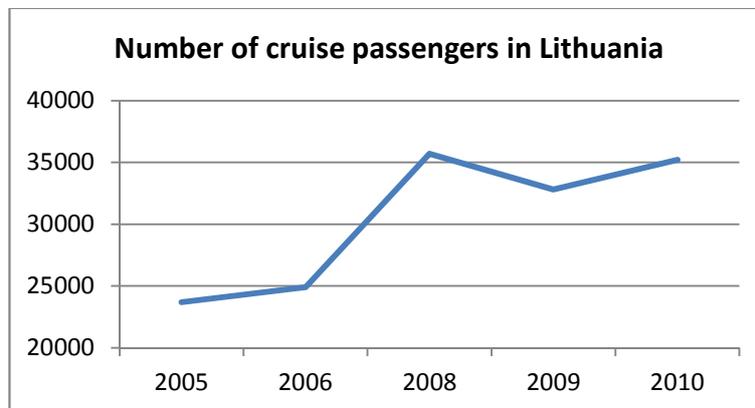


Figure 17. Growth in the number of cruise passengers in Lithuania between 2005 and 2010.

This segment of the maritime sector is a low cost and flexible segment and offers wide possibilities for people who have little education (soft skills are more important) or who live in places that are not industrial. The development of tourism has a strong positive impact on the process of professional activation of local communities, especially in attractive regions such as coastal areas. The BSR offers a wide range of marine, river and lagoon ecosystems that are interesting - and in many cases unique - for tourist exploitation. In Poland, it is especially important to investment in tourism infrastructure and improve its standards in order to attract and handle tourism traffic. One of the short-term goals in Poland is to extend the tourist season, which is now limited to the summertime. The so-called "dead season" does not generate any profits and contributes to the low economic activity.

RESEARCH is especially important in terms of innovation and technological progress. It is of critical importance for all segments relying on innovation, especially the emerging ones. Incorporation and implementation of scientific results into business activities can bring about fast development, a growth of employment and an increase in our competitiveness with other regions. Scientific development is boosted by multiple EU financial instruments supporting the research activities of universities and institutes. To meet the challenges of the future maritime sector, a close cooperation of R&D units with business and **technology transfer** are required. Both activities are emphasised by the EU and there has recently been a clear trend to favour research projects with an applied character.

The SBR possesses undeniable competences in the maritime related research and education fields (see Chapter 5).

4.7. Economic development prognosis - most promising segments in terms of development and employment

The questionnaire analysis (Chapter 3) revealed a very optimistic attitude of maritime experts from the BSR regarding the development possibilities of the maritime sector and, even if this study brings this optimism to a realistic level, a progressive economic expansion of several maritime segments is indeed foreseen. Growing international competition, the global economic crisis and a generally pessimistic economic attitude were a trigger for changes recently observed within this sector and have resulted in a re-evaluation of existing structures and a search for new solutions.

Regarding projects, plans and EU targets (e.g. 20-20-20 [35]), the **offshore wind energy** segment is expected to be the fastest in developing and generating employment. Other segments and fields of activity within the resources group - **exploration and exploitation of the seabed** and **aquaculture** - will offer a limited number of jobs in the close future. Constraints in employment generation result from the specific environmental conditions of the Baltic Sea and the strict EU environmental rules. However, the development opportunities (i.e. technologies) of these segments are still considered to be very high.

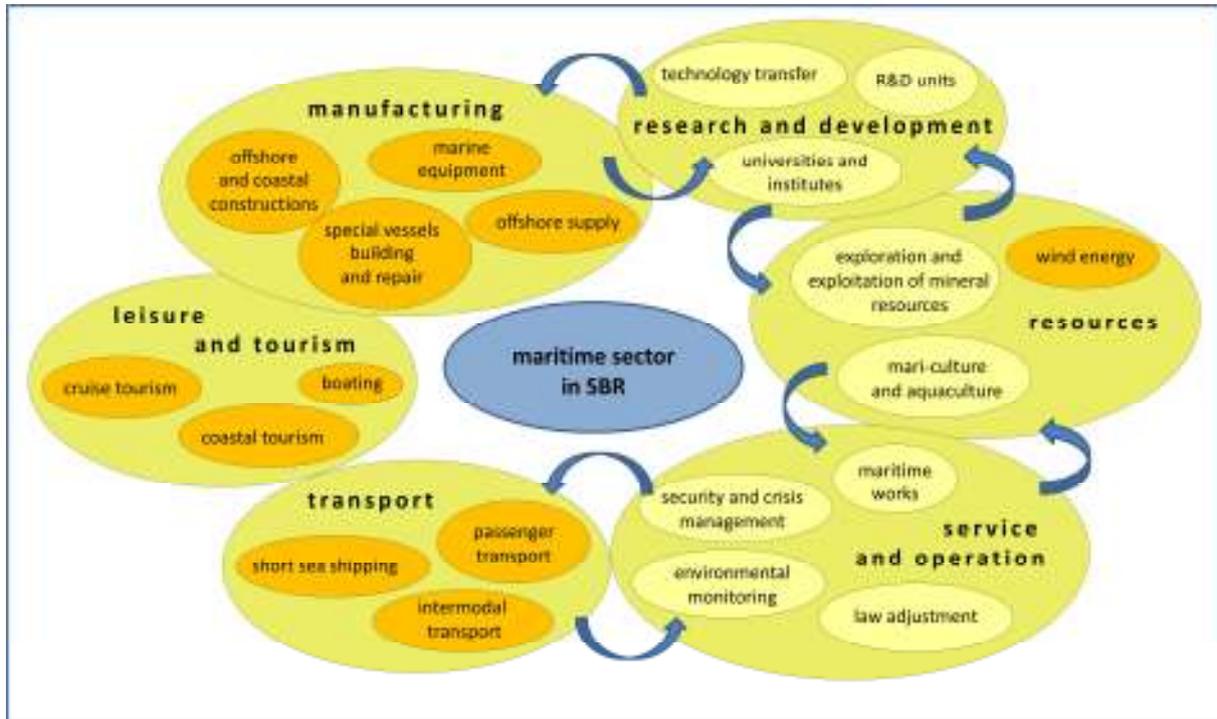


Figure 18. Most promising maritime segments and fields of economic activity in the South Baltic Region in terms of expected future development. Fields with expected high workforce demand are represented in orange ovals. The arrows show the interactions between groups of maritime activities.

High workforce demand is currently being observed and is expected to continue in several segments of manufacturing, especially in those based on innovation and specialisation: **special vessel building and repair** (incl. refitting and conversion), **offshore and coastal construction**, **marine equipment** and **offshore supply**. This particularly concerns highly qualified workers with a technical educational profile (e.g. engineers). The development of this group is dependent on technological progress and requires close cooperation with R&D.

The transport field stays in close connection with services and other operations. Developments in any of these groups will result in a parallel growth in the others as service and operations provide a favourable economic environment for transportation activities and shipping requires efficient management offering a variety of supporting services. Maritime transport - with **short sea shipping** and **passenger transport** in particular - will become a source of job offers as the scale of this type of activity is extremely large. Based on the average age of crew members one can predict a high workforce demand in the ten-year perspective. In this group, **intermodal transport** is of special importance as it responds to EU

environmental requirements. Development of this field of economic activity can have a positive impact not only on coastal and marine areas, but also enhance the development of the hinterlands.

Although **research and development** are not expected to provide a large number of jobs in the close future, it is one of the most important groups for development of the maritime sector. It is a development driver and employment trigger, reinforcing and enhancing the whole sector with new technologies, new solutions and new ideas. Advancements in R&D are mandatory for the future development of the maritime sector. As the source of innovation, R&D has a significant impact on the development of all other segments with a special importance for manufacturing and exploitation of the seabed.

Cruise tourism, boating and coastal tourism activities are expected to create a high workforce demand. This will provide a lot of job opportunities for professional activation of persons with highly developed soft (social) skills.

The future of the maritime sector does not depend on the single most promising segment, but on the large palette of diverse maritime activities (Fig. 18) translating innovation and advanced technology into economic growth and fulfilling the requirements of sustainability. Innovation within the existing segments as well as newly emerging innovative segments will give the SBR a tool for the future development of its maritime sector.

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5. EDUCATIONAL OFFER

Authors: Zbigniew Górski, Janusz Kozak, Gdansk University of Technology, Poland

The considerable unemployment situation among recent graduates or those looking for their first jobs can be considered a motivating factor for updating professional skills or learning new ones. One of the main challenges of the higher education policy of the South Baltic region is ensuring that the current curricula offered by higher education institutions reflects the needs of employers and that young people are prepared to perform successfully in the labour market. The broad availability of quality higher education as a foundation for gaining key vocational competencies is a crucial factor for the successful participation of young people in society. Educational policies as well as information on the maritime-related higher education courses offered in the SB region are presented here. Also presented is a comparison between current educational offers and the areas of anticipated economic development and demand for skilled staff, a comparison which reveals in which areas qualifications may be needed in the future. This information could help lead to revisions both in education policies and curricular contents as well as teaching

5.1 Introduction

The purpose of this section of the Foresight Study is to provide general information on the maritime higher educational offers in the SB region. The particular educational policies and educational offers in countries belonging to the project consortium was investigated and compared based on data included in regional reports produced by the project partners.

Generally speaking the higher education systems and educational standards of the South Baltic regions are of a high level. They produce quite large numbers of highly qualified young people in many different branches and subjects. One of the main challenges of higher education policies is to recognise whether the expansion of higher education has reflected the trends of the labour market and taken into account the specific needs of employers. For this reason it was crucially important for the project consortium to analyse which types of experts are needed in which regions and therefore what specific competence development and exchange programmes should be created and implemented to educate and train effective, mobile and flexible young people across the SBR. One of the overarching **strategic objectives** of the Baltic Sea Region Programme is to strengthen the development towards a sustainable, competitive and territorially integrated Baltic Sea region by connecting potentials over the borders [\[1\]](#).

5.2. SB Region Educational Policies

Higher education in the South Baltic region states is based on guidelines from the Bologna Process. The aim of the Bologna Process was the establishment of a European higher education system by 2010, characterised by structural uniformity, transparency and quality assurance. The Bologna Process aims at a broad and transparent range of study courses and simplified recognition procedures. Standardising regulations for education raises the compatibility and comparability between countries and improves the attractiveness for European and non-European students.

The Bologna Process resulted in comprehensive structural changes in national higher education systems, consisting of a framework of three cycles: Bachelor, Master and Doctorate. The introduction of the European Credit Transfer and Accumulation System (ECTS) enables measurement of student workload and provides a standard for comparing student achievement. Further, the Diploma Supplement was recently introduced. This document specifies the nature, context, level, status and content of successfully completed studies and is tied to a higher education diploma to promote transparency and provide information on qualifications.

In general, higher education is available through various modes of study, including regular daily studies as the predominant arrangement, as well as evening or extramural studies, and those offered through distance learning systems. The high education institutes (HEIs) are dependent on regional governmental authorities and their political regulations.

The higher education policies of each region are tied to the main directions of strategic economic development and the identified priority areas of economic prosperity. For example in Germany higher education policy is mainly focused on:

- maritime technology and transport,
- emerging maritime sub-sectors,
- promoting university-business cooperation,
- promoting interdisciplinary education, and
- strengthening international cooperation.

In Lithuania, the educational policy was put in place by the Parliament and implemented by the Ministry of Education and Science (among others), the Research Council of Lithuania, the State Studies Foundation, and the Centre for Quality Assessment in Higher Education. The educational strategy projects development of Lithuania as a EU member state and identifies three priority areas: a knowledgeable society, a secure society and a

competitive economy. The mission of higher education and research is to help ensure the country's public, cultural and economic prosperity, and to provide support and impetus for the full life of every citizen.

In Poland, responsibility for higher education falls to the Ministry of Science and Higher Education. The ministry allocates funding for statutory activities and research, introduces standards for education on specified courses, reviews the level and scope of education, and organises competitions for research funding. According to Art. 70 of the Polish Constitution, public authorities ensure universal and equal access to education. Learning in schools and public universities is free.

In Sweden, the higher education policy is mainly focused on supplying qualified staff to meet the needs identified by the Swedish Public Employment Service in fields such as engineering, environmental science, renewable energy, ecology, law, and economy as well as supplying professionals in some maritime sectors related professions.

5.3. South Baltic Region's Educational Offers in the Maritime Sector

Higher education in the SBR is generally carried out at institutes such as public and private universities, technical universities, universities of applied sciences or colleges.

The Higher Education Institutions (HEIs) of the SBR offer the following types of studies:

- Vocational course, through which graduates are granted a Bachelor level degree such as Bachelor of Science (BSc), Engineer, or Bachelor of Engineering (B.Eng.) depending on the focus of study.
- Complementary two-year Master-level courses for holders of a Bachelor degree, through which the graduates obtain the degree of Master or equivalent.
- Uniform five-year Master-level courses for holders of a high-school degree, through which graduates are granted a Master-level degree (e.g. M.Sc.).
- Doctoral studies for Master-level graduates, through which graduates obtain the academic degree of Doctor.

SBR universities are currently still in the implementation phase of the Bologna Process. Bachelor and Master programmes were offered at all HEIs in the SBR, sometimes in parallel with expiring programmes such as diploma courses.

Typically, a Bachelor degree requires 180-240 ECTS credits and a Master programme between 90-120 ECTS credits, with a minimum of 60 ECTS at the Master level.

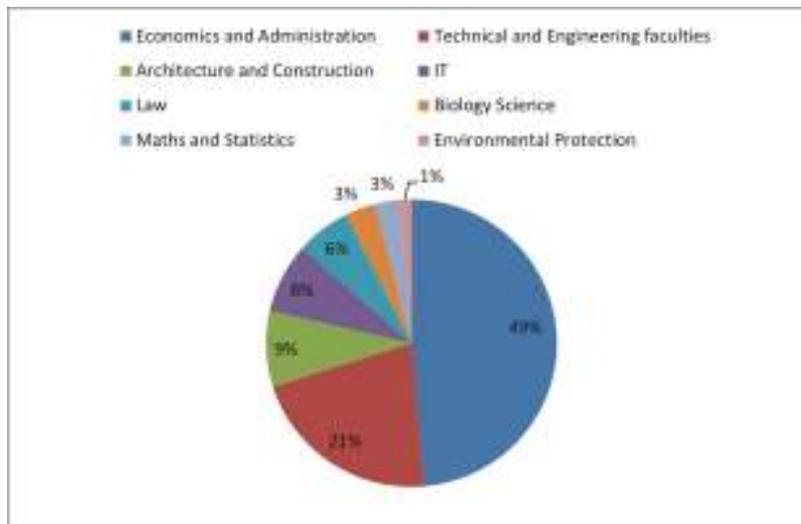
This allows for a flexible approach in defining the length of both Bachelor and Master programmes.

The SBR HEIs offer students a wide range of fields of education. In the 2010/11 and 2011/12 academic years the most popular faculties were:

a) In the Pomeranian region [2] economy and administration, and technical and engineering faculties (21%), while in West Pomeranian region economy and administration, social sciences, and teacher training and education sciences (Fig. 19a),

b) In Lithuania social sciences, humanities, and technological sciences (13%) (Fig. 19b).

a)



b)

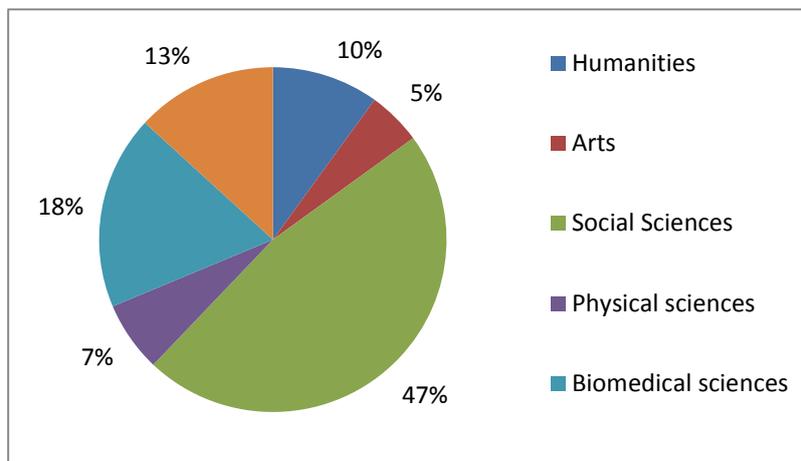


Figure 19. Distribution of Polish (a) and Lithuanian (b) higher education students in the main areas of study.

The data presented in Fig. 19 corresponds quite well to the distribution of Swedish students interests presented in Fig. 20.

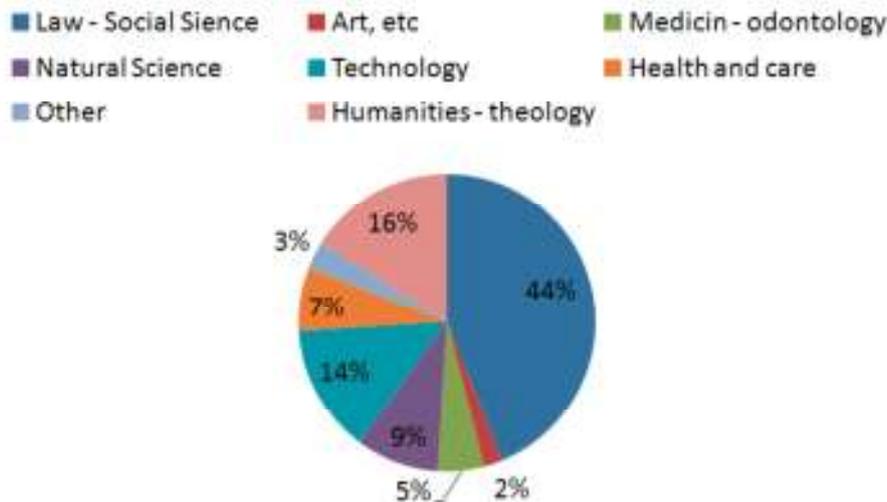


Figure 20. Distribution of Swedish higher education students in the main areas of study.

These data also bear a striking resemblance to those stemming from Mecklenburg-Vorpommern in Germany, where 15.312 students are enrolled at the University of Rostock in 2012, with most students and new enrolments in the Faculty of Mathematics and Natural Sciences and the Faculty of Economics and Social Sciences. The percentage of young people enrolled in engineering science varies between 10% and 25% of students depending on the country.

What are the trends in labour market requirements?

In Germany, key segments of the maritime sector - watercraft industry, offshore wind-energy and marine technology, research and innovation - are considered sectors with great demand for engineers, offering up to a third of the registered job offers in that country. Engineering in Germany is characterised by the development of custom constructions and tailor-made solutions instead of mass production. Solving complex technical questions requires highly qualified engineers. The same is true in the maritime sector. The German Shipbuilding and Ocean Industries Association (VSM) aimed to hire 700 engineers per year by 2010, 25% of them in the fields of naval architecture and ocean engineering.

The Swedish Public Employment Service makes annual analyses and prognoses of the labour market's demand for different professional categories. A labour market index (1-5) is used to show the status of particular job categories. An index above 3 indicates a lack of skilled people, i.e. little competition for existing positions. Below 3 the situation is consequently the opposite, while index 3 indicates a balance between supply and demand. Engineers of various trades and IT specialists fall in the spectrum of lack of skilled people.

Educational offers by regions

Maritime education at the University of Rostock (Germany) mainly concentrates on marine biology (M.Sc.), shipbuilding and ocean engineering (B.Sc. and M.Sc.) and aquaculture (M.Sc.). Furthermore, the University of Rostock provides a broad spectrum of maritime education options in cooperation with associated research institutes such as the Leibniz Institute for Baltic Sea Research Warnemünde, and offers the possibility to conduct Bachelor, Master or Doctor Theses.

The maritime focal areas of the University of Applied Sciences in Wismar and in Stralsund are navigation and ship operation engineering, and economic sciences, electrical and mechanical engineering, respectively.

Lithuanian educational offers in the maritime sector are concentrated in Klaipeda. High quality specialists targeting the maritime labour market are educated at Klaipeda University, the Lithuanian Maritime Academy and Klaipeda State College.

Generally, offers of higher education in the Pomeranian Region (21 universities) are mainly located in two main regions: the cities of Gdansk and Gdynia. The institutions of higher education are of both public and private type. All state universities offer two levels of education – the Bachelor degree and the graduate degree (Master) - while the privately owned universities offer mainly the Bachelor degree. There are also postgraduate studies available in some HEIs.

Universities strictly providing training for the maritime economy are the Gdynia Maritime Academy, the Polish Naval Academy, the various faculties and departments at the Gdansk University of Technology and the Gdansk University. Others, such as the Kwiatkowski Graduate School of Business Administration, provide only partial training (e.g. maritime law).

In the West Pomeranian Voivodeship (Poland) there are 39 universities, of which eight are public. They train at two levels: the Bachelor and Master degrees, with some postgraduate studies also available in some specialties.

Universities that train strictly for the maritime economy are the Maritime University of Szczecin, the various faculties and departments at the West Pomeranian

University of Technology, the Koszalin University of Technology and to a lesser degree the University of Szczecin. Other academic directions included in Tab. 6 also offer potential employment opportunities in certain segments of the maritime economy, but they are not directly associated with it.

Sweden offers a wide diversity of marine and maritime related educational careers, many of them with an environmental profile. In addition to the seven maritime educational programmes directly related to shipping, altogether 82 programmes at the university level (basic and advanced) can be identified as relevant to the marine/maritime sectors. Due to the flexibility of individual study programmes in Sweden, it was not possible within the frame of Generation BALT to collect data on the number of students per programme. The Swedish Higher Education Agency does not have these numbers at hand as many students are registered in more than one programme simultaneously. As for the fisheries sector, professional education in Sweden is primarily given at the pre-academic level. There is one secondary school and one folk high school offering basic fishing education, with a possible second folk high school on the way. Swedish folk high schools are institutions for adult education and certain courses lead to academic degrees. At the university level there is only one specialised programme pertaining to fishing.

Educational offers in the maritime sector in the Kaliningrad region are presented in the report 'Results of the analysis of training in the most promising directions of development of the maritime industry and compliance with their level of skill requirements in the future (taking into account the dynamic development of relevant industries) in the Kaliningrad region'.

The HEIs involved in maritime education in South Baltic region are presented in Tab. 6.

Table 6. HEIs in SB Region involved in maritime education

COUNTRY - REGION	UNIVERSITIES	COLLEGES
Germany – Mecklenburg-Vorpommern	University of Rostock University of Greifswald University of Applied Sciences Stralsund University of Applied Sciences Wismar *	Baltic College
Sweden	Linnaeus University Mid Sweden University Chalmers University Linköping University University of Gothenburg KTH Royal Institute of Technology Stockholm University Lund University Swedish University of Agriculture Karlstad University Umeå University Luleå University of Technology	Halmstad University Kristianstad University Gotland University Mälardalen University
Lithuania	Klaipeda University Lithuanian Maritime Academy	Klaipeda State College
Poland - Pomerania	University of Gdansk Technical University of Gdansk Gdynia Maritime University Naval Academy in Gdynia *	X
Poland - West Pomerania	University of Szczecin West Pomeranian University of Technology Maritime University of Szczecin Koszalin University of Technology *	X
Russia - Kaliningrad region	Kaliningrad State Technical University Baltic Fishing Fleet State Academy	Kaliningrad Maritime Fishing College

* In some South Baltic regions, like Mecklenburg-Vorpommern or the Pomeranian region, research institutes can be found - such as the Leibniz Institute for Baltic Sea Research Warnemünde, an independent research institution specialising in the interdisciplinary study of coastal oceans and marginal seas, or divisions of the Polish Academy of Science – which also offer the possibility of performing a Doctoral programme.

The SBR educational offers relating to the maritime sector segments presented in Chapters 3 and 4 of this Foresight Study are shown in Tab. 7.

Table 7. Segments & Specialisation of Maritime Education corresponding to maritime sector in SB region.

Group	Segments (according to chapters 3 and 4)	Segment of maritime education	Maritime education specialisation
Manufacturing	Watercraft industry (shipbuilding and repair) Marine equipment Offshore supply Coastal protection and construction Innovative maritime industries	Shipbuilding and ship repair Coastal protection and construction Renewable energy	Naval architecture, marine engineering, marine equipment Maritime hydro engineering Renewable energy
Transport	Seaports and logistics	Engineering and economics of transport	Transport, logistics
Resources	Offshore wind energy Exploration and exploitation of the seabed Fisheries and aquaculture	Renewable energy Fishing	Renewable energy Fishing, aquaculture
Service and other operations	Maritime services Maritime works Hydro engineering	Maritime sciences	Shipping, fleet operation
Leisure and tourism	Recreational boating Coastal tourism	Tourism	Tourism and recreation Tourism management
Public segment	Maritime area management and administration Adjustment of law concerning maritime areas Security and crisis management	Law	Maritime Law Environmental Law Security and crisis management
Others	All segments	Environmental science and environmental engineering	Environmental science Environmental engineering Marine biology, ecology

The wide diversity of educational offers in the regions is directly tied to the diversity of baseline situations - historical, economical, current state of national economy, etc.

The educational offers in the SB region are summarised in Tab. 9. The table contains information about the sector of maritime education and specialisation, the type and level of study, ECTS credits and number of courses by country/region.

As can be seen on Tab. 7, there are some educational gaps in each region with regard to some of the maritime segments and specialisations. These gaps point to those areas that present the best potential for development of new educational offers in each region. These offers can fill the gap between the future demands of the economic sector for specialised qualifications and the current skills of recent graduates. It should be noted that the academic gaps apparent in Tab. 2 point to the lack of a full Bachelor or Master Programme in the HEIs, although in some universities single courses on the maritime topics in question can still be found, for example the Faculty of Law at the University of Rostock offers lecture courses on environmental law, public economic law and infrastructural law.

Expert opinions on the prospects for development and expected future demand for qualified specialists in the various segments of the maritime sector point to some very interesting results:

1. Most of surveyed respondents indicated engineering as a leading area of qualifications needed in future.
2. The wind energy sector, which received the highest evaluation as a potential employer, will create demand for a new kind of graduate: multi-skilled, highly qualified engineers.
3. Ecological and environmental problems generate demand for skilled environmental specialists such as environmental engineers and environmental lawyers.
4. Due to their potential for very quick development, the fields of seaports and logistics as well maritime services are expected to generate substantial demand for qualified staff.
5. In maritime area management and administration as well as security and crisis management the demand for qualified specialists is generally expected to be not particularly high, but given the importance of these types of jobs, highly qualified staff is needed.

6. Regionally-specific traditions can also generate demand for qualified staff in segments other than those mentioned above, for example in the area of aquaculture in Mecklenburg-Vorpommern, in boating and tourism in Poland or in the fishing industry in Russia and Sweden.

According to the information shown in Tab. 9, there are only three maritime sector segments in which the educational offers are highly diversified:

- a) Shipbuilding and ship repair: in this case, 14 different courses are offered in Poland, six courses in Lithuania, four in Germany, two in Sweden and two in the Kaliningrad Region (altogether 26).
- b) Environmental science and environmental engineering: here Sweden is the unchallenged leader with more than 40 different courses and only a few available in Poland (nine in West Pomerania and five in Pomerania), Germany (ten), Lithuania (seven) and the Kaliningrad region (six).
- c) Tourism is regularly taught at the higher academic level in Germany (ten courses), Poland (13 courses), Sweden (nine courses) and Lithuania (two courses).

In the fields of engineering and the economics of transport, 21 courses are proposed in Poland, three courses in Lithuania, two in the Kaliningrad region and one in Sweden. No course can be found in this area in Germany.

The specialisation sector in environmental law is not proposed in any of the SBR institutions. Maritime law is taught through one course in Lithuania, Poland and Sweden.

Fishing (including aquaculture) is offered in Germany (one course in aquaculture), Poland (two courses in fishing), the Kaliningrad region (nine courses in fishing and six in aquaculture) and Lithuania (one course in ichthyology and fishery). As previously mentioned, professional education in the fisheries sector in Sweden is primarily given at the pre-university level.

In the area of renewable energy 15 courses are offered in Sweden and one in Germany.

In maritime sciences (shipping and fleet operations), seven courses are offered in Lithuania, seven in Sweden and a single course on shipping and fleet operation is offered both in Poland and in the Kaliningrad region.

Based on the aforementioned findings Tab. 9 and Fig. 21 each present the areas with gaps in educational offers in each region.

Table 8. Gaps in educational offers in the South Baltic region

Region	Gaps in educational offers	
	Main	Secondary
Mecklenburg-Vorpommern	Transport Maritime Law	Logistics Environmental Law
Lithuania	Renewable energy	Aquaculture
Pomerania	Renewable energy Environmental law	Environmental engineering Aquaculture
West Pomerania	Renewable energy Environmental law	Environmental engineering Aquaculture
Sweden	Environmental aw	Aquaculture



Figure 21. Gaps in current educational offers in the South Baltic region

Table 9. The educational offer in the SB regions of Generation Balt Partners (B = BSc, B. Eng, M = M.Sc., MA, M.Eng)

Sector of maritime education and specialisation		Type of study	ECTS credits	Number of courses by country/region						Russia/ Kaliningrad Region
				Sweden	Germany/Mecklenburg-Vorpommern	Poland		Lithuania		
Sector	Specialisation on				West Pomerania	Pomerania				
Shipbuilding and ship repair	Naval architecture and marine engineering / marine equipment	B	180-210	-	2	3	4	3	2	
		M	120-300	2	2	1	6	3	-	
Environmental science and environmental engineering	Environmental science	B	180-210	8		4	2	1		
		M	120-300	10	5	3	1	1		
	B	180-210	4		1	1	-	-		
	M	120-300	5	1	1	1	1	5		
	B	180-210	2		2	-	1	-		
	M	120-300	3	1	2	-	1	-		
Engineering and economics of transport	Ecology	B	180-210	4	1	-	-	1	1	
		M	120-300	7	2	-	-	1	-	
	B	180-210	-	-	5	5	-	-		
	M	120-300	-	-	1	3	2	-		
Law	Maritime law	B	180-210	-	-	-	-	-	-	
		M	120-300	1	-	-	1	1	-	
Law	Environmental law	B	180-210	-	-	-	-	-	-	
		M	120-300	1	-	-	-	-	-	

Sector of maritime education & specialisation		Type of study	ECTS	number of courses by Country/ Region					
Sector	Specialisation on			Sweden	Germany/ MV	Poland		Lithuania	Russia/ Kaliningrad Region
Fishing	Fishing	B	180-210	-	-	2	-	-	8
		M	120-300	2	-	-	-	1	1
	Aquaculture	B	180-210	-	-	-	-	-	6
		M	120-300	-	1	-	-	-	1
Tourism	Tourism and recreation	B	180-210	3	1	8	1	1	-
		M	120-300	3	3	2	-	-	-
	Tourism management	B	180-210	3	3	1	1	-	-
		M	120-300	-	3	-	-	1	-
Renewable energy	Renewable energy	B	180-210	5	1	-	-	-	-
	Renewable energy	M	120-300	10	-	-	-	-	-
Maritime sciences	Shipping	B	180-210	7	-	1	1	4	1
	Fleet operation	M	120-300	-	-	1	1	3	-

General conclusions

Results of the Foresight Study pointed out the most promising segments in the maritime economy labour market. This in turn allowed to formulate further projections concerning the most adequate future educational offers in order to fulfil the requirements of the future labour market.

A comparison between the current educational offers in HEIs of the SBR and the anticipated directions of economic development and demand for skilled employees reveal leading areas in which qualifications will be needed in the future.

The field of renewable energy – mainly offshore wind energy (solar energy as well as tide and wave energy to a lesser extent) – is expected to be the fastest growing segment and the one with the most demand for highly skilled staff. This field is also one of the areas with a visible gap in educational offers in the South Baltic regions of Poland and Lithuania.

Building of technical/special ships like offshore supply vessels as well as gas powered car and passenger ferries and of new types of marine equipment requires and will continue to require highly qualified engineers. The educational offers in the SBR do appear to meet the challenges in this field.

The demand for highly qualified staff is expected to remain significant in the areas of transport and logistics due to the growing importance of maritime transport (self-contained) and as a part of intermodal transport. However, transport and logistics as well as shipping and fleet operations are missing areas among the educational offers in the Mecklenburg Vorpommern region.

In the legal sector, specialisations in environmental law are not proposed in any of the SB regions. The significant role of environmental protection in the Baltic Sea will require special knowledge of the law connected with the environment along with exploration of eco-innovative solutions and devices.

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6. CONCLUSIONS AND RECOMMENDATIONS

Authors: Kamila Mianowicz, Agnieszka Strzelcka, Karina Tessar, Artur Skowronek, Michał Tomczak, Sławomir Dobosz, University of Szczecin, Poland

Bressler Ingrid, Legrand Catherine, Linnaeus University of Kalmar, Sweden

Görs Manuela, Hansen Frank, Graf Gerhard, University of Rostock, Germany

Zbigniew Górski, Janusz Kozak, Gdansk University of Technology, Poland

Marek Szymański, Piotr Dwojacki, Longina Ruszczyk-Czajor, University of Business and Administration, Gdynia, Poland

Mickeviciene Rima, Paulauskiene Tatiana, Klaipeda University, Lithuania

Paulavičienė S., Baužytė Rasa, Klaipeda Science and Technology Park, Klaipeda, Lithuania

Leonid Meyler, Baltic Fishing Fleet State Academy, Kaliningrad, Russia

According to legal regulations, the educational offers of the South Baltic Region should meet the common interests of all the regions. However, the need for an individual approach should not be forgotten given the diversity that forms the building blocks of this region's future potential. While each region has its own areas of specialisation in the maritime economy, the German maritime sector can be recognised as the most comprehensive. The more diverse the academic offers in the region, the stronger and more competitive we can expect it to become. The educational offers should be complementary to the present and future labour market requirements, both in terms of new courses and innovation within existing ones. Innovation, internationalisation and an individualised and interdisciplinary approach are the key solutions that should be taken into account by the business units, educational authorities and policy makers to ensure the success of the SBR

The maritime sector is a unique network of economic activities, interconnected through research and development and dependent on the proper education of the young people who go on to form the labour force. The adjustment of the educational offers to the present and expected maritime sector workforce demands is a key factor determining not only the success of this sector and its role in the SBR economy as a whole, but also the development potential of particular regions of the SBR. While underlining the international character of the Baltic Sea and emphasising the need for cohesive and consistent political strategies across the whole region, it is necessary to support the regions' development in a way that promotes a diversified breadth of maritime economic activities. Unification of the educational and economic environments across the SBR is needed but the regions' specialisation should also be fostered. A diversification of economic activities is the only way

to improve SBR competitiveness at the international level and can be an efficient tool in critical situations, including the ongoing global economic crisis. Although this economic crisis has had a strong negative impact on the SBR maritime labour market, it also served as a trigger for structural changes that resulted in increased competitiveness of the region. Restructuration can also result in an increased workforce demand in the newly emerged maritime segments and in those maritime industries that have successfully adjusted to the new economic situation. Despite the crisis and the difficult situation of some of the maritime segments (e.g. watercraft industry), according to the results of this foresight study, the future of the maritime sector as a whole can be considered as optimistic.

While analysis of the maritime labour market and of the professional expertise of the maritime workforce across the regions showed comparable results, some differences were nonetheless detected. The area of offshore wind energy is the unquestioned leader in terms of expected future development and workforce demand (Tab. 10). This is followed by segments relying heavily on innovation: e.g. offshore supply, exploration and exploitation of the seabed or generally innovative maritime industries. Their development will result - to some extent - from changes in the international (European) law, especially regarding environmental issues. The need to adjust our technological solutions to new regulations is expected to generate high workforce demand.

According to maritime experts the adjustment of the law concerning maritime areas does not belong among the most promising segments (last position in the questionnaire analysis). However, results of the labour market analysis contradict this finding and underline the urgent need to (1) implement the EU regulations on local and regional scales and conditions and (2) translate the legislation into operative directives. These processes will create workforce demand, especially within the group of highly qualified maritime experts. Although an immediate effect on employment is not anticipated, changes in the law could subsequently trigger the development of other segments and, as a result, influence the labour market. Highly surprising here is the poor assessment of this segment by maritime experts. To some extent it can be explained by the lack of information and promotion of the legislative aspects of every activity undertaken in maritime areas.

Table 10. List of maritime segments according to their potential workforce demand (source: Questionnaire analysis). Promising fields of activities based on the labour market analysis, are given in brackets.

	Segment of the maritime sector
1	Offshore wind energy
2	Offshore supply
3	Seaports and logistics (intermodal transport, passenger transport, short sea shipping)
4	Exploration and exploitation of the seabed
5	Innovative maritime industries
6	Maritime services
7	Hydro engineering
8	Security and crisis management
9	Marine equipment
10	Watercraft industry (special vessel building, ship repair)
11	Maritime works (e.g. dredging works, dredged material management)
12	Coastal protection and construction (offshore and coastal constructions)
13	Coastal tourism
14	Recreational boating
15	Maritime areas management and administration
16	Fisheries and aquaculture
17	Adjustment of law concerning maritime areas

The labour market analysis showed that the maritime sector in the SBR is far from cohesive. All countries differ in terms of strategic segments, maritime policies and level of development. These dissimilarities translate into slightly different assessments of the particular maritime segments both in terms of development possibilities and workforce demand (Tab. 11). Although offshore wind energy, seaports and logistics, exploration and exploitation of the seabed, offshore supply and other innovative industries scored high in all

regions, in almost every region there is at least one unique segment expected to create high workforce demand.

The expert assessments concerning prospects for **Germany** are valid for the whole SBR. The list of the five most promising maritime economy segments in Mecklenburg-Vorpommern is to a high degree consistent with the list compiled for the entire region (compare column 2 of Tab. 11 with Tab. 10), also with regard to the order of the segments. Offshore wind energy is followed by offshore supply, seabed exploration and exploitation, innovative maritime industries and maritime services. The segment of seaports and logistics is the only difference: in Germany this sector was placed in 7th position in terms of workforce demand, while in the SBR as a whole it comes up as 3rd. Nevertheless, the German expertise is considered to reflect the ongoing trends in the whole South Baltic Region and can fulfil a role as a type of maritime sector barometer.

Sweden is the only region to recognise the importance of law adjustment concerning maritime areas. This segment ranked first in terms of workforce demand (Tab. 11). This unique result can be an effect of a socially advanced society, one highly respecting of the social and environmental aspects of economic development.

Table 11. List of maritime segments expected to create the highest workforce demand in South Baltic regions. The blue fields indicate the unique segments for each region. Source: Questionnaire analysis.

	Germany	Sweden	Poland	Lithuania	Russia
1	Offshore wind energy	Adjustment of law concerning maritime areas	Offshore wind energy	Innovative maritime industries	Fisheries and aquaculture
2	Offshore supply	Offshore supply	Recreational boating	Watercraft industry	Innovative maritime industries
3	Exploration and exploitation of the seabed	Exploration and exploitation of the seabed	Coastal tourism	Seaports and logistics	Offshore wind energy
4	Innovative maritime industries	Offshore wind energy	Exploration and exploitation of the seabed	Offshore wind energy	Seaports and logistics
5	Maritime services	Maritime services	Hydro engineering	Marine equipment	Coastal protection and construction

In **Polish** Baltic Sea regions, experts expect maritime and coastal tourism to provide a substantial number of job offers in the close future. The development of these segments is possible thanks to superb environmental conditions: the longest shoreline among the SBR regions, numerous clean beaches (important for passive tourism) and multiple tourist destinations. Over the past couple of years a fast improvement in the infrastructure supported by EU funds has been observed. Moreover, local societies seem to willingly get involved in the development of tourism activities.

The watercraft industry is one of the most promising segments in **Lithuania**. This traditional industry recently underwent a deep restructuration and currently focuses on ship repair, refitting and special vessel building. High production specialisation and cooperation with innovative maritime industries can be a potential source of high workforce demand.

The **Kaliningrad** region maintains a role as a major Baltic Sea fishing centre and a hub for training in general fisheries and fishing technology. It is also strong in fishing equipment production. This is where the main fisheries academic institutions in Russia are located. Over the years it had trained hundreds of specialists that are now employed all over Eastern Europe and Russia.

The regional diversity of maritime activities is a positive phenomenon that can bring a lot of profits from the economic point of view. As underlined in the labour market analysis, the **future of the maritime sector does not depend on the single most promising segment, but on the large palette of diverse maritime activities**. The specialisation of regions is the only way to achieve this goal.

Linking maritime education with the changing job market: Recommendations

Maritime educational offers in the SBR are diversified but do not entirely cover the needs of the labour market. This misalignment is especially noticeable when it comes to innovative technologies, innovative solutions within existing industries and legislative aspects of maritime activities. Considering the recent and quite rapid changes in the maritime education sector, this is not surprising. But steps should be taken to fill the existing gaps. The strategy of making the educational offers complementary to the labour market should involve not only new courses and fields of study, but also restructuration of existing ones to make them a better fit to the present and future market demands. Since the maritime sector is changing its profile from mass production towards specialisation, high technology and innovation, the educational offers should respond to these changes.

The "I 4 maritime sector" strategy is based on four main focus areas that combine all the actions aiming at linking maritime education with the labour market. These are: implementable innovation, individual approach, interdisciplinary approach and internationalisation. This strategy is meant to answer the question: What can I do for the creation of a new generation of maritime experts? "I" can be understood in different ways and different aspects: I as a student, I as a teacher, I as a high education institution, I as a policy maker and I as the employer. The success of the maritime education depends on the personal involvement of all of us.

The I 4 the maritime sector strategy consists of recommendations for students, teachers and educational authorities, and business units grouped in four focus areas. All details can be found in the Tab. 12.

Table 12. Details of the I4 Maritime Sector Strategy.

I 4 MARITIME SECTOR STRATEGY	
<p>IMPLEMENTABLE INNOVATION</p>	<p>General recommendations:</p> <ul style="list-style-type: none"> • According to EU policy and referring to the latest economic trends, the role of innovation in the maritime sector should be increased. Innovation is a competitive advantage that cannot be missed. The emphasis on practical aspects of innovation should be highlighted in both education and business. • Implementation of innovations within different segments of the maritime sector is necessary to boost their development in the SBR. Improved mutual cooperation of R&D units with business is then required. • It is worth remembering that following best practices, especially concerning implementation aspects, can remain innovative when the practices are applied to other regions. <p>Recommendations for students:</p> <ul style="list-style-type: none"> • Study now and think for the future. Choose wisely your educational path. Innovative courses and studies can bring a lot of profits to your future professional career. • Think for the future but act now. Don't be afraid to be creative and innovative. Try to put your ideas and solutions into practice.

	<p>Recommendation for teachers and academic authorities:</p> <ul style="list-style-type: none"> • Make efforts to complement educational offers with new courses covering the breadth of innovative maritime topics and bring innovation into existing ones. Be, at the very least, up to date. Emphasize the implementation aspects of innovation. • Teach students how to put their innovative and creative solutions and ideas into practice. Show the way from formulation of a brilliant idea to a useful patent. • The process of teaching should be more creative to increase the curiosity of students and make them more interested in real world knowledge applications. • Follow best practices. Although the innovation of educational offers has to be in accordance with laws that differs in particular regions of the SBR, some effective solutions already in existence in other regions can be recommended and implemented when adjusted to local conditions. <p>Recommendations for business units:</p> <ul style="list-style-type: none"> • To implement innovation in your business activity, cooperate with research institutes and get involved in the teaching process. Help to educate your future staff. • Offer internships and feel responsible for you interns. Students can bring freshness to your company. They usually think beyond schemes and can be a source of creativity and innovative solutions. Help them gain all the practical skills and competences that will increase their competitiveness in the future labour market. It is a cliché, but practical work is often the best teacher.
<p>INTERDISCIPLINARY</p>	<p>General recommendations:</p> <ul style="list-style-type: none"> • An interdisciplinary approach opens up new possibilities for the maritime sector. New specific knowledge can be the result of combining multiple fields and disciplines. It can be then applied, boost the innovation process and increase competitiveness of the maritime sector. <p>Recommendations for students:</p> <ul style="list-style-type: none"> • Gain high competences in your main field of professional activity but be open to other ones. Participate in complementary courses, search for new ideas and solutions in other fields of science and business, extend your knowledge and interests.

	<ul style="list-style-type: none"> Remember that you will probably be working with specialists of various professions and operate within different fields of economic activity. Broad basic knowledge and broad horizons will provide the competences necessary to work in an interdisciplinary business environment. Considering recent trends observed in the labour market, it is very likely that you will be changing your job several times during your professional career. Be open-minded. An interdisciplinary approach to your education, lifelong learning and the will to retrain can provide you with professional flexibility and increase your value as a potential employee. It is you who should fit the labour market requirements, not the other way round. <p>Recommendations for teachers and educational authorities:</p> <ul style="list-style-type: none"> Provide a comprehensive educational offer with a combined approach: merge various topics, ideas and fields related to the maritime sector. It will trigger more creative and efficient use of gained knowledge. Some particularly important topics related to the maritime sector can be taught regardless of the main focus of studies. It is recommended to give the students basic knowledge on the environmental and legal aspects of maritime activities. Prepare your students to cooperate with specialists of various fields. <p>Recommendation for business units:</p> <ul style="list-style-type: none"> Extend your recruitment strategy and take into account specialists who represent various types of education and experience. Headhunt in various social groups. Through the employment of workers from different disciplines, a company can benefit from a wider range of competences, qualifications and a palette of new, surprising points of view. The activities of interdisciplinary teams of specialists give the companies more opportunities to put innovative and unique solutions into operation.
<p>INDIVIDUAL</p>	<p>General recommendations:</p> <ul style="list-style-type: none"> Nowadays both students and teachers should be aware that the individual approach to education is one of the deciding factors regarding the competitiveness of employees.

	<p>Recommendations for students:</p> <ul style="list-style-type: none"> • To make your professional competences more effective, it is really important to develop individual soft skills, such as the ability to work independently and in a group. Creativity is a skill that is sought after by potential employers. It is of crucial importance for implementing innovative solutions. • Remember that self-development can bring you a lot of professional profits. Improve your personal skills and competences. • Remember that specialised knowledge and practical skills are important but it is your professional experience that cannot be underestimated. Internships in maritime sector companies will give you a lot of advantages and increase your value on the future labour market. <p>Recommendations for teachers and educational authorities:</p> <ul style="list-style-type: none"> • Prepare a wide educational offer that covers a variety of topics and fields and let the students choose according to their profile of interests. Let the students develop their individual interests. Support their individual activities. • Educational offers should be individualised to match the demands of different maritime sector segments. • Remember the highly specialised and individualised demands of some segments of the maritime sector. Be prepared to change the educational profile according to the changing labour market requirements. Address the individual issues and topics within the maritime sector and focus on them. • The supply of workers should fit the demands of individual maritime segments.
<p>INTERNATIONAL</p>	<p>General recommendations:</p> <ul style="list-style-type: none"> • The international nature of the SBR is emphasized. It requires cohesive actions in the whole region as regards politics, development strategies, economy, law and environmental protection. • Harmonisation of educational offers on the SBR or even European level is necessary to meet the demands of the international labour market. Not only should the educational systems be comparable, but the educational offers must be comprehensive and complementary on the South Baltic regional scale. <p>Recommendation for students:</p> <ul style="list-style-type: none"> • International communication skills, fluency in foreign languages, ability to work in international teams of professionals and experts increase your value on the labour market and make you more competitive.

	<ul style="list-style-type: none"> • Take your chance and go study abroad, let the international student exchange be a starting point for your mobility and flexibility. It is very likely that your future career will require you to be spatially and professionally mobile and flexible. • Show that you are not afraid of political, economic and cultural frontiers, barriers and limits. Moreover, finding yourself in a foreign environment is the best teacher for dealing with stressful situations, acting under pressure and improving your creativity and independence. • Remember, the labour market is not limited to your own yard, town and region. <p>Recommendations for teachers and educational authorities:</p> <ul style="list-style-type: none"> • Teach students how to be mobile and flexible. Underline the international aspects of the Baltic Sea, show the need for international law, development strategies and planning. • Contact and interactions between universities and authorities as well as with policymakers is required to create and implement an international approach to maritime education. <p>Recommendations for business units:</p> <ul style="list-style-type: none"> • While professional expertise is the most important factor when headhunting, students with international experience can bring a lot of profits to your company. Increased mobility and flexibility, curiosity, and an open mind are just a few of their personal advantages. • Don't be afraid to hire foreigners if they fulfill your requirements.
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The maritime sector has strong potential for development. Our economic expansion towards the seas and oceans is reinforced by the limited resources on land. Although our knowledge of marine ecosystems has drastically improved in the last few decades, the seabeds belong to the most poorly understood areas on the planet. These hide potential for future economic growth that can later be translated into social welfare. In order to fully exploit this potential and maintain the ecologic balance, a new generation of maritime - including Baltic Sea - experts is needed. Their professional competences and skills have to be tailored to the present and future market demands. Of course, the professional expertise is the front line competence, but several other competences and skills have to be developed by graduates to fully meet the requirements of the changing maritime labour market.

APPENDIX: NOTES ON WIND ENERGY IN DENMARK

Author: Frank C. Hansen

Preamble

The present Foresight Study identifies offshore wind energy as the most promising segment with respect to future development and future demand of experts within the maritime sector in the South Baltic region. Since Denmark does not belong to the core area of the South Baltic Region it was not included in our analysis. However, Denmark is a very important country with respect to wind energy utilisation in the Baltic Sea region. Therefore, we add here some notes on wind energy in Denmark based on a desktop study.

The results presented in this section (including figure) are based on information and documents from websites, which are listed at the end of this paper under **References**.

Introduction

With the adoption of the “EU Directive on the promotion of the use of energy from renewable sources” (RES, 2008/2009) the EU has set itself the ambitious target of a 20% share of renewables in final energy consumption. The binding national targets for the member states range from 10% (Malta) to 49% (Sweden) to be achieved by 2020. Denmark shall increase its renewable energy share from 17% (2005) to 30% (2020).

Wind energy is of increasing importance for reaching this goal within the EU. While it took about 20 years to install the first 10 GW, half of the present wind power capacity has been installed over the past six years. The European Wind Energy Association (EWEA) recently reported that the European Union had passed the milestone of 100 Gigawatt (GW) of installed wind power capacity. This is equivalent to an energy production of approximately 39 nuclear power plants and can meet the energy consumption of 57 million households.

This results in a growing wind energy sector with increasing importance for economy and jobs in Europe. EWEA estimated that jobs in the offshore wind sector will increase almost five-fold from 35.000 people (2010) to 17.000 in this decade. Offshore wind energy is one of the key elements of future economic activity around Europe’s coasts (Blue Growth concept). To cope with the technological challenges, the European Union supported the establishment of The European Technology Platform for Wind Energy TPWind and numerous R&D projects.

Development of Wind Energy in Denmark

Denmark is a small country, however with a large potential for wind energy use due to its geographic location, topography and coast length. Denmark was a pioneer in developing commercial wind power in the 1970s. The first commercial offshore wind farm ever was installed in Denmark in 1991. In relative terms, Denmark is one of the leading producers of wind energy in the world. Comparison of specific wind energy production in Denmark and Germany (energy produced per energy capacity installed) reveals a considerably higher effectiveness (29% on average) in wind energy production in Denmark. One reason for that may lie in a higher share of coastal and offshore farms that profit from higher wind speed environments. Today almost 50% of all wind turbines around the world are produced by Danish manufacturers. The market is dominated by a few large companies such as Vestas, Siemens-Offshore and Dong Energy.

According to the RES Directive (see above), Denmark shall increase its renewable energy share from 17% (reference 2005) to 30% in 2020. The new Danish Government (since autumn 2011) led by prime-minister Helle Thorning-Schmidt declared its wish to considerably extend wind energy production in Denmark: 50% of Denmark's total energy consumption should come from wind energy production by 2020. This target is expected to be achieved through new wind power turbines installed offshore or near the coast. Indeed, Denmark has managed to increase its capacity in wind energy during the past two decades by a factor of twelve (see Fig. 22).

At present, two large offshore windparks in the regions of Anholt (Kattegatt) and Kriegers Flak (ca. 30 km south of the Swedish city of Trelleborg) are under construction. The Anholt windpark has just started to produce electricity and will eventually produce 400 Megawatt (MW) when it becomes Denmark's largest offshore windfarm.

Kriegers Flak Windpark will be constructed in transnational cooperation between Denmark, Sweden and Germany and, according to plans, will go into operation between 2018 and 2020. This giant windpark has a planned power production of 600 MW and will, for the first time in Europe, have its own offshore power grid. This single windpark alone would increase the Danish wind energy share of electricity production up to 42 percent.

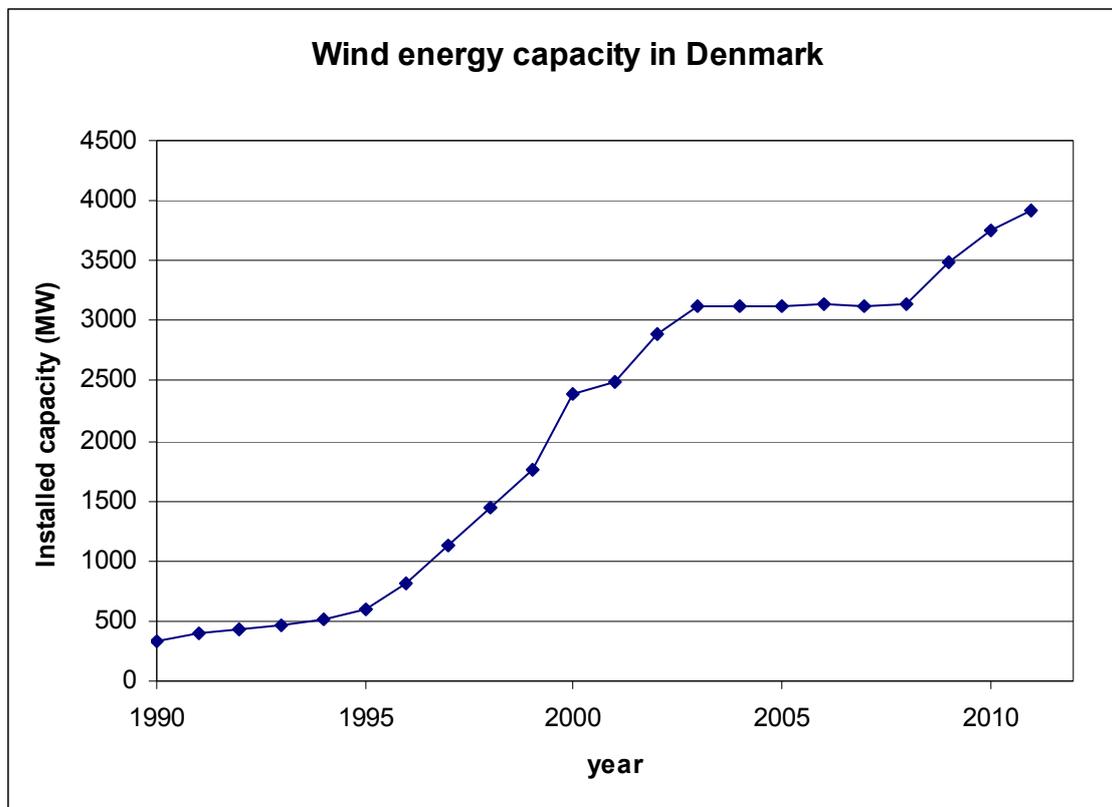


Figure 22. Installed wind capacity in Denmark from 1990 – 2012

Research and Education

To meet these ambitious plans, Denmark has put high efforts in research and development as well as in the education and training of the skilled professionals needed today and in the future.

An institution of major importance in this area is the Danish Technical University (DTU). To our knowledge, DTU is the only university worldwide which offers a full two-year Master of Science programme in wind energy. This programme closely involves teachers from the wind energy industry and qualifies students to analyse, design, develop and operate future wind energy systems. Together with Delft University of Technology, the Norwegian University of Science and Technology and the Carl von Ossietzky University Oldenburg (Germany), a new Erasmus Mundus European Wind Energy Master (EWEM) has been initiated. The DTU Department of Wind Energy manages a Ph.D. graduate school. The Ph.D. programme has attracted about 50 international graduate students. In addition, several high quality training courses are offered. The DTU Department of Wind Energy in Roskilde has more than 230 employees and is doing forefront research in aeroelastic design,

composite materials, fluid mechanics, materials science and characterisation, meteorology, test and measurements, wind energy systems and wind turbine structures, and it has access to the National Test Centre for Large Wind Turbines. A listing with links to institutions offering educational programmes relating to wind energy in Denmark are provided by the website Talentfactory: <http://www.talentfactory.dk/>

Baltic Projects on Wind Energy including Denmark

An ongoing project (2010–2013) solely about offshore wind energy is the “South Baltic Offshore Wind Energy Regions” (SB OFF.E.R) project with ten partners and nine associated organisations from Germany, Denmark, Sweden, Lithuania and Poland. The Danish partner is the DTU Department of Wind Energy. Project activities aim at fostering the establishment of offshore wind energy and promoting cross-border offshore wind energy business development in the South Baltic region.

Major outcomes so far are a South Baltic Wind Atlas providing important information on wind resources for planning offshore wind projects and a Business Cluster Map giving an overview and description of companies involved in the offshore wind industry in the South Baltic region.

One component of the SB OFF.E.R project deals with skills and recruitment activities and aims to increase the supply of specialists to match the demands of the offshore wind industry in the SB region through e.g. courses, career events and proposals for future qualification offers. For more details see the SB OFF.E.R project website: <http://www.southbaltic-offshore.eu/>

Another important ongoing project (2010-2013) in this field is „Wind energy in the Baltic Sea Region 2” (WEBSR2), a follow-up project of WEBSR. This project started in 2003 with a large consortium of institutions from Germany, Poland, Lithuania, Sweden, Estonia, Latvia, Finland, Russia, Norway and Denmark initiating extensive networking and facilitating know-how transfer between the Baltic Sea region countries with respect to wind energy planning, production and development. Project activities centre on identifying and overcoming legal and economic obstacles for existing and future wind energy projects, finding wind energy storage solutions and promoting wind energy. The project “WEBSR2 upgrade” tries to overcome scepticism and promote people’s acceptance of wind energy by combining wind energy with an artistic approach.

Jobs

Around 100.900 people are currently employed in the wind energy sector in the EU and in Denmark approximately 23.500 employees work in wind turbine and blade manufacturing and in major sub-component corporations (2008). Given the ambitious plans for developing wind energy in Denmark, a high demand for skilled employees and large job opportunities in this sector can be envisioned. The above mentioned website <http://www.talentfactory.dk/> informs about career opportunities in a number of larger companies located in Denmark. Job opportunities in European countries including Denmark, as well as outside Europe, are provided via the website <http://www.windindustryjobs.com/> sorted in the categories “functions”, “locations” and “sectors”.

Networking

More than 240 members across Denmark, including wind turbine manufacturers, energy companies and companies that provide components, services and consultancy are organised in the “Danish Wind Industry Association (DWIA)”. The DWIA is an organisation that promotes member interests nationally and internationally and enables the sharing of knowledge and experiences among members.

On a European level, the “European Wind Energy Association (EWEA)” is a large network of 42 members from Denmark (November 2013) and about 700 members in total (key players within and outside the wind energy industry). EWEA works with political issues, is involved in projects and organises campaigns and events. One of the EWEA working groups focuses on offshore research and deployment.

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