



# Blue Economy. A Manual for VET Teachers, Trainers, Career Counsellors, Learners and Professionals



# Career Guidance in Blue Economy

Cooperation for innovation and exchange of good practices

Strategic Partnerships for vocational education and training

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## BeBlue

Textbook for Online Training Course in Blue Economy

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<b>Authors</b>	Nicoleta ACOMI, Ovidiu ACOMI, Laurentiu IVANOV, Max SCHMIDLE, Medine GÜNEY, Mehmet Ali SAVCI, Hüseyin Selami KAYA
<b>Abstract</b>	<p>The blue economy is the specific part of the economy that focuses on the sustainable use of oceans, seas, and coastal resources. It includes well-established sectors such as fisheries, coastal tourism, maritime transport, marine extraction of oil and gas, as well as the emerging offshore wind industry. In addition, other promising sectors such as blue biotechnology, deep-sea mining or desalination are part of the blue industry.</p> <p>With so many application areas, the blue economy provides 4.5 million direct jobs and generates over 650 billion EUR in turnover. From this perspective, the scope of this textbook is to offer learners the required details for planning and upskilling a career in this industry. The course is intended to give an overview of each sector including general information, job categories, and opportunities for training as well as tips for trans-sectoral employability.</p>

	<p>A distinct chapter is added to emphasize the tools and instruments for career guidance, monitoring progress, and mentoring.</p> <p>This course is designed for two categories of personnel: learners/ prospective employees gain an understanding of the blue economy job sectors, while career counsellors enhance their professional toolbox with instruments for career guidance.</p>
<b>Keywords</b>	<p>Blue economy, fisheries, aquaculture, coastal tourism, maritime tourism, maritime transport, ports, shipbuilding, offshore oil and gas, offshore wind, ocean energy, blue biotechnology, deep-sea mining, desalination, career opportunities, career guidance, mentoring, career plan, SMART objectives, career map, job opportunities</p>

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## SUMMARY

The global economic potential of the Blue Industry is immense, generating in the EU approximately 5.4 million jobs and almost 500 billion euros per year. The training course in the blue economy presents the main sectors as employment and growth contributors.

Blue Industry comprises all sectors connected to seas and oceans, regardless of whether the activities take place on the sea or the land. These include fisheries, coastal tourism, maritime transport, marine extraction of oil and gas, the offshore wind industry, blue biotechnology, deep-sea mining or desalination as well as research, development, and education.

The introductory chapter of this textbook provides an overview of each blue industry sector with the intention to guide future professionals in choosing their careers.

Willing to give prospective employees and high school learners deep information about the sector, job opportunities and training centres offering specialized courses, the textbook presents eight distinct chapters. Each chapter emphasizes the professional paths of those who would like to explore new job opportunities or start a career in one of these sectors. In addition, due to the transferability of skills and competencies, professionals working in blue economy sectors have the chance to move horizontally from one sector to others. For this purpose, the trans-sectoral working section of each chapter highlights a few directions that can be considered.

Evaluation can have many purposes, from collecting information, rating students, or gathering data as part of personnel decisions. Few questions are included in the evaluation section of each chapter to offer suggestions on the main points of the chapter.

For those preferring to learn more about the blue economy sectors, reading and video resources are available in the supplementary reading section. Moreover, self-reflection questions give the opportunities to stop and be reflective about the learning that has taken place or be curious to further explorations.

The last chapter of this textbook refers to career guidance and mentoring. Depending on the experience, professional skills, and intention, each person can be a mentor or mentee. The tools included in this chapter offer the chance to have structured discussions while following a flow of mentoring. It is an invitation to career counsellors to use the good practices and tools collected by the authors for guiding their learners and professionals in planning and growing their careers.





## OVERVIEW OF THE BLUE ECONOMY

The blue economy is one of the largest industries comprising all economic activities related to oceans and seas. It includes well-established sectors such as fisheries, coastal tourism, maritime transport, marine extraction of oil and gas, as well as the emerging offshore wind industry and other promising sectors such as blue biotechnology, deep-sea mining, or desalination.



Fisheries, aquaculture and processing



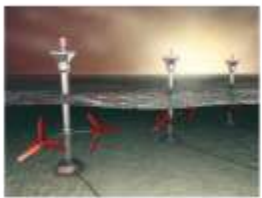
Coastal and maritime tourism



Maritime transport, ports and shipbuilding



Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Source: European Commission

Blue biotechnology



Source: UNEP in Asia and the Pacific

Deep-sea mining



Source: Junglin Kim et al. 2019

Desalination

## The place of the blue economy

The Blue economy covers a wide range of interlinked established and emerging sectors. According to the World Bank, the blue economy is the "sustainable use of the ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem."

European Commission defines it as "All economic activities related to oceans, seas and coasts. It covers a wide range of interlinked established and emerging sectors."

The 2030 Agenda for Sustainable Development outlines the important role of the blue economy, through the Sustainable Development Goals - SDG 14, which focuses on the conservation and sustainable development of seas, oceans, and marine resources, including seas, lakes, rivers and oceans.

## Fisheries, aquaculture and processing

Global seafood consumption has more than doubled in the past 50 years. Fishing is one of the oldest blue economy sectors, together with shipping. Aquaculture refers to the farming of fish, shellfish, algae and other aquatic organisms and takes place both in inland and marine waters. The increase in demand for seafood and the fisheries sector whose potential for expansion depends on the sustainable exploitation of resources have made aquaculture a fast-growing economic sector around the world. Processing refers to enterprises whose main activities are the "processing and preservation of fish and fish products".

## Coastal and maritime tourism

As part of the EU's blue growth strategy, the coastal and maritime tourism sector has been identified as an area with special potential to foster a smart, sustainable and inclusive Europe. Employing more than 2.2 million people, the sector is by far the biggest employer in the blue economy (accounting for 54 % of jobs in the established blue economy sectors). This sector includes water-based activities (e.g. boating, yachting, cruising, nautical sports), operations of landside facilities, manufacturing of equipment and services, Non-beach related land-based tourism in the coastal area, all other tourism activities that take place in the coastal area as well as the supplies and manufacturing industries associated with these activities.

## Maritime transport, ports and shipbuilding

Most blue economy activities need ships and rely on ports and the shipping industry. The two main sectors of this industry, shipbuilding and maritime shipping are interlinked and depend strongly on international markets. Shipbuilding refers to ship construction, marine equipment, ship maintenance, repair and conversion. Maritime transport includes sea transport, coastal and short sea shipping as well as inland water transport. Port activities refer to cargo handling, warehousing and storage, construction of water projects and services relating to water transportation.

### Marine extraction of oil, gas and minerals

This is one of the most established economic sectors of the blue economy. It refers to extraction, support of oil and gas and mining. As offshore oil and gas reserves are depleted, the decommissioning of extraction facilities is expected.

### Offshore wind and ocean energy

Offshore wind is the most advanced of the emerging and innovative sectors of the blue economy. The ocean energy sector refers to generating electricity from tidal and wave power.

### Blue biotechnology

Generally, blue biotechnology refers to the use of aquatic biological resources for biotechnological applications such as pharmaceuticals, cosmetics, food additives, animal feeds, biofuels and enzymes for detergents, papers and textiles.

### Deep-sea mining

Deep-sea mining is the sector of the blue economy that involves the retrieval of minerals and deposits from the ocean floor found at depths of 200 meters or deeper.

### Desalination

Desalination is the process of treating salt water to provide accessible drinking water, help with habitat protection as well as provide water to the agricultural industry.



## 1. FISHERIES, AQUACULTURE AND PROCESSING

The Marine living resources sector encompasses the harvesting of renewable biological resources (primary sector), their conversion into food, feed, bio-based products and bioenergy (processing) and their distribution along the supply chain. The EU is the sixth-largest producer of fishery and aquaculture products covering around 3% of global production.



Fisheries, aquaculture and processing



Coastal and maritime tourism



Maritime transport, ports and shipbuilding



Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Source: European Commission

Blue biotechnology



Source: UNEP In Asia and the Pacific

Deep-sea mining



Source: Junglin Kwe et al. 2019

Desalination

## 1.1. Aim and objectives

This module aims at offering a better understanding of the different subsectors in the fisheries, aquaculture and processing sectors, the different career opportunities and possible career paths to the sector and other sectors.

Upon completing the module, you will be able to:

- Identify the different sectors related to marine living resources
- Describe the different jobs that are available in the fisheries, aquaculture and processing sectors
- Present career paths in the sector
- Propose trans-sectoral working possibilities

## 1.2. General information about the fisheries, aquaculture and processing sector

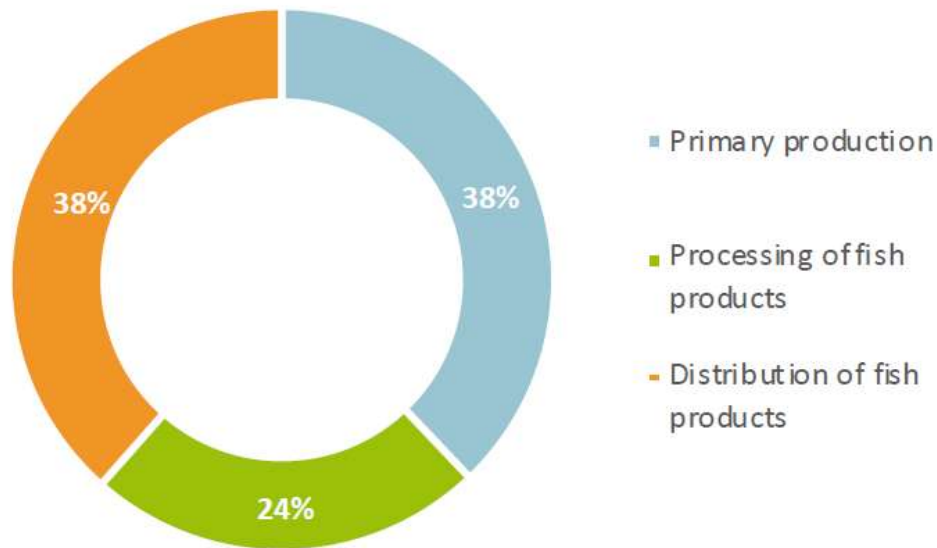
The EU has about 59 000 active vessels landing about 4.5 million tonnes of seafood, while the aquaculture sector reached a production of 1.2 million tonnes in 2018. The processing and distribution of seafood products are heavily dependent on the supply of raw materials from the primary sector. High consumption and increased demand for seafood products and stagnation in the primary sector make these activities increasingly dependent on imports from third countries. In fact, the EU is the largest importer of seafood in the world. Its self-sufficiency in meeting a growing demand for seafood products from its own waters is around 30%.

Marine living resources comprise three subsectors that are further broken down into the following activities:

- **Primary sector:** Capture fisheries (small-scale coastal, largescale and industrial fleets) and Aquaculture (marine, freshwater and shellfish);
- **Processing of fish products:** Processing and preservation of fish, crustaceans and molluscs; Prepared meals and dishes, Manufacture of oils and fats and other seafood products;
- **Distribution of fish products:** Retail sale of fish, crustaceans and molluscs in specialised stores, and the wholesale of other seafood, including fish, crustaceans and molluscs.

In broader terms, these activities form an integral part of the EU Blue bioeconomy, which includes any economic activity associated with the use of renewable aquatic biological biomass, e.g. food additives, animal feeds, pharmaceuticals, cosmetics, energy, etc. The activities included in the sector directly employed over 538 350 persons in 2018, representing 12.0% of the EU blue jobs (established sectors in the Blue Economy).

## Employment by sub-sector



Source: EC Blue Economy Report 2021

### 1.3. Job opportunities in the fisheries, aquaculture and processing sector

There are several opportunities in this sector depending on the subsector we focus on. We will focus on 3 main areas of marine living resources: the **Primary sector**, the **Processing of fish products** and the **Distribution of fish products**. So, what are the job opportunities in these sectors?



**Primary Sector**



**Processing**



**Distribution**

#### 1.3.1 Primary Production Sector

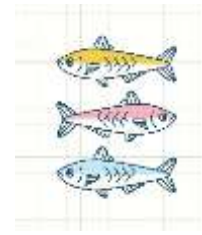
The primary sectors include jobs on fishing vessels and in aquaculture facilities. Depending on whether on fishing boats or in aquaculture, the jobs, requirements and opportunities vary. On larger fishing vessels the maritime positions known from maritime transport will also apply for positions on fishing boats. For

aquaculture the possible jobs are diverse. Some jobs can be used in both sectors (i.e., ichthyologist, hydrobiologist, quality control technician).

See various examples:



**Fisheries Sector**



**Aquaculture**

Ordinary Seaman	Chief Engineer	Technician in quality control laboratory of fishing products	Tourist Guide (in windfarms and aquaculture)	Aquaculture Reproduction Technician	Environmental Technician for Aquaculture
Deck Officer	Chief Officer	Coastal Zone Management Specialist	Installer and Maintainer of Aquaculture Facilities	Hatchery Manager	Ichthyologist
Fishing Charter Operator	HVAC Technician - Fishing	Hydro-biologist	Fishing Harvesting Crew	Seasonal Aquaculture Worker	Aquaculture Engineer

### 1.3.2. Processing of fish products

All food that is collected, either in capture fisheries or aquaculture farms, needs to be processed to some degree or another. These are jobs in the processing and preservation of fish, crustaceans and molluscs, the preparation of meals and dishes, the manufacturing of oils and fats and other marine food products. The bulk of jobs will be found in the processing of seafood, but there are several other working possibilities in management, logistics or maintenance. See some examples, and check out the related job cards, to see a full explanation of the job, training needed, qualities, skills and experience needed, as well as the possibilities to work in another subsector in fisheries, aquaculture and processing or in another different 'blue' sector:



Any company will also need administration staff (managers, administrative, accounting, etc.) that will be in the same or similar positions throughout the whole sector and as well in other blue economy sectors.

### 1.3.3 Distribution of fish products



This category includes all the activities related to the retail sale of fish, crustaceans and molluscs in specialised stores, and the wholesale of other food, including fish, crustaceans and molluscs. There are also several possibilities in the logistics related to these activities. See some examples, and check out the related job cards, to see a full explanation of the job, training needed, qualities, skills and experience needed, as well as the possibilities to work in another subsector of the Blue Economy. Some maritime-related jobs can also be used in the onshore logistical or retail sector.

## 1.4. Education and training

For the jobs we have explained before with a job card, you will find the specific training requirements explained. We can summarize the basic training requirements for the different subsectors as follows:

### 1.4.1. Primary Production Sector

**Fisheries** – The crew of fishing vessels will require specific maritime training for similar positions as on maritime transport ships or the offshore industry. Depending on the position, specific training and requirements will be required. The roles and training requirements specified in the IMO STCW Convention can vary depending on the flag of the fishing ship and national regulations. Some positions as marine biologists or ichthyologists can also work on some fishing vessels and will only require Basic Safety Training to enrol.

**Aquaculture** - The positions in aquaculture facilities can vary depending on the positions and the characteristic of the facility (onshore, offshore, etc.). The workforce responsible for the harvesting and maintenance of the aquaculture facilities usually requires specialised VET Training in Aquaculture or Maintenance, but some of the jobs can also be done without formal education. Some other positions in Environment, Ichthyologists, Marine Biologists, Researchers or Manager and Senior Positions will need graduate or postgraduate qualifications. All positions that require working on board a vessel in any commercial activity will always need STCW Basic Training and a medical certificate.



### 1.4.2. Processing of fish products

The required training and qualifications always vary depending on the position. The marine food processing sector will require graduate and postgraduate qualifications in management, economics or logistics for senior or management positions. There are several roles in quality management, chemical analytics or safety requirements that will also need superior VET and graduate qualifications in quality control, chemistry, biology, etc. Most of the seafood processing workers will require intermediate or higher VET qualifications related to food processing, not necessarily specific to seafood processing. In most European countries a food hygiene and safety certificate will also be necessary for the processing of seafood.

### 1.4.3. Distribution of fish products

Managing and senior positions in distribution, logistics and sales will often require a graduate qualification. Fish Salesmen will often not require any specific training but basic food hygiene and security training or intermediate or superior VET training. There are also lots of positions in logistics, sales, distribution or warehouses that will require no specific formal training.

## FISHERIES, AQUACULTURE AND PROCESSING - EDUCATION AND TRAINING

### Wageningen University & Research

Droevendaalsesteeg 4, 6708 PB Wageningen, The Netherlands

Courses Accredited: Aquatic Ecology

<https://www.wur.nl/en.htm>

### Pukyong National University

45, Yongso-ro, Nam-Gu. Busan, Korea

Courses Accredited: Training for Fisheries and Marine Science

<https://fishsci.pknu.ac.kr/eng/index.do>

### Hellenic Centre for Marine Research

46,7 km Athens Sounio ave. P.O. Box 712, P.C. 19013 Anavyssos, Attiki Greece

Courses Accredited: Biotechnology and Aquaculture

<https://www.hcmr.gr/en/>

## 1.5. Trans-sectoral working possibilities

There are multiple connections between the different sectors in the blue economy and also between specific subsectors in the same sector. These connections are explained in the job cards and allow professionals to move to new careers in the blue economy. Find a summary of the main connections we can find with and from the fisheries, aquaculture and processing sector.

- Positions on fishing vessels larger than 24 m will require specific IMO STCW-F training, depending on the position, on the bridge or the machine room. These positions can be directly transferred to similar positions on commercial vessels in other sectors, such as maritime transport, wind and

ocean energy or the extraction of oil gas and minerals. To work on board fishing vessels in other countries may require specific national qualifications depending on the national fishing regulations.

- The aquaculture sector is often closely related to the marine biotechnology sector, with the biotechnology companies, such as pharmaceuticals, cosmetics or animal feed producers, having their own aquaculture farms. These types of farms are often related to algae biomass production. Workers from offshore aquaculture facilities have the possibility to move to onshore production sites without much or any new training required.
- Another interesting trans-sectoral possibility for aquaculture technicians and professionals is related to offshore wind farms, with new developments in hybrid installations that combine the production of electricity and aquaculture, in so-called multifunctional offshore installations.
- Marine biologists, ichthyologists or environmental technicians can work in other sectors related to Maritime Spatial Planning, coastal zone management and environmental protection.

Professionals working in the distribution and logistics sector can work in similar onshore positions in other blue economy sectors such as maritime transport, warehouses or shipbuilding in commercial ports.

## 1.6. Facts and figures

The most cultivated species in European aquaculture are mussels, salmon, trout and oysters.

About one-half of all EU fisheries production from fisheries catches and aquaculture came from just three Member States: Spain, France and Denmark.

## 1.7. Summary

There are many working opportunities in the marine living resources sector, namely in the primary production sector from fisheries or aquaculture, the processing sector and the sales and distribution sector. The jobs include mariner positions on fishing vessels or aquaculture farms, harvesting, processing, sales and distribution, among others. Trans-sectoral possibilities exist between seafaring positions in commercial vessels to other onboard positions in other blue economy sectors, such as maritime transport, marine extraction or marine renewable energies. Aquaculture is also related to blue biotechnology and includes possibilities to work on onshore production sites. New developments are linking the marine renewable energy sector or marine extraction sector with aquaculture production in multipurpose offshore installations.

## 1.8. Evaluation quiz no.1

1. What country has the largest number of captures in fisheries in the EU?
  - A. Spain
  - B. Denmark
  - C. France

2. Which is the seafood that is produced most in European Aquaculture?
  - A. Mussels
  - B. Salmon
  - C. Oysters
  
3. How many people does the fishing industry employ in Europe?
  - A. About 300.000 people
  - B. About 1 million people
  - C. About 160.000 people
  
4. How large is the European fishing fleet?
  - A. About 50.000 ships
  - B. Roughly 100.000 vessels
  - C. More than 200.000 ships
  
5. What sea basin has the most problems due to overfishing?
  - A. The Baltic Sea
  - B. The Caspian Sea
  - C. The Mediterranean Sea
  
6. What sector is employing more women?
  - A. Capture fisheries
  - B. Processing of seafood
  - C. Sales and distribution

## 1.9. Supplementary information

### Reading

EU Directorate for Maritime Affairs and Fisheries, [https://ec.europa.eu/info/departments/maritime-affairs-and-fisheries\\_en](https://ec.europa.eu/info/departments/maritime-affairs-and-fisheries_en)

EURES Aquaculture Jobs, [https://ec.europa.eu/eures/portal/jv-se/search?page=1&resultsPerPage=10&orderBy=BEST\\_MATCH&keywordsEverywhere=aquaculture](https://ec.europa.eu/eures/portal/jv-se/search?page=1&resultsPerPage=10&orderBy=BEST_MATCH&keywordsEverywhere=aquaculture)

Facts and figures on the common fisheries policy, [https://ec.europa.eu/oceans-and-fisheries/facts-and-figures/facts-and-figures-common-fisheries-policy\\_en](https://ec.europa.eu/oceans-and-fisheries/facts-and-figures/facts-and-figures-common-fisheries-policy_en)

### Video materials

VR Reality Visit to Aquaculture Farm in Greece, <https://youtu.be/DPuma8JcmqY>

An explanatory video (archive footage) on collected information about Fisheries & Aquaculture biomass in Europe analysed by the JRC (Joint Research Centre), <https://audiovisual.ec.europa.eu/en/video/I-209045?lg=EN>

### 1.10. Self-reflection

Which job opportunities in this sector are more appealing to you and why? Not interested to work in this sector? Please tell us why.



## 2. COASTAL AND MARITIME TOURISM

Coastal and Maritime Tourism is the most important sector in the Blue Economy in Europe. It accounts for the largest GVA and persons employed in all the Blue Economy sectors in Europe. The tourism industry represents 10% of the EU's GDP, encompassing 2.4 million businesses accounting for 12% of EU employment.



Fisheries, aquaculture and processing



Coastal and maritime tourism



Maritime transport, ports and shipbuilding



Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Blue biotechnology



Deep-sea mining



Desalination

## 2.1. Aim and objectives

The coastal and maritime tourism module aims at offering a better understanding of the different subsectors in maritime tourism, the different career opportunities and possible career paths to the sector and other sectors.

Upon completing the module, you will be able to:

- Understand the importance of the Coastal and Maritime Tourism sector in the EU Blue Economy
- Distinguish the subsectors in coastal tourism
- Describe the different jobs that are available in coastal and maritime tourism sectors
- Present career paths in the sector
- Propose trans-sectoral working possibilities

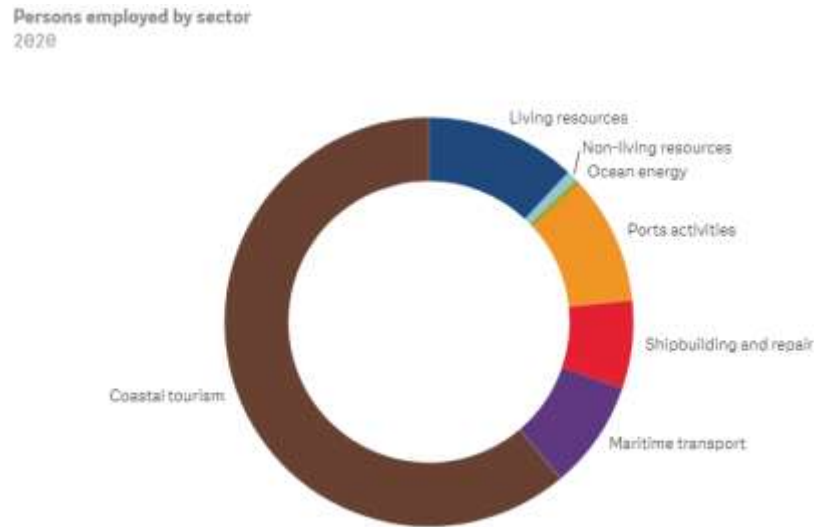
## 2.2. General information about the coastal tourism sector

Coastal tourism is by far the most significant in terms of tourist flows and income generation. Among tourist destinations, coastal areas are often preferred by tourists, and the Mediterranean region is the world's leading tourist destination. Europe is the most-visited continent, welcoming half of the world's international tourist arrivals. The EU alone accounts for almost 40% of the world's international arrivals. Coastal areas and islands tend to be major tourism hotspots. According to the World Tourism Organization, it represents one-third of world income generated by tourism revenues. As part of the EU's Blue Growth strategy, the coastal and maritime tourism sector has been identified as an area with special potential to foster a smart, sustainable and inclusive Europe. Tourism is particularly important for countries in Southern Europe, like Spain, Portugal, Italy, Malta and Greece, but also in other coastal countries namely Croatia, Bulgaria, Romania and the Netherlands. For many of the countries that offer "sun, sea and sand" tourism, beach tourism accounts for a significant amount of their total national revenue. However, the use of the sea for such diverse purposes is at the origin of increasing pressure, namely:

- Competition for space leads to conflicts between various activities (fishing, services, agriculture)
- The degradation of the natural ecosystems that support coastal areas, especially due to the impact of climate change
- Large seasonal variations in population and employment.
- Increasing tourist flows in coastal areas, especially in the form of tourism associated with new concerns about their potential repercussions.
- Negative impacts on regional development from an environmental, economic and social point of view.

Coastal and maritime tourism originates as an activity in the 19th century and this has persisted since. The extraordinary beauty, cultural wealth and great diversity of the EU's coastal areas have made them the preferred destination for many holidaymakers in Europe and abroad. The industry encompasses 23 million direct and indirect jobs accounting for 12% of EU employment, whereas 37% of tourism workers are under

35 years old. The sector, however, employs directly more than 2.8 million people, generating a total of € 80 billion in gross value added and representing over one-third of the maritime economy. As much as 51% of bed capacity in hotels across Europe is concentrated in regions with a sea border. It is the biggest blue economy sector in terms of gross value added and employment.



Source: EC Blue Economy Indicators

### 2.3. Job opportunities in the coastal tourism sector

While land-based coastal tourism includes all the activities and jobs related to accommodation, transport and other expenditures, we will also focus on jobs related to maritime tourism. Nevertheless, all the ‘traditional’ onshore tourism positions offer multiple opportunities to work in maritime tourism, sometimes with some additional training required and sometimes with no or few additional training needed to occupy a similar position in maritime tourism.

#### 2.3.1. In maritime tourism

We focus on 3 main areas: recreational boating, superyachts and ferries and cruise ships. So, what are the job opportunities in these sectors?



**Recreational Boating**



**Superyachts**



**Cruise ships and ferries**

### 2.3.1.1. Recreational Boating

With recreational boating, we refer to the companies and jobs that we can find in marinas (recreational ports) with a majority of private vessels and some commercial vessels. Here we can differentiate different types of companies and jobs related to them.

#### Boat Brokers, Insurance Companies, Chandlers

These are jobs in commercial activities related to sales of boats or parts of boats and related services. See some examples, and check out the related job cards, to see a full explanation of the job, training needed, qualities, skills and experience needed, as well as the possibilities to work in another subsector in coastal tourism or another different sector:



In this category, we can find other jobs related to sales (of boats, insurances, parts), which will require strong commercial skills and customer support. These jobs will require some basic training in commercial activities, knowledge of languages, negotiation skills and the skills and qualifications to work in the commercial sector. These qualities will allow the candidates to work in the commercial sector of other companies in the same sector and also in other sectors of the blue economy.

Any company will also need administration staff (managers, administrative, accounting, etc.) that will be in the same or similar positions throughout the whole sector and as well in other blue economy sectors.

#### Charters, water sports, maritime excursions

This category includes all the activities related to tourism in the leisure boat sector, such as charter companies, water sports or maritime excursions. Jobs related can be found in the sales department, managing, all the professions on board the leisure vessels, such as skippers and crew, and services on board as well as those related to water sports. See some examples:

Onboard



In port



Water sports

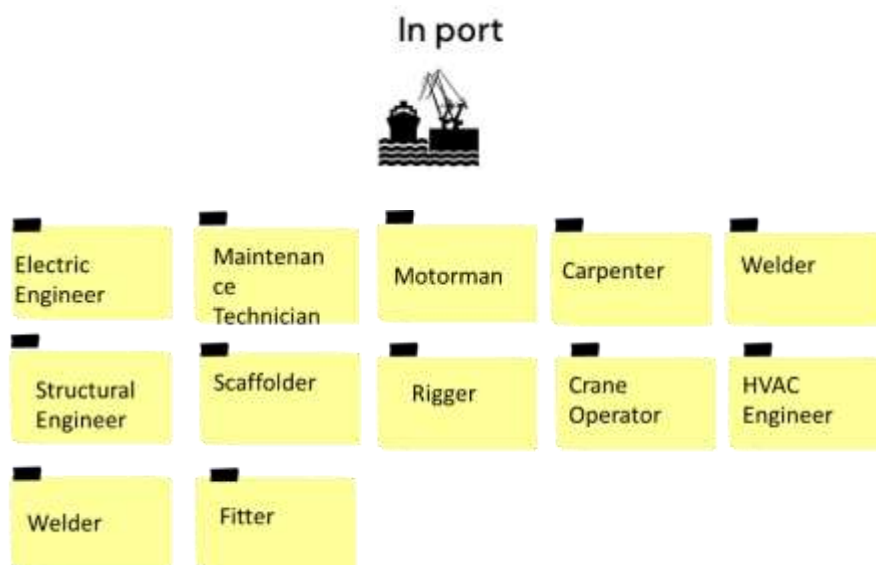






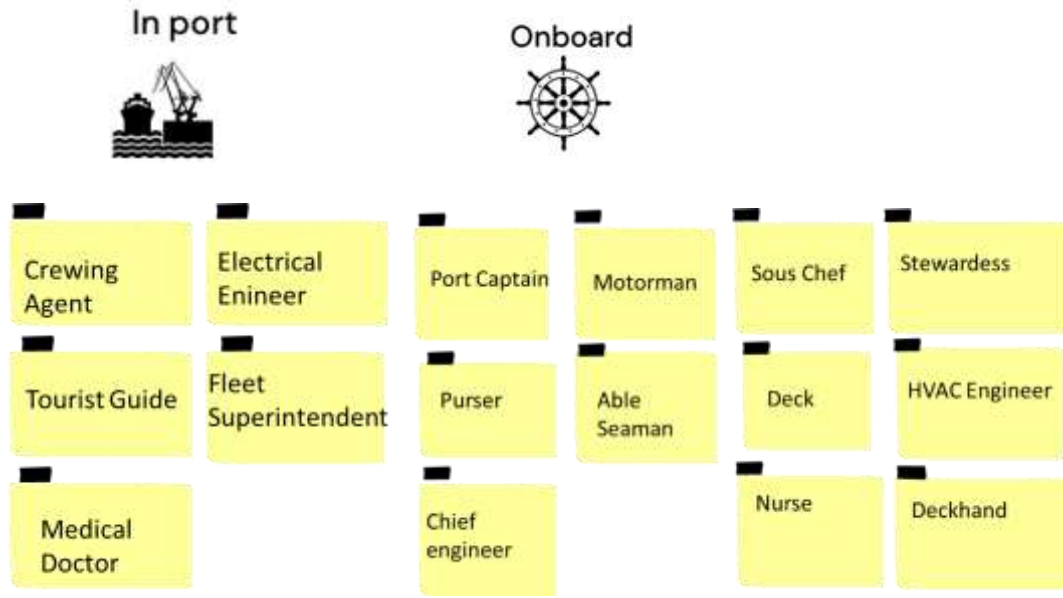
### Maintenance and services

Another important subsector in leisure ports is related to the boat maintenance companies and the jobs related to them. These jobs include basic cleaning of exteriors and interiors, maintenance of surfaces, painting, polishing and antifouling, but also some more specialised jobs like electricians, carpenters, air conditioning or other boat construction and maintenance professions. See some examples:



### 2.3.1.2. Superyachts

The yachting sector is a luxury subsector in recreational boating, and there are some similar jobs as in recreational boating, as the yachts require maintenance, crew and services as well. But the size of these vessels will also require crew and mariners with commercial maritime qualifications. Most of the time, these super vessels are privately owned which also differentiates the onboard jobs from those in charter companies (longer periods embarked). See some examples:



There are other service-related jobs onshore (apart from maintenance), related to catering, delivery of special services for the boat owners, guardianship (of boats and villas) and professions related to the selection of crew as well as training for the super-luxury sector.

### 2.3.1.3. Ferries and cruise ships

This sector will have some onshore jobs related to maritime transport, such as fleet superintendents, surveyors, insurance professionals, fleet managers, agents, sales, management, accounting, IT, administration and crewing, which will be explained in more detail in the corresponding module.

Some similar positions in leisure boating and boat maintenance can be found in ferries and cruise ships, but most of them will require specialized maritime qualifications or advanced training in boat construction and maintenance.

Mariner, engineering and, crew positions will be similar to those in superyachts, although some of them will require further specialization and commercial maritime training for larger vessels.

We will focus on the positions related to 'classic' tourism (hotels, restaurants, bars, services) that also be done on cruise ships and ferries. The jobs are exactly the same as they are onshore and will require very little extra 'maritime' training for those who want to work in this sector. Let's see some examples:



To these jobs we can add all the jobs you could also do in hotels and restaurants and ‘classic’ tourism, such as waiters, baristas, cleaners, animation, musicians, DJs, casino staff, lifeguards, onboard maintenance, luxury stores, massages, beauty and many other professions. Remember, cruises and lower extension ferries, are little ‘floating cities’ that include many different jobs and activities.

### 2.3.2. Coastal tourism

It covers beach-based tourism and recreational activities such as swimming, sunbathing, coastal walks and wildlife watching. Coastal tourism also covers maritime tourism and is broken down into three main sub-sectors:

- a.) Accommodation
- b.) Transport
- c.) Other expenditures

**Employment:** Other expenditures generated over 1,3 million jobs, corresponding to 46% of the Coastal tourism direct employment. Accommodation employed 1, 1 million persons (39%) and transport a further 422 850 jobs (15%). Compared to 2009, all sub-sectors, apart from other expenditure that increased by 22%, saw a decrease in persons employed: -14% in Accommodation and -5% in Transport. However, such decrease rates in the tourism sector are not permanent, especially in coastal tourism.



## Accommodation



The term accommodation refers to a room, building or lodging which provides shelter for a person to stay, sleep and live. Therefore, the role of accommodation managers is crucial in the hotel tourism industry. An accommodation manager mainly deals with human resources, accountancy, inventory and seaside facilities. Especially in land-based coastal tourism hotel accommodation managers should have good qualifications in those areas. Not only the staff working in front but technicians, room keepers, doctors and nurses and food and beverage staff should know target languages at least at the A2 level. As well as preparing a safe and good accommodation for tourists, all accommodation staff should have good communication skills with their clients.

## Transport

Ports are crucial for the economic growth of coastal and inland areas. Passenger and cruise transport are important means for maritime and coastal tourism development while freight transport can be seen as a competing activity in terms of space. When we talk about land-based transport, which includes hotel amenities, transportation services can make or break a hotel's appeal. There are various types of hotel transfers such as courtesy coaches (Picking up guests from the airport and dropping them to the airport is a free service), limousine services, cars for official duties, valet parking and city courtesy services, city tours, ambulance services. There are many job opportunities for drivers, sales officers and sales executives at land-based hotels tourist guides work in collaboration with this sector.

## Other Expenditures

Especially for summer vacations, land-based coastal hotels are very popular for all. Choosing the perfect summer destination is a great decision, especially if you have a big family and they look forward to these days of fun, animation, new artistic and sportive activities, sunbathing, swimming, diving, and beach sports. In order to serve these activities in good quality, each hotel should have employees such as swimming instructors, lifeguards, beach sports trainers, divers and tourist guides.

## 2.4. Education and training

For the jobs we have explained before with a job card, you will find the specific training requirements explained. We can summarize the basic training requirements for the different subsectors as follows:

### 2.4.1. Recreational Boating

#### **Sales** (of boats, parts and services)

Although no specific training will be necessarily needed, it is recommendable to have some commercial training (VET or Bachelor in Sales), language skills are of foremost importance and well as good customer service skills. Some specific training or knowledge may be needed for specific activities, in boat sales, insurances, chandlery, boat rental, etc.

#### **Charters, maritime excursions, water sports**

While the onshore professions such as sales and administration have been already explained; we will focus on the maritime qualifications for skippers and crew for leisure boats and maritime excursions. The minimum qualification to work professionally on board a boat in any commercial activity will always be the STCW Basic Training and a medical certificate. This is required for crew members, such as deckhands, but also waiters or stewardesses. The skippers of the recreational vessels require different leisure boating qualifications depending on the size of the boat, the number of passengers they carry and the length of the boat. For instructors in different water sports, additional courses will be needed, such as windsurfing instructors, open water diver instructors or Jet Ski instructors.

#### **Maintenance**

Although many of the basic maintenance tasks will not require specific qualifications, on-the-job training is always needed. For more specialized tasks or the maintenance of bigger vessels, intermediate and higher VET Training will be needed, in some cases, higher education will be required.

### 2.4.2. Superyachts

We can divide the positions in superyachts into deck officers, engineers and crew. The bridge and commanding positions, as well as the positions in the machine area, will require specific maritime qualifications, depending on the size of the vessel, responsibilities, and the position. The service crew will offer services to the boat owners, such as catering, cooking, cleaning, etc., and will often require no more qualifications than the Basic STCW Course and Medical Certificate. Luxury service courses, basic leisure boating qualifications and experience will be a surplus.

### 2.4.3. Ferries and Cruise Ships

While most of the mariners in the different departments will require specific maritime training and courses, the service crew will not require any further training apart from the STCW, Medical and depending on if they are embarking passengers or cargo, they will need additional STCW certificates.

#### **2.4.4. Land-based Coastal Tourism**

##### **Accommodation in coastal tourism:**

In coastal tourism, in order to work in the accommodation sector, you need to have a bachelor's degree to work as a doctor, hotel manager or accountant but in some jobs, you can learn and get it through in-service training activities or by attending some short-term courses and get a certificate such as pool keeping, landscape design, office management, waiter/waitress or receptionists.

##### **Transport in coastal tourism:**

Transport in coastal tourism includes transfer from airport/train/bus station to a hotel and vice versa and touristic visits to historical sites. It also includes transfer to hospitals in case of any emergency. The drivers need to have a driving license depending on the type of transport. However, if you are working as a sales officer and tourist guide you should have a bachelor's degree or a certificate.

##### **Other expenditures in coastal tourism:**

Swimming, beach sports, animator activities, coastal walk, sunbathing, or diving are only some of the activities held at hotels by the seaside. Such activities are very important for hotels and guests. If you are graduated from the Physical Education department by getting some in-service training courses or private courses you can work as a lifeguard, beach sports trainer and swimming instructor. However, to work as a tourist guide you need to have a diploma.

In order to get more info about the job opportunities in coastal tourism, you can have a look at the job cards and see the employment opportunities.

### **COASTAL AND MARITIME TOURISM - EDUCATION AND TRAINING**

#### **Maritime MT (MMRTC)**

MaritimeMT Training Centre, HHF041A, Hal Far Industrial Estate, Birzebbuga, BBG3000

Deck, Hospitality, STCW, Simulations

<http://maritimemt.edu.mt/>

#### **Xone Superyacht Academy**

İnönü Bulvarı No:35 Göcek, Fethiye - Muğla Turkey

International, flotilla skipper, Training for instructors, Introduction to boating & international crew

<https://xonesuperyacht.com/academy/>

### **Barcelona Academy**

Barcelona Port Vell, Office 1 C/ Escar, 26, Gallery Building, 08039 Barcelona Spain  
Superyacht Deck Crew Module, RYA Yacht Master Coastal/Offshore - Theory - Online  
<https://www.barcelonacrewacademy.com/store/c4/Maritime-Training->

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### **Marbella Sailing School**

Local 24B Edificio Levante, Calle Levante, Puerto deportivo de Estepona, 29680 Estepona, Málaga  
Day Skipper, Coastal Skipper / Yachtmaster  
<https://www.marbellasailingschool.com/>

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### **Training Centre Baldoyle**

Baldoyle Industrial Estate Baldoyle Dublin 13 D13 K1V3  
Community Training Centres provide second-chance education and training  
<https://baldoyletrainingcentre.ie/>

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### **Sovren Nautical Academy**

Carrer d'Espartero 8, 07014, Palma, Illes Balears, Spain  
STCW Training for Superyachts  
<https://thenauticalacademy.net/>

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### **Escola Port**

Moll de la Marina 11, Port Olímpic. 08005 · Barcelona  
Nautical qualifications  
<https://escolaportbarcelona.com/en/>

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### **Marine Education & RYA Training**

Powerboat & Jetski Courses: Port of Poole Marina UK  
RYA Powerboat, Jet ski (PWC) Courses, RYA Instructor Training + Theory  
<https://www.marine-education.co.uk/j/shop/terms>

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## 2.5. Trans-sectoral working possibilities

There are multiple connections between the different sectors in the blue economy and also between specific subsectors in the same sector. These connections are explained in the job cards and allow professionals to move to new careers in the blue economy. Find a summary of the main connections we can find in the coastal tourism sector.

### 2.5.1. Recreational Boating

When we talk about boat sales and the sales of parts for boating, profound knowledge of the structure of the boats, their functioning and maintenance are advantageous. Professionals with this knowledge and experience can opt for a 'second' career in these sectors. We are talking of professionals in shipbuilding and maintenance, with qualifications or experience in mechanical engineering, maritime construction and maintenance workers. Professionals that work in the machine department of larger vessels, such as Electrical engineers, mechanical engineers or HVAC engineers, have a large knowledge of the part and functioning of ships and boats and can develop their careers in the sale of spare parts. These professionals can come from sectors such as maritime transport, shipbuilding, offshore energy or marine extraction.

On the other hand, professionals already working in this sector will have to get new qualifications required by the IMO to work professionally on commercial vessels, in sectors like maritime transport, fisheries, offshore energy or marine extraction.

The sales department professionals with commercial skills and qualifications can also change their career coming from the sales department from other sectors. The before mentioned sectors already have knowledge in the field required for this new career, while sales professionals coming from different sectors (i.e. fisheries) will need to train or learn about the new sector. Sales professionals from the coastal tourism sector will have the commercial skills to work in the sales and marketing departments of other sectors, but will have to learn about the new sector and market.

Marine surveyors, fleet superintendents or fleet managers, as well as naval engineers from other sectors such as maritime transport, can work in the insurance sector for recreational boats. Marine surveyors need to be qualified as naval engineers or chief engineers, which means they can also adopt these positions on board commercial vessels in other sectors, such as maritime transport or the shipbuilding industry. Other insurance professionals from coastal tourism can work in other sectors. Maritime transport is the one which offers the most possibilities for these workers.

In charters, water sports, and maritime excursions the professional skippers and crew can come to this sector from a career in maritime transport, specializing in smaller boats. The service crew, such as waiters, baristas or stewards can develop their new careers coming from the whole tourism sector and onshore coastal tourism. Professional skippers and crew can change to work on board in maritime transport, but they will need to train and acquire professional maritime qualifications.

Professionals from any other sector can work in this sector with no new training or by taking courses to acquire leisure boating qualifications.

In the subsector of boat maintenance, workers from other sectors that are not related can start with no additional training or basic on-the-job training for simpler tasks (i.e. boat cleaning, basic maintenance). The professionals from shipbuilding and maintenance have the skills and qualifications to work in higher positions in leisure boat maintenance or do specialized tasks they were doing in shipbuilding. Other professionals that have the knowledge to work in this sector are all the engineers that have worked in the machine room of ships and boats in other sectors, such as maritime transport, ocean energy, fisheries, aquaculture and marine extraction. Leisure boat maintenance professionals can move on to shipbuilding or maritime transport, by training in higher VET training or University studies for shipbuilding or by getting professional maritime qualifications for engineers in maritime transport.

### **2.5.2. Superyachts**

To work on superyachts, we have to differentiate between the professional mariners and the service crew. The professional mariners will need to have professional maritime qualifications for deck or machine positions, which means they can come to this sector but also go to other sectors where professional



mariners are required, such as fisheries, maritime transport, aquaculture, offshore energy and marine extraction.

Service crew such as waiters, stewardesses, cooks, etc. can come to this sector from the whole onshore tourism and gastronomy sector. They could move to another sector to work as a service in maritime transport or on oil and gas platforms, by getting new professional maritime qualifications.

### **2.5.3. Ferries and Cruise Ships**

Similar to superyachts, the professional mariners will need professional maritime qualifications, with further training required for these larger vessels. This enables professional mariners from other sectors to work on ferries and cruise ships, and also for the mariners on cruise ships and ferries to move to other sectors, such as maritime transport.

The service crew on ferries, and especially on cruise ships, have a large variety of different profiles that can come from the whole tourism and gastronomy industry and over from other sectors not related to maritime transport. This crew can also change to similar positions on superyachts, but also on recreational boating. Similar to the crew from superyachts, they can work as cooks or waiters on ships and platforms by acquiring further maritime qualifications.

### **2.5.4. Land-based coastal tourism**

No matter if you are spending your vacation as a client in a land-based hotel or on a cruise, you ask for almost the same services /amenities from the hotel/cruise management. So, the hotel manager of a cruise can work in land-based hotels too. It is the same for the accountants, receptionists, food and beverage managers, waiters, doctors, nurses, technicians, sales managers, lifeguards and divers, too. Travel management and tourist guides can also work both at maritime and land-based hotels.

The service crews can easily find job opportunities in other sectors apart from coastal tourism. Boating inspectors and lifeguards also have the same chance and possibility to work in trans-sectoral fields.

## **2.6. Facts and figures**

Some superyachts are larger than 150 metres with crews of one hundred persons and up to 36 guests. The largest cruise ship can accommodate up to 7000 passengers and crews over 2000 persons! A common misconception is that hotels and accommodation are more expensive at the seaside, but often the accommodation in large cities is more expensive!

## **2.7. Summary**

There are many opportunities in the maritime tourism sector and land-based coastal tourism, namely in recreational boating, superyachts and ferries and cruise ships in the maritime tourism sector and accommodation, transport and other expenditures. There are also a lot of working opportunities in all the service companies that support the different subsectors. There is the possibility for trans-sectoral working

possibilities, mainly between the maritime professional seaman and onshore working possibilities or recreational boating. There is also the possibility to move from onshore professions to maritime professions with additional training.

## 2.8. Evaluation quiz no.2

1. Which parts of the world are particularly well-suited to maritime tourism?
  - A. Spain, Portugal, Italy, Malta and Greece, Croatia, Bulgaria, Romania and the Netherlands
  - B. Germany, France, Spain and USA
  - C. England, Italy, Malta, Brazil and Czech
2. What is the length of time that the coastal and maritime tourism business has been around?
  - A. Since 16<sup>th</sup> century
  - B. Since 17<sup>th</sup> century
  - C. Since 19<sup>th</sup> century
3. How many people does the coastal and maritime tourism industry employ in Europe?
  - A. 2.8 million people
  - B. 3.6 million people
  - C. 1.8 million people
4. What three major aspects of maritime tourism can you name?
  - A. Recreational boating, superyachts, ferries and cruise ships.
  - B. Boating, sailing, yachts
  - C. Charters, water sports, maritime excursions
5. What types of occupations can we find in the yachting industry?
  - A. Hotel Manager, Hotel receptionist
  - B. Deck Officer, Tourist Guide, Master Mariner
  - C. Crane operator, Fitter, Welder
6. What level of training is required for more specialized missions or ship maintenance?
  - A. Only intermediate level
  - B. VET for intermediate and advanced students. There will be a need for training, and in some situations, further education will be required.
  - C. Only higher education

## 2.9. Supplementary information

### Reading

European Strategy for Sustainable Blue Economy 2021, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:240:FIN>

How To Get a Job On a Superyacht - The Ultimate Guide, <https://www.superyachtcrewagency.com/blog/how-to-get-a-job-on-a-superyacht-the-ultimate-guide/17493>

How To Get a Job on a Cruise Ship <https://www.cruisemummy.co.uk/how-to-get-a-job-on-a-cruise-ship/>

### Video materials

Professionals in the Blue Economy – Professional Skipper, [https://youtu.be/-Jpxs-nd\\_fg](https://youtu.be/-Jpxs-nd_fg)

How I Got into the Super Yacht Industry <https://youtu.be/y1UJfIC4NmU>

## 2.10. Self-reflection

In your view, what are the benefits of working in the coastal and maritime tourism sector?



### 3. MARITIME TRANSPORT, PORTS AND SHIPBUILDING

The maritime transport is the backbone of international trade and the global economy, serving for moving freight from its source of production to points of consumption. This movement of goods is an integral aspect of port operations, maritime transportation and planning. To support all these operations, shipbuilding, maintenance and repairs are concerned.



Fisheries, aquaculture and processing



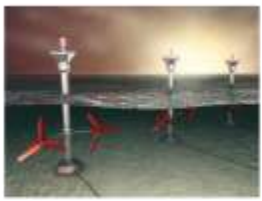
Coastal and maritime tourism



Maritime transport, ports and shipbuilding



Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Source: European Commission

Blue biotechnology



Source: IAHG in Asia and the Pacific

Deep-sea mining



Source: Janghwa et al. 2019

Desalination

### 3.1. Aim and objectives

The maritime transport, ports and shipbuilding module aims at offering a deep understanding of what a job in maritime transport means and at providing a wide perspective of blue career opportunities.

Upon completing the module, you will be able to:

- Recognize the role of the maritime transport in the blue economy
- Explain the types of jobs that one can get in maritime transport, ports and shipbuilding
- Describe the career paths that can be explored
- Propose trans-sectoral working possibilities

### 3.2. General information about the maritime transport, ports and shipbuilding sector

The main transport mode for global trade is ocean shipping: around 90% of traded goods are carried over the waves. As such, the oceans provide the main transport arteries for global trade. Multiple players from different sectors within the maritime ecosystem work together to bring us most of what we need and use on a daily basis – from the flour for our bread at breakfast, to the vehicles, and even the latest IT gadgets. As demand for global freight increases, maritime trade volumes are set to triple by 2050 (OECD, Ocean shipping and shipbuilding, 2021).

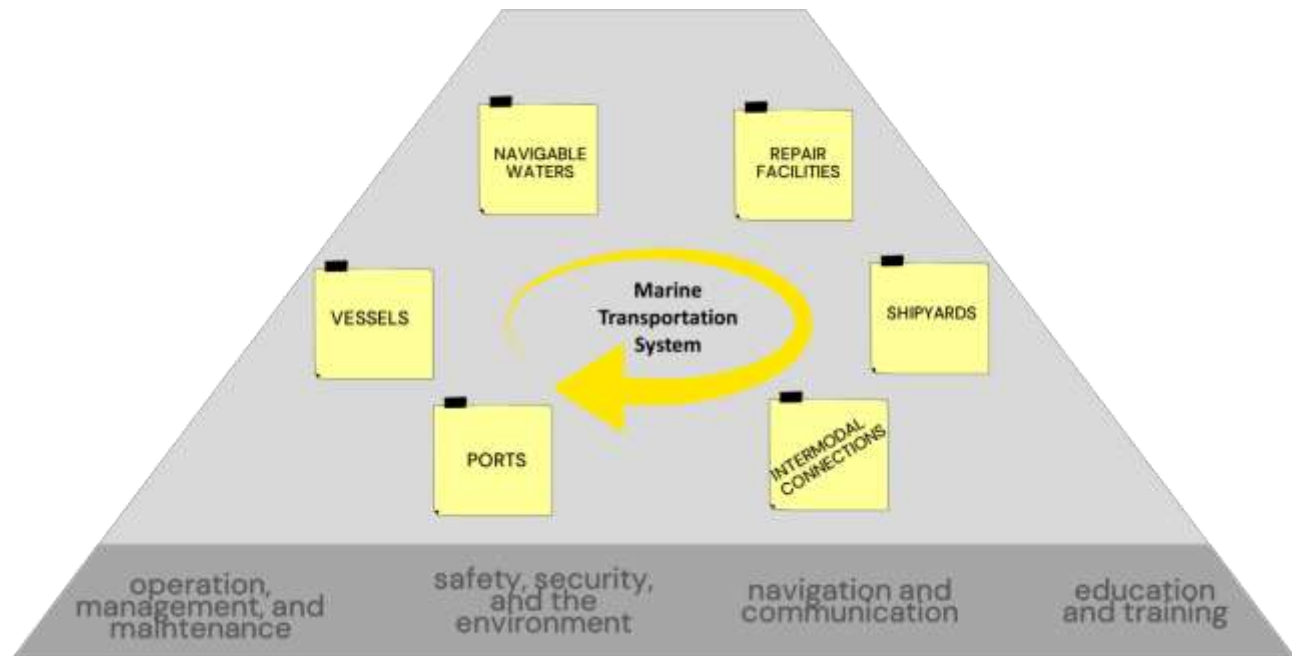
Maritime transport refers to a means of transport where goods or people are transported via sea routes. In some cases, maritime transport can encompass pre- and post-shipping activities. This way, maritime transport connects goods to consumers through our highway system, railroads, air transit and inland water transportation routes. Very closely related to maritime transport are ports and port operations. Ports serve as important transportation hubs that facilitate goods movement, as well as economic drivers being significant sources of local employment.



During these movement operations, communities and businesses around the world gain economic benefits (EPA, 2021), being actors along the logistic chain. The entire logistic chain from fabrics, freight

forwarding, port operations, maritime transport, intermodal connections, warehouse and distribution, brings variety and makes the careers in maritime transport attractive.

As you may notice, the breadth of the maritime industry provides a broad range of roles, and opportunities for individuals, companies and communities.



The marine transportation system consists of the following main physical components (Said, El-Rabbany, & A.O., 2006):

- Navigable waters
- Vessels (publicly and privately owned)
- Ports (harbour and land-side facilities)
- Intermodal connections (highway and railway)
- Shipyards
- Repair facilities

Several important functions are necessary for this physical infrastructure, including:

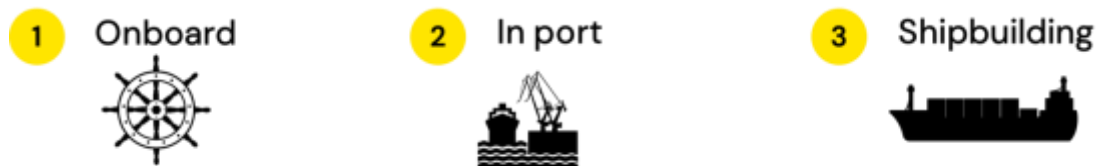
- Operation, management and maintenance
- Safety, security, and the environment
- Navigation and communication
- Education and training

All these components are important sources of employment and in addition, these are gates to international careers.

### 3.3. Job opportunities in the maritime transport, ports and shipbuilding sector

There are many job opportunities in the maritime transport industry. Depending on the job you want and your aspirations, you need to carefully plan your career. First, you need a qualification. We will help you identify various aspects of education and training related to occupations in a marine transportation system.

Marine transportation occupations spread over all components of the marine transportation system, including various areas of engineering and non-engineering. Several occupations are on the waterside, on board ships, as well as in the port and shipbuilding industry.



#### Careers on board

Several types of ships offer job opportunities on board. Here are only a few examples:

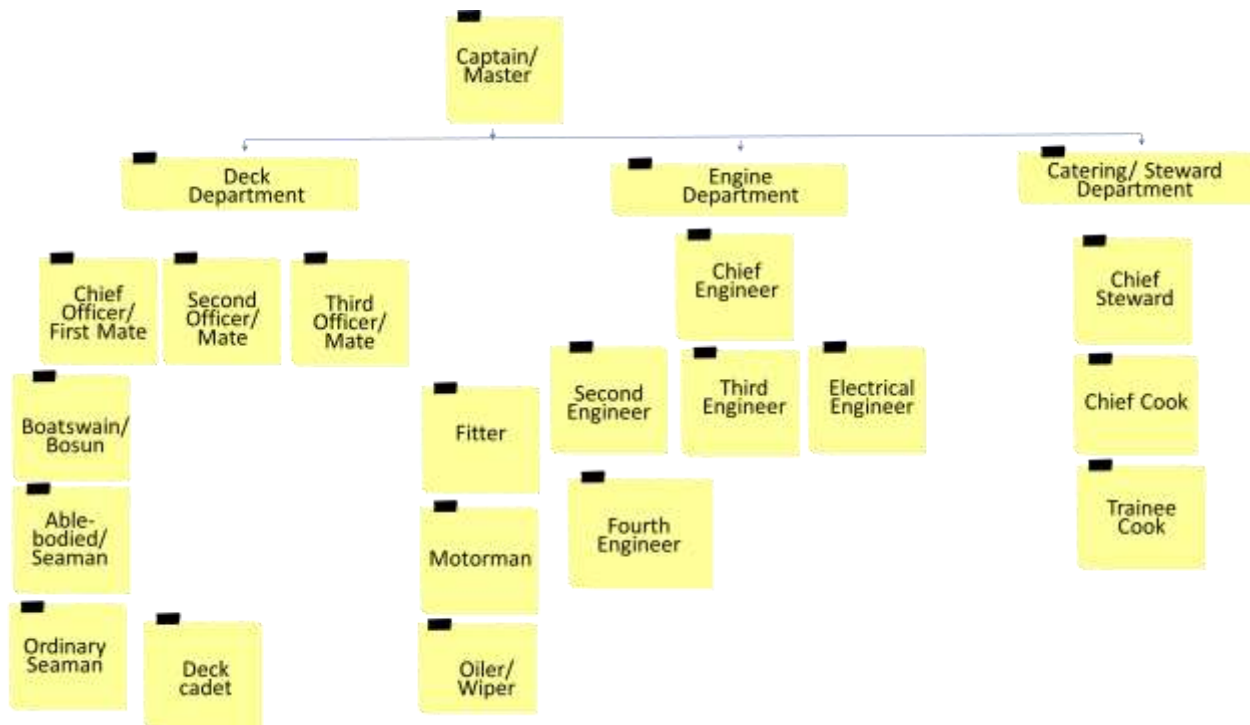
- Commercial ships carrying various types of cargo: general goods, petroleum products, grains and cereals, fruits and vegetables and even medicines.
- Passenger or research vessels
- Other ships are designed to accommodate passengers and cargo. These are ro-ro and ferryboats – carrying cars and train wagons.
- Other are service vessels for support activities. For example, pilot vessels, tugboats or icebreakers.

The list can continue with fishing vessels, dredge, cable laying vessels and many other specialized vessels.

Working as a seafarer on board these vessels is a challenging but rewarding job for adventurous people who like to travel, spend time outdoors on the open waters, and have ample free time when home on the shore.

Maritime jobs offer good wages and benefits and a fulfilling work environment.

On board vessels, people have different jobs: engineers, deck officers, electrical engineers, chief cook, fitter, boatswain, helmsman and seaman. In this chart, we have enumerated unique marine careers and jobs which offer an exciting and satisfying professional life. Note that this is not an exhaustive list, and we will keep on adding more interesting and rewarding career options to this huge marine job list.



### Careers in ports

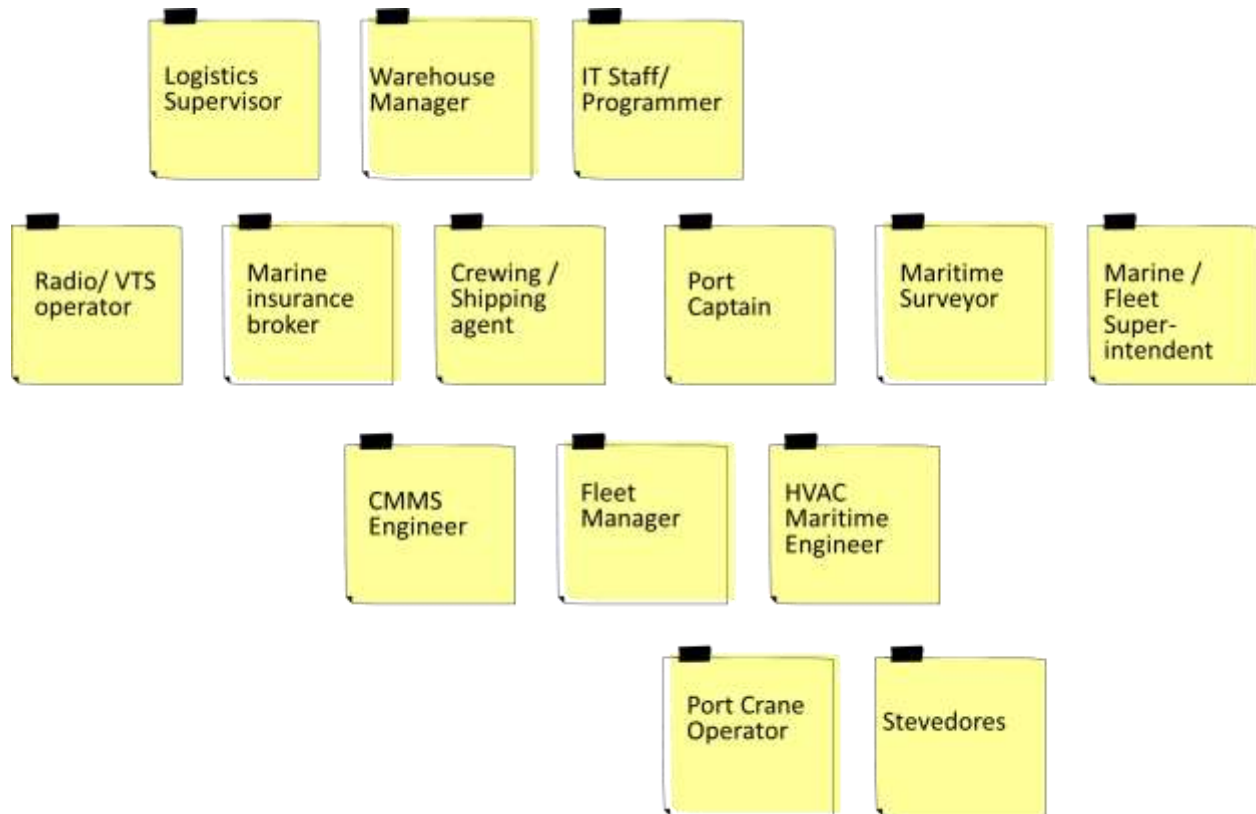
Maritime ports differ in terms of size, function and geographical characteristics, ownership and governance structures. Ports need to accommodate various ships and require adapted port infrastructure and waterways, and services such as fast cargo handling, storage facilities and smooth hinterland connections, or passenger terminals and supply services.

Moreover, the development of conventional and renewable energies has turned some ports into energy hubs.

In addition, the use of technology in the shipping industry is rapidly growing which means that there are increasing opportunities for jobs in marine tech. That means if you're a coder or programmer you could find yourself in high demand.

With all these supply services and their administration, ports generate employment and economic benefits, bringing together port and logistics, shipping and maritime services, shipbuilding and repair. These are few career opportunities in the blue economy in the port sector.





## Shipbuilding

Shipbuilding refers to ship construction, marine equipment, ship maintenance, repair and conversion.

This is a very important sector in the blue industry. All ships in service depend on shipyards to keep them sailing smoothly. With shipyards being a major anchor of the worldwide supply chain, shipbuilding is a dependable industry when it comes to career possibilities. Someone can take numerous paths to a successful career in this industry, as there are many types of professions found in shipbuilding, including designers, engineers and tradespeople.



Ship construction is a long process, with vessels delivered several years after orders are made. For those currently looking to get into the shipbuilding industry, experts (Quanta, 2020) recommend considering four different paths:

1. **Design.** Maritime architects and designers are responsible for designing a ship's hull. They develop concepts and draft plans so that ship moves smoothly and economically.

2. **Fabrication.** As soon as the plans for a vessel have been drafted, they must be converted into physical parts. A modern technique known as optical marking is used to transform the small-scale drawings of various ship parts into photographic negatives are then projected onto steel plates and automated fabrication equipment is used to cut and meld the metal into the necessary sizes and shapes.
3. **Skilled trade work.** As you might expect, the creation of a ship typically requires a lot of work from skilled tradespeople. The hull of a ship is put together by shipwrights. Operators and riggers lift massive sections into place to create the hull. Ship fitters then check each section to see if everything is properly in place. Welders and metalworkers are responsible for permanently galvanizing the hull. After the hull is intact, electrical workers, carpenters, painters, and metal workers build out bathrooms, kitchens, sleeping quarters and closets. These tradespeople also install lights, HVAC, radar equipment, and other ship systems. As soon as the vessel is outfitted, it is suitable for sailing.
4. **Management.** Management is necessary for every industry and shipbuilding is no exception. Shipyard supervisors oversee the physical assembling of a ship, while other managers oversee ship design and the myriad financial aspects of running a shipyard.

Ship maintenance, repair and conversion include outfitting, and refitting of various types of ships, oil platforms and offshore installations. Specialists working in the ship construction industry can easily move into the repair, design and engineering positions. They can provide expertise in inspection, maintenance, consulting and project management, as well as real-time quality and technical services.

### 3.4. Education and training

Undergoing the right training and having the correct qualifications are essential if you want to apply for one of the many marine jobs. There are many opportunities on board, in ports and shipyards no matter what your level of experience and your relevant qualifications are.

- Vocational training courses in the maritime and port industry can offer you new skills and knowledge to work in a range of roles across the maritime industry. These VET courses are able to offer you a specialization if you are at the beginning of your career, and also to change your career route.
- If you do see yourself working in an office environment in shipping, it's a lot more likely that you'll need to graduate from university (technical or economic).
- If you're a graduate of a maritime university you can get a well-paid job on board or you can work in management positions ashore.
- There are also several jobs, such as port stevedore, crane operators and seaman for which you would need short-term VET training courses.
- Having a diploma or equivalent in subjects like IT, Science and English will help set you apart from the competition when it comes to applying for jobs so don't make the mistake of thinking you can just give up on school.

When it comes to skills and qualities, we must admit that working in the maritime industry requires a lot of personal qualities namely an eye for detail, punctuality and integrity, and often physical strength and determination.

- Of course, safety awareness is an absolute must in the maritime industry and anyone working in one of the many positions in a port needs to be aware of their responsibility towards not only crewmates and co-workers but also the vessels and cargo they work with too.
- Good communication skills are a big plus for most jobs. In the maritime industry, even the smallest miscommunication or instance of something getting lost in translation can cause serious issues. If you can speak two or more languages, you could be a real asset to any employer in the maritime industry.
- The shipping industry is an industry that literally never sleeps. Depending on the job you choose, you might also need to be prepared to work in shifts. To be fair: working in the maritime industry in many jobs isn't on typical 9 to 5.

#### **MARITIME TRANSPORT, PORTS AND SHIPBUILDING - EDUCATION AND TRAINING**

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##### **Constanta Maritime University Training Centre**

104 Mircea cel Batran, 900663, Constanta Romania

Faculty of Navigation and Naval Transport and Marine Engineering

Online and Face to Face

<https://cmu-edu.eu/>

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##### **GIMET Europe S.R.L.**

Str. Mihai Viteazul nr. 47B, postal code 900826, Constanta, Romania

STCW training courses and Professional Education, Training and Assessment of Seafarers

Online and Face to Face

<https://gimet.global/>

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##### **Georgian College**

1450 8th St. E. Owen Sound, ON N4K 5R4

Marine Training and Research (CMTR)

Online and Face to Face

<https://www.georgiancollege.ca/marine-training/>

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##### **Aboa Mare**

Juhana Herttuan puistokatu 21, Turku – 20100 Finland

Maritime Academy, Maritime Training Centre Online and Face to Face

<https://www.aboamare.fi/>

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##### **GMC Training Center**

47 Gounari Street, Piraeus 18531 2 Fustel de Coulanges, Chios 82100 Agios Nikolaos, Kalymnos 85200

Maritime Training Centre, Online and Face to Face

<https://gmcmaritimecenter.com/>

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### 3.5. Trans-sectoral working possibilities

Individuals working in the maritime transport industry can follow different career paths as many of the roles or skills are transferable.



**Management and planning.** Ship operations and management have become significant in the maritime industry over the last few years. Managerial careers include maritime traffic management, technical management, ship maintenance systems, management of foreign vessels, crew management, shipping and port operations management. For a managerial career, it is necessary to have a specific skill set, which includes motivation, innate people management skills, rational thinking, commercial awareness, excellent communication skills, and updated knowledge of the maritime industry (SHMGroup, 2019).

**Engineering.** Engineers play important roles in the maritime industry. A marine engineer is someone who designs, builds, tests and repairs ships, boats, underwater craft, offshore platforms, and drilling equipment. This includes creating blueprints, designing engines and propulsion systems, testing prototypes, and supervising the construction of full-size ships.

**Scientists.** If you have a scientific background then you can be employed by marine research institutes, universities, international organisations, commercial companies, government agencies and not-for-profit organisations (Prospects, 2020).

**Economics.** If you work in the maritime industry and you have good economic skills, then you can (re)boost your career in the Maritime and Logistics industry. The types of positions vary widely from Logistics Manager to Consultant, to Port Engineer (MaritimeEconomics, 2020).

The companies directly related to the maritime industry are not the only major employers of our graduates. There are many companies that have a link to the maritime industry. Therefore, opportunities exist across a vast number of private and public organizations in any sector. These can range from the financial, consumer and information technology industries.

### 3.6. Facts and figures

#### Types of jobs available

A common misperception is the types of jobs available, which go far beyond the perceived seafaring roles. Statistics from 2018 show that:

- Maritime transport employs about 232 000 people (6 % of jobs in the established blue economy).
- Shipbuilding employs about 315 000 people (8 % of jobs in the established blue economy).
- Ports employ more than half a million people (14 % of jobs in the established blue economy).

#### Gender equality

Another misconception is that the maritime industry is male-dominated. Empowering Women in the Maritime Community" was the World Maritime Day theme for 2019. The theme provided an opportunity to raise awareness of the importance of gender equality, in line with the United Nations' Sustainable Development Goals (SDGs), and to highlight the important contribution of women all over the world to the maritime sector (IMO, 2019).

- I would say that the industry has made great headways to promote gender diversity. There are many examples of successful female maritime professionals.
- The International Maritime Organization Assembly has adopted a resolution proclaiming an International Day for Women in Maritime. This is celebrated on 18 May every year.
- To achieve a more diverse workforce, it is essential that women are visible. To do this IMO has invited women of the maritime sector to share photos of themselves at work, using the hashtag Maritime Women Photo Share.
- In addition, IMO has launched a new logo for its Women in Maritime programme, as part of its mission to support the United Nations Sustainable Development Goal 5: Achieve gender equality and empower all women and girls.

### 3.7. Summary

The maritime transport is the backbone of international trade and the global economy, occupying a central role within the entire logistic chain from fabrics, freight forwarding, port operations, maritime transport, intermodal connections, and warehouse to distribution.

The maritime transport, port and shipbuilding sectors are economic drivers for local communities and significant sources of employment. The entire transportation system comprises navigable waters, vessels,

ports and land-side facilities, intermodal connections (highway system, railroads, air transit and inland water transportation routes), shipyards, and repair facilities.

Various occupations in engineering and non-engineering areas are on the waterside, on board ships, as well as in the port and shipbuilding industry. Undergoing the right training and having the correct qualifications are essential for many marine jobs. Individuals working in the maritime transport industry can follow different career paths in management roles, engineering, science, logistics and economics.

### 3.8. Evaluation quiz no.3

1. Which of the following statements referring to the logistic chain is correct?
  - A. Logistic chain refers to freight forwarding and port operations
  - B. Logistic chain starts from fabrics and ends with distribution
  - C. Logistic chain refers to the maritime transportation of goods
2. The maritime transportation system comprises various occupations. Select the correct response:
  - A. The maritime transportation system comprises only engineering occupations
  - B. The maritime transportation system comprises only on-board ships occupations
  - C. The maritime transportation system comprises engineering and non-engineering occupations
3. The use of technology in the shipping industry is rapidly growing. How will this influence careers?
  - A. There will be increasing opportunities for jobs in marine tech
  - B. All the people will face difficulties in carrying out their current jobs
  - C. Robots will replace the human persons
4. Training courses in the maritime and port industry can offer you skills and knowledge to work in a range of roles across the maritime industry. How does it influence career progress and paths?
  - A. There are many opportunities on board, in ports and shipyards but you can progress only on the path that you have experience
  - B. Individuals working in the maritime and port transport industry can follow different career paths as many of the roles or skills are transferable
  - C. If you started work in the maritime industry, then you can work only for companies directly related to the maritime industry
5. Which of the following statements about working in the maritime industry is correct?
  - A. The maritime industry is only for seafarers
  - B. The maritime industry is only for men
  - C. There are international initiatives to promote gender diversity in maritime
6. What are the responsibilities of specialists working in the shipbuilding industry?
  - A. Approving designs and budgets
  - B. Providing expertise in inspection, maintenance, consulting and project management

- C. Taking care of the ship's personnel

### 3.9. Supplementary information

#### Reading

Managerial careers in the maritime industry (2019) <https://www.shmgroup.com/blog/managerial-careers-in-the-maritime-industry/>

MARTIDE, Shore-based maritime jobs, <https://www.martide.com/en/blog/seafarers/jobs-in-seaports/>

7 Reasons to Work in the Marine Industry, <https://blog.v-hr.com/blog/7-reasons-to-work-in-the-marine-industry>

Careers advise for youngsters who want to work in maritime, <https://zeymarine.com/careers-advice-for-youngsters-who-want-to-work-in-maritime/>

#### Video materials

Working in the maritime industry in the 2020s: The new trends. <https://youtu.be/0XUxRJqm2HI>

What is the Maritime Industry? <https://youtu.be/jFKmtho5NOK>

### 3.10. Self-reflection

In this module, we were focusing on maritime transport, ports and shipbuilding. Which of these areas is more appealing to you and why?



## 4. MARINE EXTRACTION OF OIL, GAS AND MINERALS

Throughout the Earth’s history, oil, gas and minerals have formed from the remains of marine algae and land plants, with large deposits accumulating in certain rock strata. Today, using modern drilling techniques and giant platforms, these resources are being extracted from ever-greater depths.



Fisheries, aquaculture and processing



Coastal and maritime tourism



Maritime transport, ports and shipbuilding



Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Blue biotechnology



Deep-sea mining



Desalination



#### 4.1. Aim and objectives

The marine extraction of oil, gas and minerals module aims at offering a deep understanding of what a job in this sector means and at providing a wide perspective of blue career opportunities.

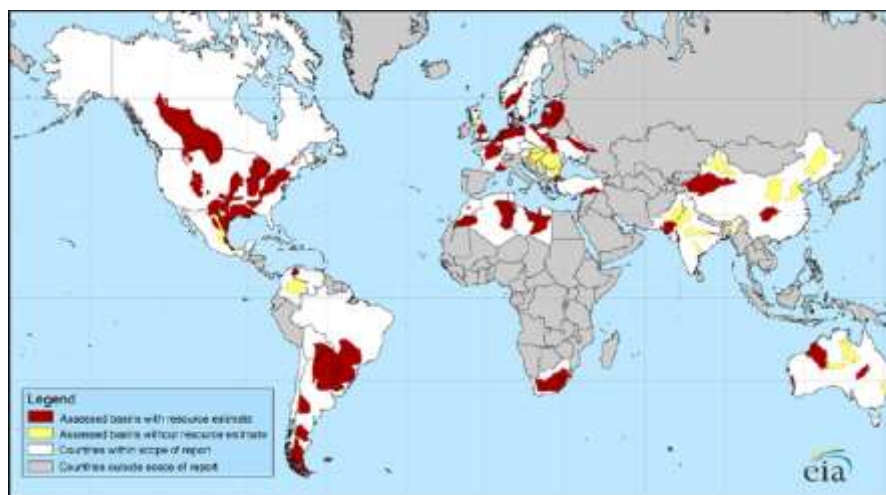
Upon completing the module, you will be able to:

- Understand that the oceans hold a veritable treasure trove of valuable resources
- Recognize the role of the Marine extraction of oil, gas and minerals in the blue economy
- Explain the types of jobs that one can get in the Marine extraction of oil, gas and minerals sector
- Describe the career paths that can be explored

#### 4.2. General information about the marine extraction of oil, gas and minerals sector

Oil, gas and mineral deposits are the raw materials that drive the global economy. The marine extraction of oil, gas and minerals represents around 13% of the gross value added (GVA) of the established blue economy, although it accounts for only 4% of the jobs (162 374 people). The extraction of minerals accounts for half of employment, followed by support activities (combined – 28%), offshore oil (13%) and then natural gas (9%).

When talking about the oil reserves of a specific country, it is worth mentioning that it is about the amounts of crude oil that can be found in the country and recovered at a cost that matches the current price of oil. Most of the conventional natural gas reserves are in the Middle East, representing 40% of total world reserves. Russia has the second-highest amount of proven reserves, with about 25%. The United States contains just over 4% of the world's natural gas reserves. Venezuela has the largest known oil resources in the world, but ageing infrastructure and internal conflict are preventing the country from producing as much as it could.



Source: EIA

Reserve and occurrence. Both the terms occurrence and reserve refer to some amount of a resource, however, the ideas are fundamentally different. Primary raw materials occur on the Earth and have associated occurrences (all that exists) and reserves (the amount that can be economically extracted).

### Main steps for marine extraction

In order to extract these resources, there is a lot of technology and planning. Various activities are carried out before the actual extraction.

- I. The first is Decision. To decide on a site with potential oil/gas/minerals, Geologists and Geo-Scientists work to collect information about the areas with potential oil or gas reservoirs.
- II. Secondly, the Survey stage. Specialized vessels in survey are then employed for seismic surveys. These vessels are equipped with sophisticated equipment, machinery and laboratories, which are able to scan the sea bed to understand the rock formations and find out natural resources.
- III. Once the natural resources were identified, the site would be Acquired. The boundaries are earmarked by the local governing bodies for energy and resources.
- IV. The next stage is the Impact evaluation. Studies for impact on the environment are carried out by specialized companies.
- V. Finally, the Drilling can start. Oil companies are then called for auctions and the extraction can start. There are several types of drilling units that can be deployed to carry out the jobs, depending on depth, seabed structure and extraction technology. Support vessels are hired for various purposes as well. Some of the holes drilled will be economically viable and will enter into exploitation. When that happens, offshore fields will be developed with the subsea infrastructure, which includes the oil rigs and the connecting pipelines.
- VI. Lately, to protect our planet, the need for Decommissioning has revealed a new industry. The decommissioning of oil facilities consists in bringing back the operating site in a state as close to its original environment as possible and in optimal safety conditions.

All these steps take place over several years and require the mobilisation of significant logistical, financial and administrative resources.

### Types of MODUs

Once a prospective reserve is found and impact assessed, companies will drill highly-regulated exploration wells with Mobile Offshore Drilling Units (MODUs). Some MODUs are converted into production rigs, meaning they switch from drilling for oil to capturing oil once it's found. Most of the time, the oil company will replace the MODU with a more permanent oil production rig to extract the oil.

There are four main types of MODUs:

- Drill ships are ships that have a drilling rig on the top deck. The drill operates through a hole in the hull. Drill ships can pilot to the drill site and then use a combination of anchors and/or propellers to correct for drift as the rig drilling for oil. They can operate in deep water conditions.

- Semi-submersibles float on the surface of the ocean on top of huge, submerged pontoons. Some have propulsion systems, which allow them to navigate to drilling sites under their own power while others require a second vessel to tow them to the right location. Most use several anchors -- up to a dozen -- that help maintain the structure's orientation. Computers control the tension on each anchor chain to correct for drift. Some can convert from drilling rigs to production rigs, reducing the need for a second rig to take its place once oil is found.
- A jack-up is a rig that sits on top of a floating barge. A ship tows the barge to the drilling site. Once positioned, the jack-up can extend its legs down to the sea floor. The legs are loaded in such a way that they don't penetrate the floor. Once each leg is secure, the jack-up continues to ratchet the legs so that the platform rises above the water level. This keeps the rig safe from tidal motions and waves. Jack-ups can operate in depths of up to 525 feet (160 meters).
- A submersible or barge MODU usually consists of a barge that rests on the sea floor at depths of around 30 to 35 feet (9.1 to 10.7 meters). On the barge's deck are steel posts that extend above the water line. A drilling platform rests on top of the steel posts. These rigs are typically used in areas with calm water.

### Types of vessels

In addition, the marine extraction of oil, gas and minerals requires diverse activities carried out with the support of several types of vessels:

- Platform supply vessels (PSV): High-capacity supply ship, either in deck or cargo hold.
- Anchor handling tugs supply (AHTS): Similar to PSV, they can anchor and tow floating oil platforms (jack-ups and semi-submersible ones)
- Multipurpose supply vessels (MPSV): Universal vessels able to provide a large variety of maintenance services. They are most of the time equipped with a high-capacity crane (100 tons and more). "Jumpers", particularly MPSV are equipped with ROV (remotely operated vehicles) to upkeep submarine equipment like wellheads.
- Fast Supply Intervention Vessels (FSIV): High-speed ships, (approximately 25 knots, 46 km/h, 29 mph) with a smaller deck capacity. They can nevertheless transport passengers. They essentially serve for urgent delivery or small shipment.
- Crew Boats: Those vessels are meant to shuttle back and forth oil platform workers between the sea installation and land. They can be high-speed craft (NGV). Smaller vessels are used for cross-sites transports. The helicopter is also widely used, especially when the weather is tough like in the North Sea.
- Stand-by/Rescue vessels: Ships destined for security, which keep patrolling around the installation and must be ready to intervene in case of sea fall, evacuation or firefighting. They are used mostly in the northern seas.
- Line Handling Vessels (LH): Vessels used for handling spies (mooring lines).
- ROV Support Vessels (RSV): Support vessels specialized in ROV (Remote Operated Vehicle) operation.
- Tug Supply Vessels (TS): Vessels used as a tug and in the supply of platforms.

- Oil Spill Response Vessels (ORSV): Vessels dedicated to responding to offshore oil spills.
- Diving Support Vessels (DSV): Vessels are used as a floating base for professional diving services.

### 4.3. Job opportunities in the marine extraction of oil, gas and minerals sector

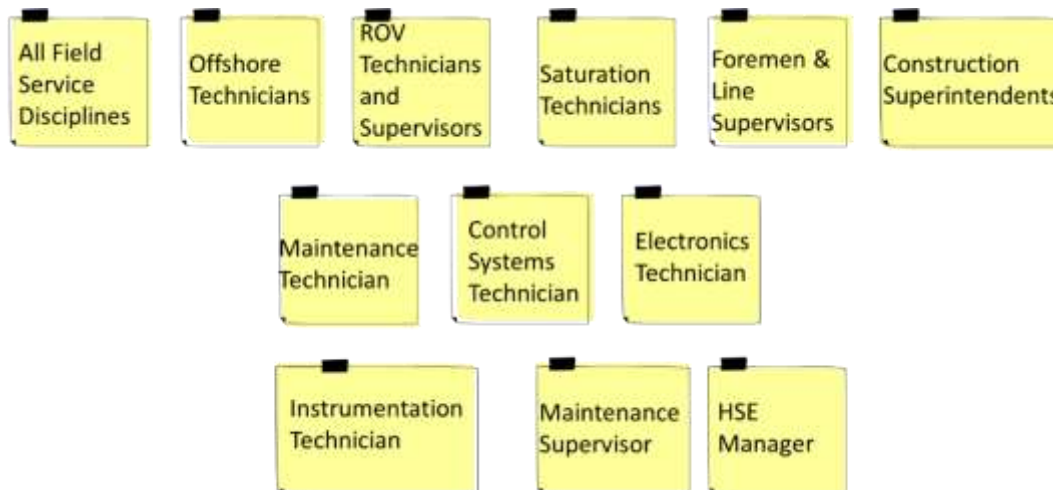
There is a great variety of job opportunities within the marine extraction of oil, gas and minerals industry for seafarers, working directly on the different vessels that support the industry, such as platform support vessels (PSVs), anchor-handlers (AHTSs), emergency rescue recovery vessels (ERRVs), diving support/construction vessels, and survey vessels. Working on types of vessels requires physical and mental readiness.

Depending on the job you want and your aspirations, you need to carefully plan your career. First, you need a qualification. We will help you identify various aspects of education and training related to occupations in the marine extraction of minerals, oil and gas systems.

Several engineering and non-engineering occupations are on the platforms side, shore and offshore side. The careers on the platforms are attractive and 250,000 European seafarers want to move into offshore oil & gas or in a shore-based job (cross-sectoral mobility).

Here are some of the most common types of positions in the Oil & Gas industry (OrionTalent).

#### Technical & Supervisory Careers



**All Field Service Disciplines** are responsible for the overall operation and maintenance of compressor packages and gas-processing equipment in various regions.

**Offshore Technicians** perform various maintenance duties such as repairs, calibrations and improvements for all equipment in the assigned field.

**ROV Technicians and Supervisors** supervise and/or participate in the maintenance, repair and operation of complex underwater search and recovery systems and subsystems.

**Saturation Technicians** operate, repair, and maintain all diving saturation equipment used in underwater operations.

**Foremen & Line Supervisors** lead and organize crews, delegate job responsibilities and verify that the appropriate equipment is available and on-site to complete small project/job(s).

**Construction Superintendents** are responsible for managing projects that entail the renovation and construction of petroleum retailing facilities.

**Maintenance Technicians** spend the majority of their time at a maintenance facility working on the troubleshooting, testing and repair of equipment that has been brought back from the operating crews in the field.

**Control Systems Technicians** install, maintain and troubleshoot instrumentation, control circuits and equipment related to natural gas processes such as the compression, dehydration, measurement, transmission and storage of natural gas.

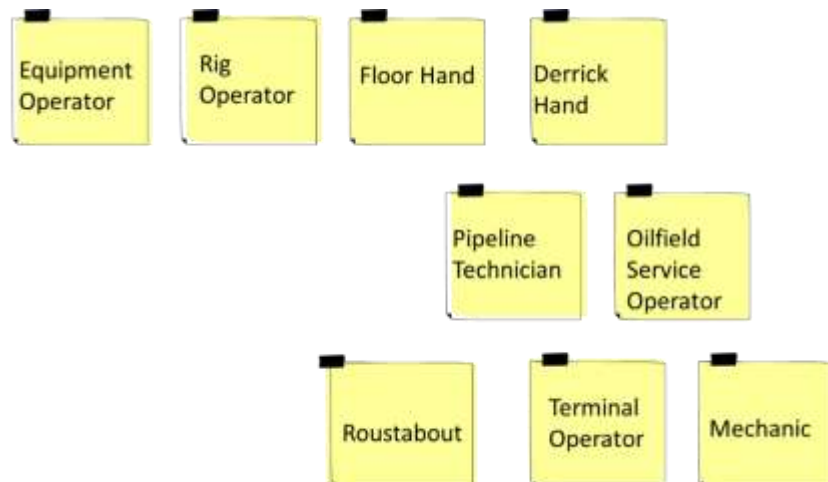
**Electronics Technicians** oversee and monitor the electronic function of the base location or specific department, and are responsible for ensuring all electronic-related issues are managed effectively and completely.

**Instrumentation Technicians** inspect, test, adjust, and repair electric, analog and digital electronic, pneumatic, hydraulic and mechanical instruments and systems.

**Maintenance Supervisors** are responsible for the safe, efficient, and environmentally responsible maintenance of refinery equipment.

**The Health, Safety & Environmental (HSE) Manager** provides leadership and accountability of business HSE goals, HSE programs, and HSE processes for the site(s).

#### Operations Positions



**Equipment Operators** are responsible for driving, operating and maintaining field operational equipment, in accordance with local and company safety standards and guidelines.

**Rig Operators** are responsible for operating power construction equipment, such as compressors, pumps, hoists, shovels, cranes, or tractors to excavate and move earth, erect structural and reinforcing steel, and pour concrete or other materials.

**Floor Hands** are responsible for carrying out the maintenance and cleaning of the drill floor and all drilling equipment.

**Derrick Hands** are responsible for monitoring and maintaining proper procedures for the daily operations of well-servicing rigs.

**Pipeline Technicians** are responsible for providing operational, technical, electrical, and mechanical support for all facility equipment, including on the pipeline itself but also at the pump station/storage areas.

**Oilfield Service Operators** are responsible for the installation, commissioning and troubleshooting of rig automation controls, AC and DC drives and other equipment.

**Roustabouts** do many different roles in the support of the oil rig, including offloading of personnel and supplies from cargo vessels (e.g. food, drill pipe, casings, tubing and cutting boxes).

**Terminal Operators** perform routine terminal maintenance and ensure the quality and quantity of refined products.

**Mechanics** are responsible for performing maintenance and repair on pipeline pump stations and terminal equipment, which includes natural gas-fired engines, diesel-fired engines, motors, centrifugal and positive displacement pumps, compressors, meters, gravimeters, transmitters and other equipment.

#### Management & Engineering Positions



**Project Managers and Engineers** are responsible for the successful initiation, planning, design, fabrication, and customer delivery of the company's product through the monitoring and controlling of a project.

**All Engineering Disciplines** are responsible for taking an identified problem or opportunity associated with some facet of operations, examining alternative solutions, selecting the optimum solution and preparing a complete process design for modification or addition.

**Well Site Managers** are responsible for leading a crew at a well site. Your primary role and responsibilities will be to safely and efficiently manage onsite operations and lead field personnel to deliver the business objectives, in full compliance with relevant standards, policies, and legislation.

**Leadership Development Programs** can work in a variety of roles based on strengths, desires, and the needs of the company.

**Logistics and Supply Chain** staff are responsible for gathering and analysing data, evaluating and recommending route plans and providing logistics support for exploration and production operations.

In a **Sales and Business Development** role, staff build and maintain fuel order volume and market share by locating, developing, closing and maintaining sales business relationships.

In order to have such roles, first, you need a qualification. We will help you identify various aspects of education and training related to occupations in the Marine extraction of oil, gas and minerals.

#### 4.4. Education and training

Explore your career interests by visiting career centres, faculties, advisors, counsellors, friends, and professionals. Talk to people and use helpful tools such as career assessments and career counselling appointments. You can also utilize your self-assessments to identify jobs that match your personality, abilities, values, interests, skills, academic training, and life experiences.

Write the answers to the following Key Questions as part of your self-assessment:

- 1) What Do I Want to Do?
- 2) What Can I Do?
- 3) What Do I Need to Do to Develop Myself Further?
- 4) How Can I Get the Job I Want After Graduation?

### MARINE EXTRACTION OF OIL, GAS AND MINERALS - EDUCATION AND TRAINING

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104 Mircea cel Batran, 900663, Constanta, Romania

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Dynamic Positioning Courses

<http://www.cmu-edu.eu/dp/>

### **University of Petrosani**

Face-to-face courses

Engineering courses for oil and gas extraction

<https://www.upet.ro/en/>

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### **Petro Skills Academy**

Kingsway Business Center, 11810 Kingsway NW, Edmonton, AB T5G 0X5 Canada

Online and Face to Face

Developing Competent Petroleum Professionals Worldwide

<https://www.petroskills.com/blended>

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### **Moga Marine, Oil & Gas Academy**

Online and Face to Face

Introduction to Oil and Gas

Exploration and Production Themes such as geosciences, engineering and drilling

<https://moga.saoga.org.za/courses/introduction-oil-and-gas>

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## 4.5. Trans-sectoral working possibilities

The oil and gas industry provides a diverse variety of career opportunities, be it offshore or onshore, seismic shipyards, drilling rigs, shale oil exploration, or traditional office jobs. Although you may have to deal with intense long shifts and harsh working conditions pursuing a career in an oil and gas industry, going the extra mile in this field is definitely rewarding, because the salaries are higher, typically above average. Oil and gas engineers may work in office buildings, labs, industrial plants or on-site. They may work in the exploration and extraction process or for equipment manufacturers. There are several career paths to choose in the oil and gas industry (Safety4Sea, 2018).

Petroleum engineers are involved in almost all stages of oil and gas field assessment, development and production.

Energy engineers may be based in an office or laboratory on land or on-site. They can work for the production of energy through natural resources, such as the extraction of oil and gas, or from renewable sources of energy, such as biofuels, hydro, wind and solar power. Energy engineers may choose between design, research or development roles.

Geoscientists can work for interpreting geophysical, geochemical and geological data to develop models for discovering commercially viable reserves of natural resources, such as oil, gas, minerals and water. Their activity is based in offices or laboratories or at sea, onboard research and exploration vessels.

Engineering geologists assess natural conditions, such as geological risks and deal with factors that could affect engineering works.

Hydrographic surveyors usually work on board survey ships and platforms for measuring and mapping underwater surfaces and studying the morphology of the seabed.



Mining engineers ensure the efficient development of mines and other surface and underground operations. Mining engineers are involved at all stages of a project. Before a new site is developed, they assess its viability, oversee mining production processes and are involved in the final closure and rehabilitation process.

Mud logger monitors drilling activity, recording information about the well status during the extraction of oil or gas.

#### 4.6. Facts and Figures

Despite high salaries and chances to travel the world, a career in oil and gas does not seem attractive for the new environmentally-sensitive generation.

- 14% of millennials would not be interested in pursuing a career in the sector, due to its 'negative image' from an environmental and tough-working-conditions point of view (McKinsey, 2016).
- The extraction itself impacts the environment, but developing the infrastructure required to extract these resources can cause severe environmental damage.

There are few women in oil and gas than in almost any other major industry.

- Women are especially scarce in technical and field roles, which often lead to advancement.
- Among entry-level positions requiring college degrees, women fill 50% of office and business support roles, compared to only 15% of technical and field roles.

The blue economy is a driving force for economic growth, innovation and employment. According to (EuropeanCommission, 2019), the established sector's contribution to the blue economy:

- Extraction and commercialisation of marine living resources, 14% of jobs.
- Marine extraction of minerals, oil and gas, 4% of jobs.
- Maritime transport, 6% of jobs.
- Port activities, 14% jobs.
- Shipbuilding and repair, 8% of jobs.

And just a little chemistry:

- Crude oil is fractionated to obtain the chemicals used for gasoline, lubricants, plastics and other products.
- Natural gas is often associated with coal and petroleum deposits.
- Natural gas produces fewer greenhouse gases per energy unit than coal.

#### 4.7. Summary

Marine extraction of oil, gas and minerals in a certain area takes place over several years and requires the mobilisation of significant logistical, financial and administrative resources. In order to extract the resources, several steps are followed, starting from decision, survey, acquiring, impact evaluation, drilling to decommissioning.

There is a great variety of job opportunities within the marine extraction of oil, gas and minerals industry for seafarers working on different types of vessels. Several engineering and non-engineering occupations are on the platforms side, shore and offshore side.

Oil and gas engineers may work in office buildings, labs, industrial plants or on-site. They may work in the exploration and extraction process or for equipment manufacturers.

#### 4.8. Evaluation quiz no.4

1. What is the location of the large conventional natural gas reserves?
  - A. South America
  - B. The United States
  - C. The Middle East
2. Where are the most resources of oil and gas located?
  - A. Russia
  - B. Venezuela
  - C. The United States
3. The marine extraction of oil, gas and minerals industry includes occupations:
  - A. On board different types of vessels and shore-based sites
  - B. On the platform side
  - C. In the research institutes
4. The greatest damage to the environment caused by oil extraction is from:
  - A. The drilling process
  - B. The remediation and relocation
  - C. Road construction and infrastructure development
5. What does the oil reserve mean?
  - A. The amount that can be economically extracted
  - B. The amount that can be found on the Earth
  - C. The amount located in every deposit in the world
6. What is the last stage in the marine extraction of resources?

- A. Survey stage
- B. Drilling
- C. Decommissioning

#### 4.9. Supplementary information

##### Reading

Managerial careers in the Marine extraction of oil, gas and minerals, <https://safety4sea.com/cm-seven-career-paths-to-choose-in-oil-and-gas/>

Careers in mining, oil, and gas, <https://www.bls.gov/careeroutlook/2013/spring/art02.pdf>

Working in the Marine extraction of oil, gas and minerals, <https://worldoceanreview.com/en/wor-3/oil-and-gas/where-and-how-extraction-proceeds/>

Careers advise for youngsters who want to work in Marine Industry, [https://www.seafair.io/for-seafarers-b?gclid=EAIaIqobChMIsrH2ibm29gIVheFRCh2R2AUIEAMYASAAEgKyYPD\\_BwE](https://www.seafair.io/for-seafarers-b?gclid=EAIaIqobChMIsrH2ibm29gIVheFRCh2R2AUIEAMYASAAEgKyYPD_BwE)

##### Video materials

Working in the Marine extraction of oil, gas and minerals industry in 2021s: The new trends.  
<https://www.nesfircroft.com/blog/2021/08/9-Biggest-Middle-East-Oil-and-Gas-Projects-Happening-in-2021>

What is the Marine extraction of oil, gas and minerals industry?  
<https://www.youtube.com/watch?v=jBaH6LUnC94>

#### 4.10. Self-reflection

In your opinion, what are the advantages of working in the oil and gas sector, compared to the maritime transport sector?



## 5. OFFSHORE WIND AND OCEAN ENERGY

With the oceans covering over 70% of the earth’s surface, they are the world’s largest collector and retainer of the sun’s vast energy – and the largest powerhouse in the world. This energy is continually renewed and is available 24/7. Just a small portion of the energy conveniently stored in the oceans could power the world. On the other hand, wind energy is an indirect form of solar energy. It is estimated that 1-2% of the solar radiation that reaches the earth is converted to wind energy.



Fisheries, aquaculture and processing



Coastal and maritime tourism



Maritime transport, ports and shipbuilding



Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Source: European Commission

Blue biotechnology



Source: UNCTAD in Asia and the Pacific

Deep-sea mining



Source: Jungblut et al. 2019

Desalination

## 5.1. Aim and objectives

There is significant global interest in harnessing renewable energy from the Earth's oceans. The module offshore wind and ocean energy are intended to offer an in-depth overview of wind and ocean energy sources, focussing on working opportunities in this sector.

Upon completing the module, you will be able to:

- Understand the role of offshore wind and ocean energy in the blue economy
- Explain the types of jobs that ones can get in
- Describe the career paths that can be explored
- Propose trans-sectoral working possibilities

## 5.2. General information about the offshore wind and ocean energy sector

### Offshore wind

Offshore wind power or offshore wind energy is the generation of electricity through wind farms in bodies of water, usually at sea. Because the speed of the wind is higher offshore than on land, offshore farms can generate more electricity.

Wind energy is recognised worldwide as a proven technology to meet increasing electricity demands sustainably and cleanly. Offshore wind energy has the added attraction that it has minimal environmental effects and, broadly speaking, the best resources are reasonably well located relative to the centres of electricity demand.

### Ocean energy

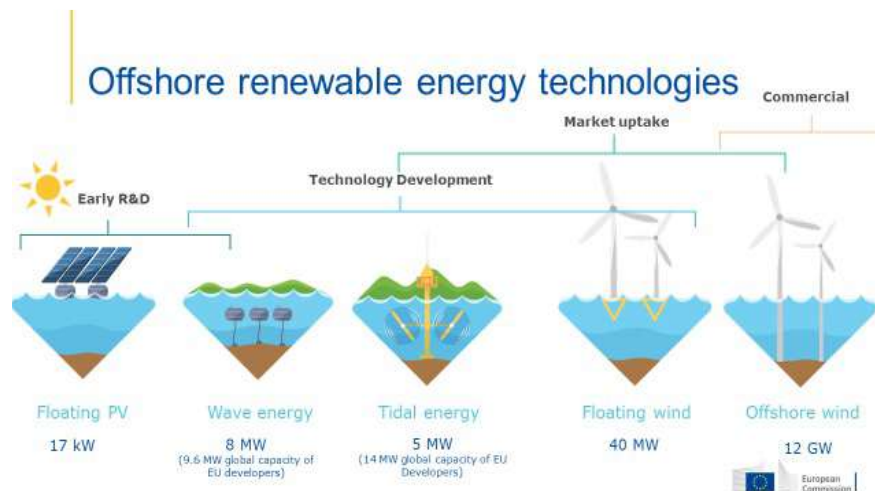
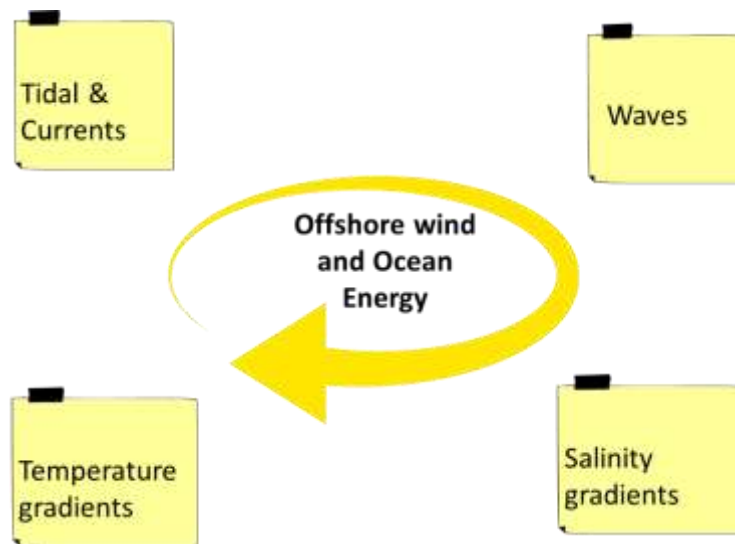
The oceans are the world's largest untapped source of energy. Ocean energy technologies exploit the power of tides and waves, as well as differences in temperature and salinity, to produce energy.

Marine energy or marine power refers to the energy carried by ocean waves, tides, salinity, and ocean temperature differences.

- **The movement of water** in the world's oceans creates a vast store of kinetic energy or energy in motion. Some of this energy can be harnessed to generate electricity to power homes, transport and industries.
- **Wave energy** technologies capture the movement of the ocean and sea waves and use it to create energy – usually electricity. The amount of energy created depends on the speed, height and frequency of the wave, as well as the water density. Waves are created by the wind moving over the surface of the ocean, but they continue long after the wind has died down. This complementarity makes wave energy the perfect partner for wind energy, as it extends the power production significantly.

- **Tidal currents** are not influenced by weather conditions, but only by the well-known cycles of the moon, sun and earth. This long-term predictability makes tidal energy one of the most reliable sources of renewable energy available. Tidal stream turbines operate in a similar way to wind turbines and represent a 100% predictable clean energy source.
- **Salinity gradient.** A constant supply of ocean energy - salinity gradient power generation is a renewable energy source available 24 hours a day. It is therefore complementary to more variable sources of energy like wind, wave, and solar.

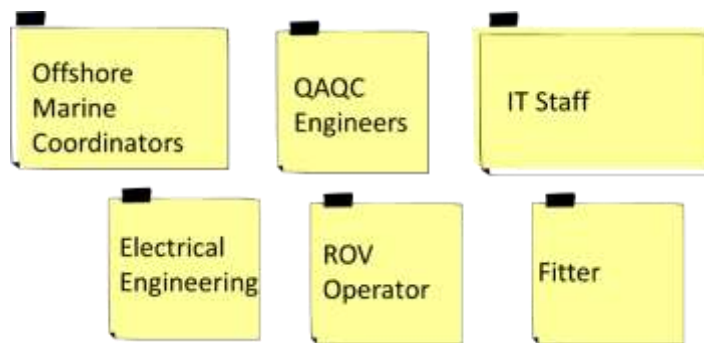
Ocean energy resources are contained in:



Source: European Commission (2020) Offshore Renewable Strategy

### 5.3. Job opportunities in the offshore wind and ocean energy sector

Ocean energy and Offshore Wind Energy are purely industrial. Accordingly, almost all of the employees consist of technical personnel. Platforms established to obtain energy are located in the open seas, underwater and sometimes close to the shore. Climate engineers, energy production and conversion, establishing platforms, designing and producing parts to establish a platform, ensuring the stable operation of machinery and energy transmission systems, ensuring the organization of systems and employees, ensuring continuous communication of employees, constantly analysing the monitors of climate and energy systems (IT). Engineers and technicians are among the most frequent jobs. Of course, accounting, work and performance reporting, accommodation and provision of human needs are mandatory. The need for healthcare workers may not be continuous. Below are sample occupations.



Electrical and electronics engineers can work in wind power plants. In addition, authorized maintenance personnel can work at the maintenance stage, civil engineers at the installation stage, and industrial engineers at wind farms in the field of turbine design.

- **Electrical Engineering.** In order to enter the occupation, prospective electrical and electronics engineers need a bachelor's degree in electrical engineering, electronics engineering, or electrical engineering technology.
- **QAQC Engineers** have graduated from Mechanical Engineering departments of universities and worked as Mechanical Engineers in the Wind Energy sector for at least 2 years.
- **Offshore Marine Coordinators** hold a certificate of Competency as Master on vessels over 3000GT, unrestricted DPO Certificate, experience in offshore operations, and knowledge of offshore construction
- **Fitters** get most of their education from on-the-job training, as most employers only require a high school diploma
- **ROV Operator** (ROV Pilot Technician) controls the movement of the vehicle from a ship's cabin or other indoor location on the surface.

### 5.4. Education and training

The hydropower industry is well established both nationally and internationally, and, in many parts of the world, has seen a significant increase in development in recent years. Of late, tidal energy has become

commercialised and continues to develop. Wave energy remains at a nascent stage, with the primary focus remaining on the research sector. However considerable global interest and investment exist in wave energy, and it is expected that further career opportunities will become available in the coming years as a commercial wave energy industry emerges driven by the vast resource, increased desire to de-carbonise economies and through synergies with the rapidly developing offshore wind energy sector. Numerous academic and research positions are also available in both the areas of tidal and wave energy research.

Those with engineering degrees can have better working conditions if they can do MSc in Ocean Energy, MSc in Renewable Energy Systems and Postgraduate Research.

## OFFSHORE WIND AND OCEAN ENERGY - EDUCATION AND TRAINING

### University of Strathclyde

16 Richmond Street Glasgow G1 1XQ

Professional Development Program

<https://www.strath.ac.uk/engineering/electricelectricalengineering/windmarineenergysystemsstructures/>

### University of Hull

Hull, UK HU6 7RX

Carbon Capture, Climate Change Essentials, Nature-Based Solutions, Hydrogen

<https://www.hull.ac.uk/study/cpd/courses/offshore-wind-energy>

### University of Aberdeen

King's College, Aberdeen AB24 3FX, UK

Energy Transition Systems and Technologies

<https://on.abdn.ac.uk/energy/>

### Suny Maritime College

6 Pennyfield Avenue, Throggs Neck, NY 10465

Online and Face to Face courses

Center of Excellence for Offshore Energy

<https://www.sunymaritime.edu/aboutcenters-excellence/center-excellence-offshore-energy>

## 5.5. Trans-sectoral working possibilities

Ocean energy employs about 2,000 people across Europe. Because of its potential, there is a lot of research ongoing in the EU with around 320 companies and organisations operating in this sector from the various Member States. Between 2007 and 2015, 2,6 billion € were invested in this sector in the EU. The size of the prize for commercialising ocean energy is huge. In Europe alone, the ocean energy industry plans to deploy 100GW of production capacity by 2050, meeting 10% of electricity demand. That's enough to meet the daily electricity needs of 76 million households.

Deploying 100GW of ocean energy will also mean creating a new industrial sector based firmly in Europe, and 400,000 skilled jobs all along the supply chain.



In short, Ocean energy (tidal, waves, etc.) employs about 2,000 people in Europe now and 10,500-26,500 permanent jobs and up to 14,000 temporary jobs could be created by 2035.

A lot of different areas are offering jobs in the field of ocean energy such as:

- Entry-level mechanical work
- Marine engineering
- Supply industry
- Project development, operations and maintenance
- Boating and transport
- Research and science
- Construction

## 5.6. Misconceptions about the sector

**Myth:** intermittency makes renewable energy unreliable

Conventional thinking has long held that renewable energy intermittency makes solar, wind and other green alternatives too unreliable. Thankfully, rapid technological innovation in recent years means this myth is outdated.

Indeed, solar energy is only produced when the sun is shining on solar panels. Likewise, wind energy is dependent on the ebb and flow of air currents. But the sheer volume of renewable energy being deployed, the ability to store that energy for longer, and to match demand with supply using software, creates a balanced grid.

**Myth:** the energy transition will be too expensive

The second myth is that the switch to renewables is too expensive for mass adoption; that government and society cannot bear the massive costs of a full-scale transition. Some analysts forecast as much as \$14 trillion will need to be invested in a fully renewable power system over the next 30 years.

Renewable energy is now the cheapest new electricity in countries that make up three-quarters of the world's GDP. It's not only cheaper; it's also more efficient. Coal power generation is 35% efficient, meaning 65% of energy is wasted in production and transport. In comparison, electricity powered by renewable sources is virtually 100% efficient at end-use and can be produced and managed locally.

**Reality:** decentralized, decarbonized and digital energy

Past energy transitions moved slowly because they relied on sweeping infrastructure changes from centralized sources. By contrast, the renewable-energy transition is driven by small, decentralized generation and storage on buildings and homes, all connected by software.

Common assumptions about the green energy transition are fast becoming outdated. This new energy system, which is already being built, will benefit the planet and future generations – and the sooner we lay the myths to rest, the better.

<https://www.weforum.org/agenda/2021/03/renewable-energy-myths-debunked/>

## 5.7. Summary

Ocean energy is abundant and renewable. It can play an important role in the energy mix as it is very predictable, contributing substantial value to the energy system. The main forms of ocean energy are waves, tides, marine currents, salinity gradient and temperature gradient.

Under the right conditions, ocean energy could contribute around 10% of EU power demand by 2050.

The technologies to capture ocean energy are at different stages of development in Europe. It is expected to reach the capacity to employ 400,000 people by 2050.

Ocean energy is a climate-friendly solution and emits no CO<sub>2</sub> and has no known environmental adverse effects. Studies show that marine life is not affected by ocean energy.

It is a visible reality that these developments will open up new opportunities for the traditional shipping industries.

## 5.8. Evaluation quiz no.5

1. What is ocean energy?
  - A. Solar energy systems that will be installed on the seas
  - B. Fossil fuels extracted from under the sea
  - C. The energy carried by ocean waves, tides, salinity and ocean temperature differences
2. What are the types of ocean energy?
  - A. Tidal energy, wave energy and ocean thermal energy
  - B. Oil, natural gas, Solar energy and Ocean currents
  - C. Solar energy, wind energy, tidal energy
3. Which of the following best describes the job of the ROV operator?
  - A. An ROV Operator controls the movement of the remotely operated vehicle from a ship's bridge
  - B. An ROV Operator controls the movement of the remotely operated vehicle from ashore
  - C. An ROV Operator controls the movement of the remotely operated vehicle from a ship's cabin or other indoor location on the surface
4. Which of the following is one of the advantageous aspects of offshore wind energy?

- A. Because the speed of the wind is higher offshore than on land, the offshore farms can generate more electricity
  - B. They develop tourism on the coastline where they are established nearby
  - C. Offshore wind turbines fail less than onshore turbines
5. Which of the following statements is false?
- A. The term marine energy encompasses both wave power i.e. power from surface waves, and tidal power i.e. obtained from the kinetic energy of large bodies of moving water
  - B. Offshore wind power is not a form of marine energy, as wind power is derived from the wind, even if the wind turbines are placed over water
  - C. Ocean thermal energy conversion (OTEC) plants may be land-based
6. Why tidal energy is considered one of the most reliable sources of renewable energy available?
- A. Because the tidal currents create a vast amount of energy in a short period
  - B. Because the tidal currents are influenced by the cycles of the moon, sun and earth, having long-term predictability
  - C. Because the tidal currents do not harm soil and water

## 5.9. Supplementary information

### Reading

Handbook of Ocean Wave Energy – Book -Editors: Arthur Pecher, Jens Peter Kofoed,  
<https://link.springer.com/book/10.1007/978-3-319-39889-1>

Fundamentals of Ocean Renewable Energy – Book - Authors: Simon Neill, M Reza Hashemi,  
<https://www.elsevier.com/books/fundamentals-of-ocean-renewable-energy/neill/978-0-12-810448-4>

Renewable Energy Magazine, [https://www.renewableenergymagazine.com/ocean\\_energy#](https://www.renewableenergymagazine.com/ocean_energy#)

Renewable Ocean Energy, [https://beachapedia.org/Renewable\\_Ocean\\_Energy](https://beachapedia.org/Renewable_Ocean_Energy)

Ocean Energy Technologies <https://www.seai.ie/technologies/ocean-energy/ocean-energy-technologies/>

Tapping into Ocean Power <https://news.climate.columbia.edu/2017/02/14/tapping-into-ocean-power/>

Tidal energy <https://www.nationalgeographic.org/encyclopedia/tidal-energy/>

Wave Energy Conversion And Ocean Thermal Energy Conversion Potential In Developing Member Countries <https://www.adb.org/sites/default/files/publication/42517/wave-energy-conversion-ocean-thermal-energy.pdf>

What is Ocean Energy, <https://www.oceanenergycouncil.com/ocean-energy/>

Ocean energy could be the wave of the future <https://www.sciencenewsforstudents.org/article/ocean-energy-could-be-wave-future>

Ocean Energy Forum

[https://webgate.ec.europa.eu/maritimeforum/sites/default/files/OceanEnergyForum\\_Roadmap\\_Online\\_Version\\_08Nov2016.pdf](https://webgate.ec.europa.eu/maritimeforum/sites/default/files/OceanEnergyForum_Roadmap_Online_Version_08Nov2016.pdf)

### **Video materials**

Is offshore wind the energy of the future? <https://www.youtube.com/watch?v=IsUBq3BM8rU>

Ocean Energy - Wave Power Station <https://www.youtube.com/watch?v=gcStpg3i5V8>

Can Underwater Turbines Solve Our Energy Problems?

<https://www.youtube.com/watch?v=CIYA6Jwwp4s>

Ocean energy <https://arena.gov.au/knowledge-bank/ocean-energy-video-playlist/>

### **5.10. Self-reflection**

Please give some examples of employment opportunities in this sector in your country or internationally. Why do you think that this sector is more developed in some countries compared to others?



## 6. BLUE BIOTECHNOLOGY

Blue biotechnology refers to using biology-based technology to transform marine organisms that until now often have been ignored for commercial exploitation. This includes microorganisms, algae and invertebrates.



Fisheries, aquaculture and processing



Coastal and maritime tourism



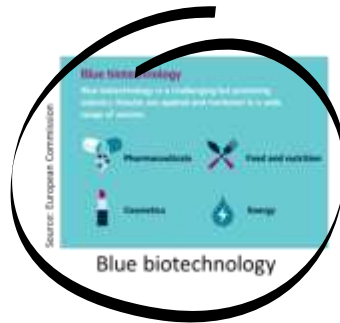
Maritime transport, ports and shipbuilding



Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Blue biotechnology



Source: UNDP in Asia and the Pacific

Deep-sea mining



Source: Anglin Kim et al. 2019

Desalination

## 6.1. Aim and objectives

The blue bio-economy is developing fast while several products and services that we use on a daily basis are the results of biotechnology. Blue biotechnology is the biotechnology using aquatic organisms, meaning using the living organisms to make some products like plastics, food and beverages, fabrics, medicines, and even personal care products.

Upon completing the module, you will be able to:

- Describe the application of biotechnology in the blue industry
- Understand the role of biotechnology in the blue economy
- Explain the types of jobs that ones can get in
- Describe the career paths that can be explored

## 6.2. General information about the blue biotechnology sector

The blue bio-economy turns aquatic biomass into marine biotechnology products such as food, feed, nutraceuticals, pharmaceuticals, cosmetics, energy, packaging, clothes and much more. This is an activity based on the sustainable use of renewable aquatic resources and water expertise. The development of these marine biotechnology products goes through different stages from discovery to selling.



Stages of a marine biotechnology product development, Source: (Basalo, 2016)

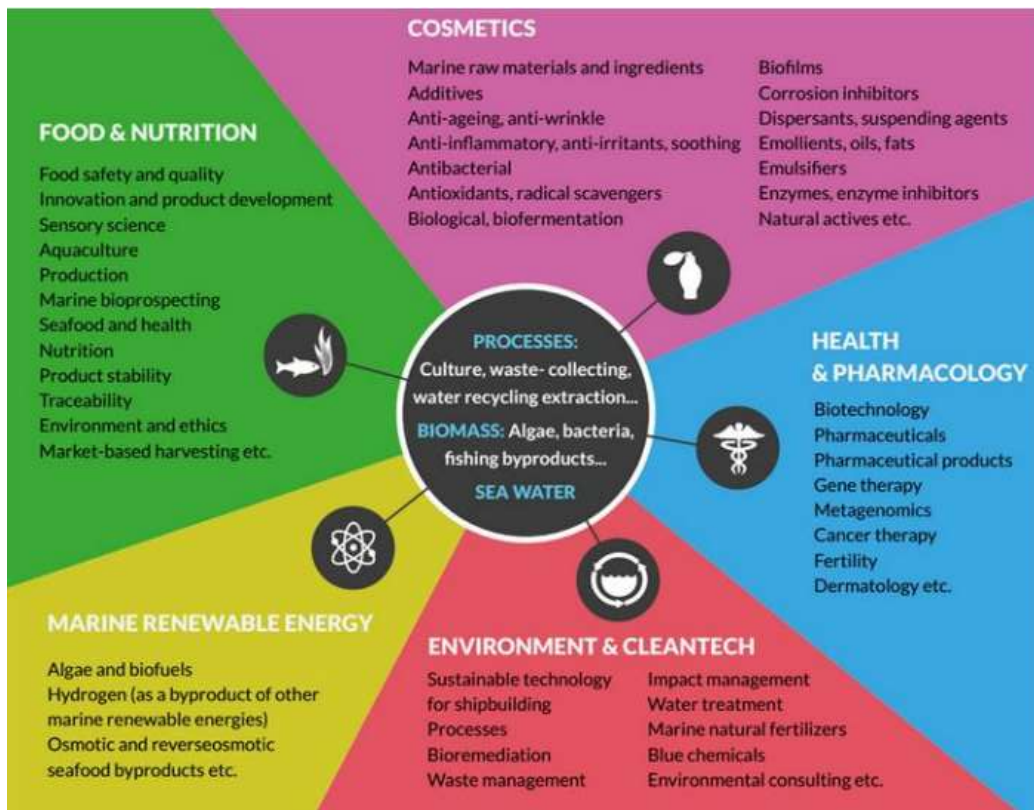
All these stages include the use of various technologies. In brief, blue biotechnology is concerned with the exploration and exploitation of marine organisms in order to develop new products.

Definitions:

- The blue biotechnology sector is generally considered the use of marine bio-resources as the source of biotechnological applications. Marine resources and marine organisms are used to develop products or services for biotechnological gain.
- In contrast, marine biotechnology also includes the application of biotechnology developed using any resource (marine, terrestrial, freshwater or a combination) to the marine environment, and human activities therein.

The blue biotechnology has the potential to contribute to a variety of other biotechnology and industry areas. There are several ways to classify biotechnology. The most used is the classification based on the colour code: red (medical, health and pharmaceutical), green (agricultural), yellow (environmental), white (industrial) and blue (marine biotechnology).

The marine biotechnology sector includes a large variety of products, processes, and services, as depicted below.



Source: The Marine Biotechnology Sector (Basalo, 2016)

The blue biotechnology has the potential to contribute to a variety of other biotechnology and industry areas. Therefore, this sector can produce investment, jobs and economic growth. The Blue Economy includes economic activities that are:

- Marine based such as capture fisheries and aquaculture, offshore oil and gas, offshore wind energy, ocean energy, desalination, shipping, maritime transport and coastal tourism.
- Marine related such as seafood processing, marine biotechnology, shipbuilding and repair, port activities, communication, equipment, maritime insurance and maritime surveillance.
- It also includes those parts of the public sector with coastal and ocean responsibilities such as national defence, coast guard, environmental protection as well as marine education and research.

In brief, blue biotechnology is the application of science and technology to living aquatic organisms for the production of knowledge, goods and services (OECD, 2016).

### 6.3. Job opportunities in the biotechnology sector

The first question arising is if the sector can be good for you. You may want to know more about blue biotechnology.

Well, career-wise, the biotech industry overview is positive. According to the biotechnology job growth statistics forecasts, the 5% employment rate in this field should grow at a faster pace than in the majority of other occupations (BLS, 2020).

With this trend and taking into consideration the fact that several industries are connected to blue biotechnology, you may find this sector a good opportunity. Blue biotechnology products can be found in:

- Agrifood: food supplements and fertilizers derived from the processing of microalgae.
- Cosmetics and cosmeceuticals: anti-wrinkle creams, antimicrobial facial care, thalassotherapy.
- Pharmacology: development of new oncological, cardiovascular, dermal and bone regeneration drugs.
- Aquaculture: methods to valorise the protein fraction of fishing co-products.
- Energy: second and third-generation biofuels.
- Environment: enhanced oil recovery, bio-detoxification, recovery of precious metals or rare types of earth. Organisms (fresh water and marine) to develop new commercially viable products or applications.

### 6.4. Education and training

If you want to work in the blue biotechnology sector, you need specialised training. Here, several training centres are providing specialised training:

#### BLUE BIOTECHNOLOGY - EDUCATION AND TRAINING

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##### IMBRSea University

Krijgslaan 281/S8 9000 Ghent, Belgium

International Master of Science in Marine Biodiversity

<http://www.imbrsea.eu/blue-biotechnology-and-bioeconomy>

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##### UDEMY Teaching & Academics

Online Courses

Biotechnology Courses

<https://www.udemy.com/course/blue-biotechnology-for-you/>

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##### Ocean4Biotech

Avenue du Boulevard – Bolwerklaan 21, 1210 Brussels | Belgium

Master program in Marine Biotechnology

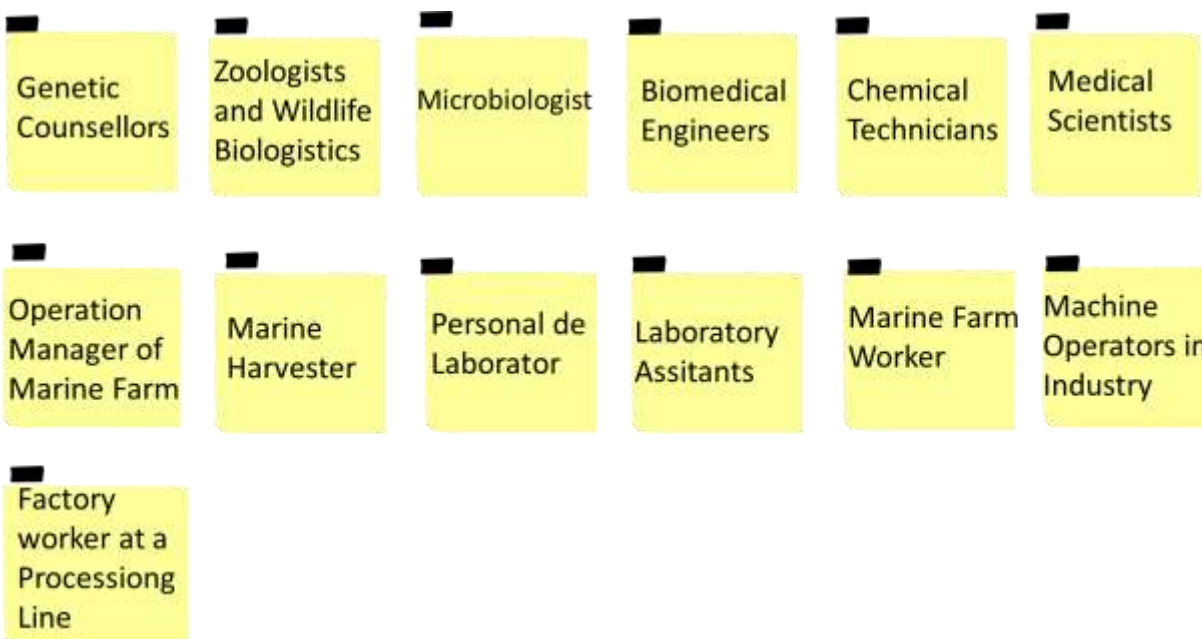
<https://www.ocean4biotech.eu/2020/12/01/advanced-training-on-blue-biotechnologies/>

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## 6.5. Trans-sectoral working possibilities

The marine biotechnology subsector offers jobs and careers in research institutions. The most common sectors the blue biotechnology experts work in are health, nutrition and aquaculture domains. Here are a few examples of opportunities in this sector:



## 6.6. Facts and figures

In 2019, there were 87,500 biotechnology jobs. The job market for biotechnology has been growing at an above-average rate. With the growth of 5%, there should be around 4,300 more jobs in this sector in 2029 than there were back in 2019.

The average biotechnologist salary varies, but the median stands at about \$80,455 a year.

A comprehensive screening of EU-supported interventions in the 2014-2020 funding period showed that € 238.6 million of EU funds have been invested in 182 projects and initiatives related to Blue biotechnology with a total budget of EUR 336 million (EC, Smart Specialisation and Blue biotechnology in Europe, 2020).

## 6.7. Summary

With three-quarters of the globe covered by the sea, scientists have realised that aquatic and marine organisms can become a good source of energy, new medicines, products as well as new jobs.

The subsector of marine biotechnology offers jobs and careers in research institutions. The most common sectors the blue biotechnology experts work in are health, nutrition and aquaculture domains.

This course gives you some materials if you want to work in the blue biotechnology sector.

As mentioned before, the blue biotechnology sector is unique amongst biotechnology sectors. Blue biotechnology has the potential to contribute to a variety of other biotechnology and industry areas, in this sector.

This very promising and still under-exploited sector faces many challenges, including the industrialization of processes.

We must cherish the Blue Biotechnology products because there are present in our life in different ways like cosmetics, agrifood and the environment.

The environment should be protected from us, because in many cases these economic sectors can damage the environment we live in, especially the waters.

Water pollution is also linked to industrialisation, civilisation and living standards, which are directly linked to people's economic levels. Water pollution seems to be more directly related to population growth than to simple population growth.

No doubt this will be a start for global warming and natural disasters that will affect all kinds of industries as well as future generations.

## 6.8. Evaluation quiz no.6

1. What is the purpose of the blue biotechnology sector?
  - A. To turn aquatic biomass into food, feed, nutraceuticals, pharmaceuticals, cosmetics, energy, packaging, clothes
  - B. To protect the blue environment
  - C. To encourage fishing and guide people towards a cleaner environment
2. What are the sectors of biotechnology?
  - A. Black, blue, orange, white, green
  - B. Red, green, yellow, white, blue
  - C. Green, purple, blue yellow, red
3. Career-wise, the employment rate in the biotech industry is expected to
  - A. Grow
  - B. Remain stable
  - C. Have a descendent trend
4. Blue biotechnology products belong to the following sector:
  - A. Pharmacology, agrifood, aquaculture
  - B. Environment, forest, building
  - C. Wind energy, mechanical, technological
5. Which are the trans-sectoral working possibilities in the blue biotechnology sector?
  - A. Marine farm worker, chef engineer, fourth engineer
  - B. Medical scientists, rigging specialists, officer
  - C. Marine harvester, laboratory staff, microbiologists

6. What are the most common sectors the blue biotechnology experts work in?
  - A. Health, nutrition and aquaculture
  - B. Cosmetics, surgery, installation
  - C. Construction, consulting, sales

## 6.9. Supplementary information

### Reading

Blue bioeconomy and blue biotechnology [https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/blue-bioeconomy-and-blue-biotechnology\\_ro](https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/blue-bioeconomy-and-blue-biotechnology_ro)

Blue biotechnology new opportunities for EU,  
[https://ec.europa.eu/environment/archives/greenweek2011/sites/default/files/3-6\\_Querellou.pdf](https://ec.europa.eu/environment/archives/greenweek2011/sites/default/files/3-6_Querellou.pdf)

Commonwealth urges policy changes to unleash blue economy  
<https://thecommonwealth.org/news/commonwealth-urges-policy-changes-unleash-blue-economy>

Blue Biotechnology in the Baltic Sea Region <https://www.submariner-network.eu/what-we-do/23-roadmap/topics/967-blue-biotechnology-topic>

Blue biotech: What is it, and why do European start-ups have the potential to lead the sector?  
<https://www.eu-startups.com/2020/09/blue-biotech-what-is-it-and-why-do-european-startups-have-the-potential-to-lead-the-sector/>

### Video materials

What Is Blue Biotechnology? - Applications & Examples <https://study.com/academy/lesson/what-is-blue-biotechnology-applications-examples.html>

Blue biotechnology <https://www.youtube.com/watch?v=DnTbpoWitgQ>

## 6.10. Self-reflection

In your view, what are the benefits of blue biotechnology for people?



## 7. DEEP-SEA MINING

Deep-sea mining is the sector of the blue economy that involves the retrieval of minerals and deposits from the ocean floor found at depths of 200 meters or greater.



Fisheries, aquaculture and processing



Coastal and maritime tourism



Maritime transport, ports and shipbuilding



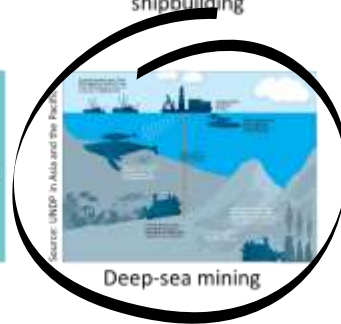
Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Blue biotechnology



Deep-sea mining



Desalination

## 7.1. Aim and objectives

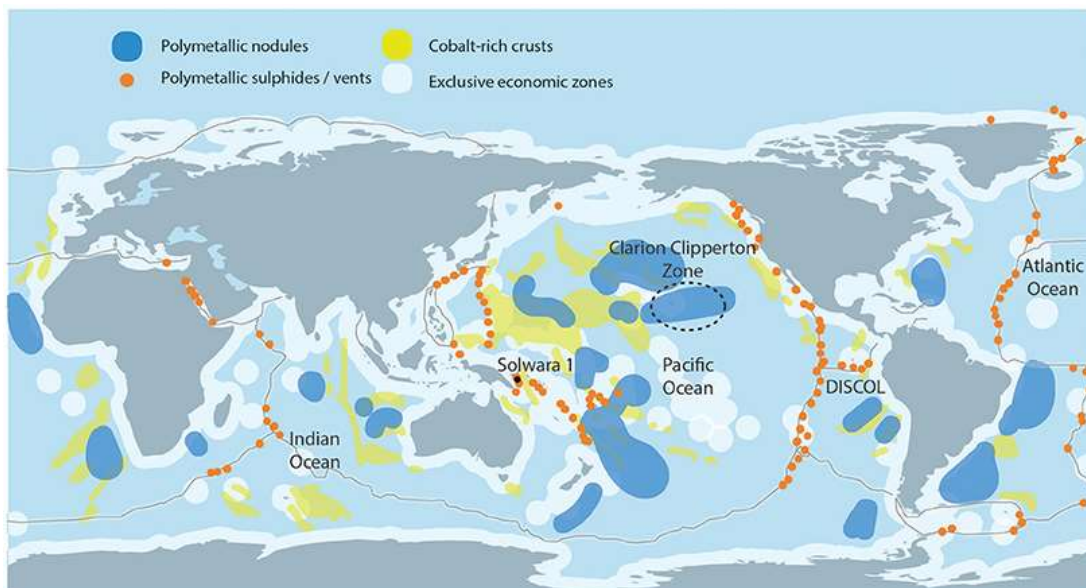
The Deep-Sea mining module aims at offering a deep understanding of what kind of job you may find in Deep-Sea Minerals Exploitation and to provide a wide perspective of blue career opportunities.

Upon completing the module, you will be able to:

- Recognize the role of Deep-Sea Mining in the blue economy
- Explain the types of jobs that ones can get in Deep Sea Mining
- Describe the career paths that can be explored
- Recommend mentoring tools that can contribute to success in career

## 7.2. General information about the deep-sea mining sector

Deep-sea mining is the process of retrieving mineral deposits from the deep sea. Over the past decade, there was a growing interest in the mineral deposits of the deep sea. This is largely due to depleting terrestrial deposits for metals such as copper, nickel, aluminium, manganese, zinc, lithium and cobalt, coupled with rising demand for these metals to produce high-tech applications such as smartphones and green technologies such as wind turbines, solar panels and electric storage batteries (Watson, 2022).



World map showing the location of marine mineral deposits Source: (Miller, 2018)

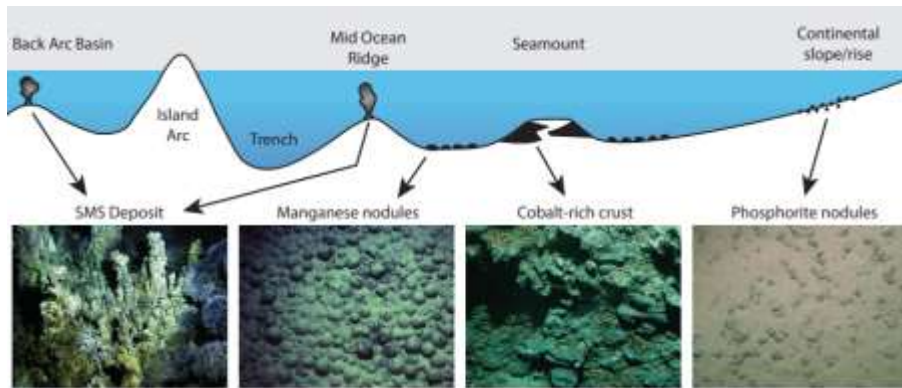
Mining the deep sea has been of interest to the mining industry since the 1960s, that the sea floor contained almost endless supplies of certain metals. Limited technology and decreasing metal prices made commercial exploitation impossible at that time, but with the development of technology and metal prices mining the deep sea once again has gained the attention of both industry and governmental organizations.

Certainly, the demand for metals for use in clean energy and emerging technologies will increase in the next decades. Retrieving metal resources from seabed mining has been identified as one sector with a high potential for development within the European Commission's blue growth strategy (EC, Report on the Blue Growth Strategy towards More Sustainable Growth and Jobs in the Blue Economy, 2017). After four years, in 2021, The Blue Economy Strategy (EC, Sustainable blue economy, 2021), published by the European Commission focuses on growth without economic growth, and an economy based on sufficiency rather than efficiency. Deep-sea mining and oil and gas drilling were considered harmful and it is mentioned that the area and its impacts have to be sufficiently researched, the risks understood and the activity needs to demonstrate no serious harm to the environment.

### **Deep-sea mineral resources**

The main types of resources that are of current commercial potential:

- **Manganese Nodules.** These occur over large expanses of the abyssal plains at depths of 4000–6000 m. Nodules of up to 150 mm in diameter form through precipitation from the surrounding seawater or sediment waters over millions of years. They are abundant in the Pacific Ocean, especially in the Clarion-Clipper ton Zone, in the central-eastern Pacific and around islands in the southwest Pacific. They are rich in manganese, nickel, copper and cobalt.
- **Seafloor Massive Sulphides.** SMS deposits form when metals that are in solution in the hot sub-seafloor water precipitate out after mixing with cold oceanic waters. This typically occurs at sites of hydrothermal venting along mid-ocean ridges and certain submarine volcano systems. Deposits at depths of 1000–3000 m are of commercial interest. They comprise copper, gold, silver, zinc, and lead.
- **Cobalt-rich ferromanganese crust.** These crusts form also from seawater precipitation over millions of years and are thickest on the flanks of seamounts and guyot where currents keep the seafloor free of sediment. They are rich in cobalt, nickel and platinum, and can form a continuous substrate at depths of 800–2500 m. large guyot features in the mid-north Pacific Ocean have been identified as amongst the most promising sites.
- **Phosphorite nodules.** These nodules are found much shallower than manganese nodules and have recently been commercially explored off New Zealand and Namibia at depths of 200–400 m. On continental margins, they form from limestone deposits and subsequent chemical reactions, calcium phosphate in areas with upwelling and high surface productivity. Nodules can be 1–4 cm across and occur on the surface and in the sediment to depths of 0.5 m or more. They contain elements used to make phosphate fertilizer.

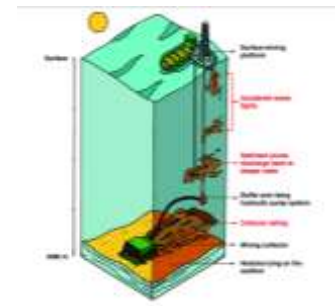


Source: (IUCN, 2015)

### Deep-sea mining operations

The sorts of equipment used in the exploration and exploitation of deep-sea resources, as well as the methods, differ between the mineral deposits, and between mining companies. Phosphorite and manganese nodules are likely to be dredged off the seafloor, whereas SMS and cobalt crust extraction involves more rock-cutting technology (IUCN, 2015).

In general, there are three key components to deep-sea mining operations, irrespective of the mineral.



#### Seafloor operations

- Seafloor operations - extracting the minerals from the seafloor involves dredging or cutting the resource. This is where large mining machines will move around on the seafloor.
- Midwater transport - dredged or cut material is transported from the seafloor to the surface. This can be as a slurry in riser pipes, or closed bucket-type conveyor systems.
- Surface processing - the mined material is sorted and dewatered on the surface vessel. The filtered wastes and seawater are returned to the water column somewhere between the surface and the seafloor.

#### Midwater transport

#### Surface processing

Large companies developed several technologies and designs for both exploration and systems to deliver extracted material to ships or surface-based mining platforms (GAO, 2021). Few examples:

- Underwater remotely-operated vehicles (ROVs) can be used to locate prime extraction sites and collect samples from the seabed.
- Technologies to collect material from the seabed (with vacuum, hydraulic pumps and hose systems that lift the extracted materials to surface vessels or platforms).
- Extraction of deposits by drilling and cutting, and transporting the resources to the surface.

### **Types of environmental impacts**

Exploration and exploitation can have a negative impact on the environment. Therefore, as part of the progression of mining operations from exploration to exploitation, there is a strong need for detailed environmental assessment. Companies wishing to apply for exploration licenses must submit the Environmental Impact Assessment (EIA). The International Seabed Authority ISA, established in 1982 by UNCLOS is responsible for the mineral resources and the marine environment. The ISA considers applications for exploration and exploitation of deep-sea resources from contractors, assesses environmental impact assessments and supervises mining activities.

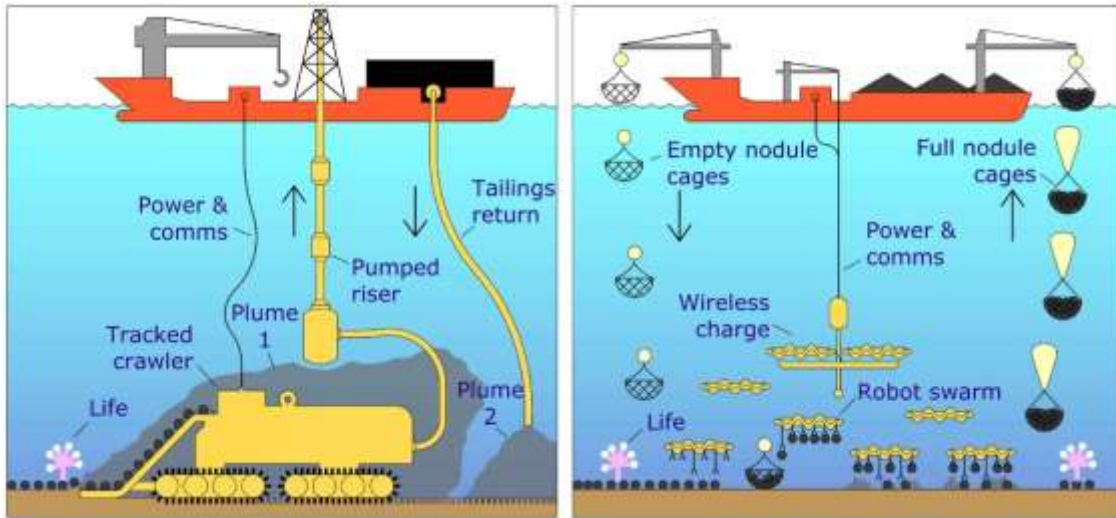
Deep-sea mining activities can affect the biodiversity and ecosystems (Cuyvers, 2018), by:

- Disturbance of the seafloor – equipment and machines can alter or destroy deep-sea habitats, leading to the loss of species
- Sediment plumes – the technology can spread up fine sediments on the seafloor consisting of silt, clay and the remains of microorganisms, creating plumes of suspended particles
- Pollution – there are species such as whales, tuna and sharks that could be affected by noise, vibrations and light pollution caused by mining equipment and surface vessels. In addition, there is a risk of leaks and spills of fuel and toxic products
- Thermal pollution – dewatering discharges at depth may cause local heating of the seawater, which can make the content of dissolved oxygen decrease locally (Sakellariadou, 2022).

### **7.3. Job opportunities in the deep-sea mining sector**

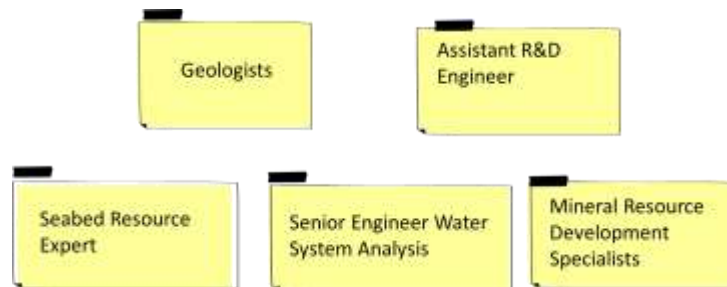
As you noticed, the ocean bed contains a wealth of minerals such as cobalt, nickel and copper that are needed to support our global economy and power the future of green energy. Companies are working on the development of deep-sea mining harvester and riser systems to gather minerals with minimum environmental impact and transport them to the ocean's surface. All these processes are creating various job opportunities.





Source: (<https://www.nseenergybusiness.com/>, 2021)

### Careers in the Deep-Sea Mining sector



**Geologists** – are often involved in exploration and identifying new mineral reserves

**Seabed Resource Experts** - study the ocean policies, marine resource management, international ocean governance and environmental regimes, and are researching political processes that govern deep seabed mining.

**Senior Engineer Water System Analysis** - responsible for effectively managing end-to-end water network systems by performing activities including forecasting demands for water systems, formulating master plans for water networks and assets, analysing water systems, hydraulic modelling, and evaluating water balance in reservoirs, desalination plants, pumping stations and water districts.

**Assistant R&D Engineers** – The role of planning, preparing and executing prototype tests and analysis of test results. They assist with the development of new economic and financial models for deep-sea mining.

**Mineral Resource Development Specialists** – The role of sustainable development of mineral resources seeks to attain a balance between economic development, environmental protection, community benefits, and government responsibilities.

## 7.4. Education and training

If you want to work in the deep-sea mining sector, you need to participate in training. Several training centres and universities are providing specialised training:

### DEEP-SEA MINING - EDUCATION AND TRAINING

#### NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

Deep Sea Mining Course

<https://www.ntnu.edu/studies/courses/TGB4228#tab=omEmnet>

#### EIT INTERNATIONAL SUMMER SCHOOL

Derby Road, Long Eaton Nottingham NG10 4AD

From Dredging to Deep-Sea Mining

<https://eitrawmaterials.eu/eit-international-summer-school-from-dredging-to-deep-sea-mining/>

#### UNIVERSITY OF DELAWARE

Minerals, Materials and Society

<https://sites.udel.edu/ceoe-mms/mms-short-courses/>

#### Heriot-Watt University

Edinburgh, Scotland, UK EH14 4AS

Deep Green Metals Inc's deep-sea discovery programme

<https://www.hw.ac.uk/uk/research/global/lyell-centre/deep-sea-mining.htm>

#### DSM school

Building 34 Mekelweg 2, 628 CD Delft

Competency related to Dredging Engineering

<https://www.tudelft.nl/3me/over/afdelingen/maritime-and-transport-technology/research/dredging-engineering/dsm-school>

## 7.5. Trans-sectoral working possibilities

Working in the deep-sea mining sector is attractive from a financial perspective and career progression point of view. Being specialized in operation, research, geology or management, there are some career paths that you can explore:

- **Operations** - operate possible technologies for deep-sea mining.
- **Technical research** - evaluate the challenges one faces when exploring deep-sea minerals, extracting ore from the seabed and transporting it to a processing plant.
- **Economy** – conduct cost and profitability studies.
- **Geological scientists** – understand the characteristics of relevant deposit types.
- **Technical expertise** - suggest a mining method and a plan for the mining operation, considering constraints such as the sea bed type, depth, and weather conditions.
- **Environmental managers** - in charge of planning and execution of projects.

## 7.6. Facts and figures

### Tellurium

Among the minerals found 1000 meters below the ocean surface was tellurium, which is used in the making of solar panels, wind turbines and electronics. It was no small find. The deposit is 50,000 times more concentrated than deposits found on land.

### Robots

Deep-sea mining jobs are likely to involve robots. Three robots can be sent to collect the minerals all with different jobs (Seeker, 2015).

- One chews through the metal-rich chimneys that form as a result of super-hot water coming out of sulphurous vents on the seafloor.
- The second robot then comes in and uses its strength to pulverize rock walls.
- The third then feeds the crushed rock up a pipe that is dangling from the vessel the robots were sent out on.

It's all operated by remote control.

## 7.7. Summary

A large continuous supply of special economic metals is essential for any high-tech future. Copper, nickel, aluminium, manganese, zinc, lithium and cobalt are needed to produce smartphones, wind turbines, solar panels and electric storage batteries.

Equipment used in the exploration of resources differs between the mineral deposits and mining companies. Companies applying for exploration licenses assess the environmental impact

Jobs in deep-sea mining include operations, technical planning, economy, scientific research, and environmental management. Robots designed to collect minerals are operated by remote control by an ROV operator.

## 7.8. Evaluation quiz no.7

1. What does deep-sea mining stand for?
  - A. It is the process of retrieving mineral deposits from the area of the ocean below 200 metres
  - B. It is the process of retrieving mineral deposits from the area of the ocean below 800 metres
  - C. It is the process of retrieving mineral deposits from the area of the ocean below 1000 metres
2. What is the purpose of underwater remotely-operated vehicles (ROVs) in deep-sea mining?
  - A. ROVs are used to replace the people working to collect samples from the seabed

- B. ROVs are used to control the quantities of resources to be retrieved from the ocean
  - C. ROVs are used to locate prime extraction sites and collect samples from the seabed
3. What are the job opportunities in the deep-sea mining sector?
- A. Fleet manager, fish market salesman
  - B. Shift supervisor, HVAC Engineer, hydro-biologist
  - C. Mineral resource development specialists
4. Which of the following technologies are used to collect deep sea minerals?
- A. Technologies with vacuum, hydraulic pumps and hose systems that lift the extracted materials
  - B. Technologies with cranes that lift the extracted materials
  - C. Technologies with suction pumps
5. How can deep sea exploration and exploitation impact the environment?
- A. No impact because companies invest in the development of equipment with minimum or zero impact
  - B. Disturbance of the seafloor by equipment and machines that can alter deep-sea habitats
  - C. Positive impact because it attracts the investors
6. How many types of robots can be sent to collect minerals from the seabed?
- A. Five
  - B. Three
  - C. Two

## 7.9. Supplementary information

### Reading

An Overview of Seabed Mining Including the Current State of Development, Environmental Impacts, and Knowledge Gaps, Kathryn A. Miller, Kirsten F. Thompson, Paul Johnston and David Saltillo, REVIEW article, Front. Mar. Sci., 10 January 2018 | <https://doi.org/10.3389/fmars.2017.00418>, <https://www.frontiersin.org/articles/10.3389/fmars.2017.00418/full>

Why is deep-sea mining important? <https://www.iucn.org/resources/issues-briefs/deep-sea-mining>

Is mining the ocean bottom for metals really better than mining on land? <https://metals.co/is-mining-the-ocean-bottom-for-metals-really-better-than-mining-on-land/>

Why do we explore the ocean? <https://oceanexplorer.noaa.gov/backmatter/whatisexploration.html>

### Video materials

Mining the Deep Sea, Massachusetts Institute of Technology (MIT)

<https://www.youtube.com/watch?v=MWvCtF1itQM>

Visualizing Deep-sea Mining, Massachusetts Institute of Technology (MIT)

<https://www.youtube.com/watch?v=Lwq1j3nOODA>

Deep-Sea Mining Demystified, Hakai Magazine <https://www.youtube.com/watch?v=LMCAXa5wHeQ>

## 7.10. Self-reflection

In your opinion, what are the pros and cons of deep-sea mining compared to shore-based mining?



## 8. DESALINATION

Desalination refers to the process of removing salts and minerals from marine or brackish water in order to produce water suitable for human consumption or irrigation (Kim, Park, & Yang, 2019).



Fisheries, aquaculture and processing



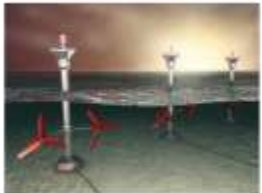
Coastal and maritime tourism



Maritime transport, ports and shipbuilding



Marine extraction of oil, gas and minerals



Offshore wind and ocean energy



Source: European Commission

Blue biotechnology



Source: UNEP in Asia and the Pacific

Deep-sea mining



Source: Jungbin Kim et al., 2019

Desalination

## 8.1. Aim and objectives

The desalination course module aims to provide an overview of how water can be obtained from high salinity water. The produced water should be acceptable for potable use and/or other intended uses. Modern desalination techniques include thermal (distillation) techniques and membrane filtration techniques, which are extensively reported in the relevant literature.

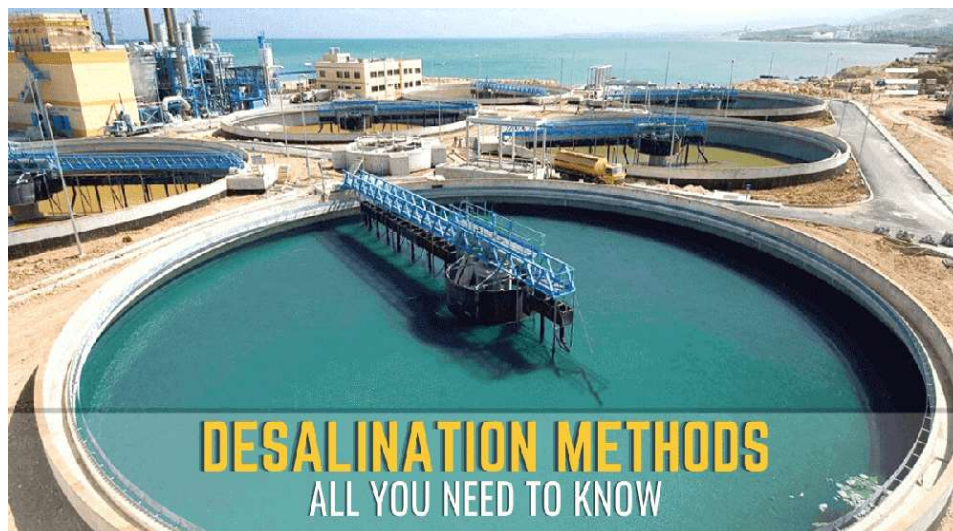
Upon completing the module, you will be able to:

- Recognize the role of Desalination in the blue economy
- Understand how the desalination process works
- Explain the types of jobs that ones can get in one Desalination Plant
- Describe the career paths that can be explored

## 8.2. General Information about the desalination sector

Clean-water technologies become more critical for consumable water as the climate changes, creating new patterns of water distribution across the globe. Desalination continues to move toward the forefront. Although it is effective, desalination can be complex, energy-intensive, and expensive.

Desalination is the process of removing salts or other minerals and contaminants from seawater, brackish water, and wastewater effluent and it is an increasingly common solution to obtain fresh water for human consumption and domestic/industrial utilization (Kucera, 2014).



The two main types of desalination processes are membrane (reverse osmosis, or RO) and thermal, which include multi-effect distillation (MED) and multi-stage flash distillation (MSF) (El-Dessouky, 2002). Desalination technology works mainly with seawater and brackish water. There are several steps to this process.

1. Seawater is drawn from the sea via an underground and undersea tunnel. Seawater enters the plant through screens that filter out larger material.
2. Pre-treatment filters remove smaller particles.
3. Filtered seawater is pumped into the reverse osmosis building.
4. Waste from the pre-treatment filtration process is dried using a centrifuge and either reused or removed for disposal.
5. Seawater is pushed at high pressure through reverse osmosis membranes to remove salt and minerals.
6. Fluoride and minerals are added to the freshwater to meet drinking water standards and health requirements. Demineralised water is then disinfected and transferred to the drinking water holding tank.
7. Water is stored in the drinking water holding tank and then pumped to the national network through a pipeline
8. Seawater concentrate is returned to the ocean.

### Types of water used for desalination

Freshwater is a basic need and desalination of saline water is important to make more potable water accessible to the needed populations. This process removes excess salt and also decreases the amount of minerals from the water. The types of water used for desalination are mainly seawater and brackish water.

- **Seawater.** The water to be desalinated can be taken from the surface of the sea, or beneath it. It is viable to source salty surface water when there is a need to minimize the impact on the surrounding area. If filters can be used to minimize the amount of pre-treatment necessary before the water makes it to the primary treatment systems, this method is effective. Subsurface intake causes less damage to marine life but harms nearby freshwater aquifers if the geology is not favourable. Methods of intake from below the surface include infiltration galleries, vertical beach wells, and radial wells.
- **Brackish water.** Brackish water is considerably less salty than seawater and is commonly found in aquifers, which are underground stores of water, or estuaries which are lower courses where the river meets the sea.

### Methods of seawater desalination

Thermal distillation is one of the best ways of treating seawater and brackish water to convert them into potable water.

The most common desalination processes are:

- **Multi-stage flash distillation**, seawater is sent through multiple chambers where it is heated and compressed at high temperatures and high pressure. As the water moves through the chambers, the pressure is reduced. As a result, saline water boils and forms freshwater vapour, which condenses and collects.



- **Multi-effect distillation** uses the same process as multi-stage flash distillation. The main difference is that instead of using multiple chambers of a single vessel, this process uses successive vessels. The multiple vessels make this process more efficient.
- **Vapour compression distillation** uses the heat of vapour compression to evaporate the feedwater. It can either be used independently or combined with another process for thermal distillation. These units are commonly used for small- to medium-scale purposes such as resorts, industries, and petroleum drilling sites.
- **Electrodialysis** uses membranes that only allow the passage of either negatively charged or positively charged ions at a time.
- **Reverse osmosis** is a water treatment that uses a pressure gradient to move the high-pressure saltwater feed through a membrane that filters out chlorine, salt, and dirt.

### 8.3. Job opportunities in the desalination sector

There are many ways to get started in an occupation in the Desalination industry. Some requirements are general for most workers, others are specific to occupations. For that, you need a place to start and some people to guide you. Let's take it step by step. Depending on the job you want and your aspirations, you need to carefully plan your career.

As an example, for the Victorian Desalination Plant (Melbourne 2019) about 10,500 people work on the project during its construction of the desalination plant, with the workforce peaking at around 4,500 at one point. Direct and indirect jobs are created through jobs on-site and contracts awarded for products and services. There are about 50 full-time equivalent jobs involved in operating the plant and more contract positions to support operations, maintenance and servicing.

Jobs and sub-contracts included:

- Pipe manufacturing
- Power cable manufacturing
- Supply structural and reinforcing steel
- Fabricate and install structural steel on the plant site
- The operator of desalination plants
- Desalination plant technician
- Water treatment plant technician
- Desalination equipment operator
- Water treatment plants technician

#### Careers in the Desalination sector



## 8.4. Education and training

If you want to work in the desalination sector, you need to participate in training. Several training centres and universities are providing specialised training on:

- How to make fresh drinking water from seawater
- Sustainable solutions for energy generation and water desalination
- Conversion of renewable energies and design of desalination technologies

### DESALINATION - EDUCATION AND TRAINING

#### IDA Desalination Academy

Topsfield, MA 01983, USA

Certificate and Degree Programs and the global advanced water treatment

<https://idadesal.org/training/academy-events/ida-academy-desalination-masterclass/>

#### MEDRC Water Research

Building 3200 Al Dama Street, Al Hail North Corniche, PC 133 Al Khuwair Sultanate of Oman

Customized Pump Operator and Maintenance

<https://www.medrc.org/training/>

#### Swansea University Marine Training

Krijgslaan 281/S8, 9000 Gent, Belgium

Drinking water treatment, Waste-water treatment, Process-water treatment

<https://www.marinetraining.eu/nl/node/2204>

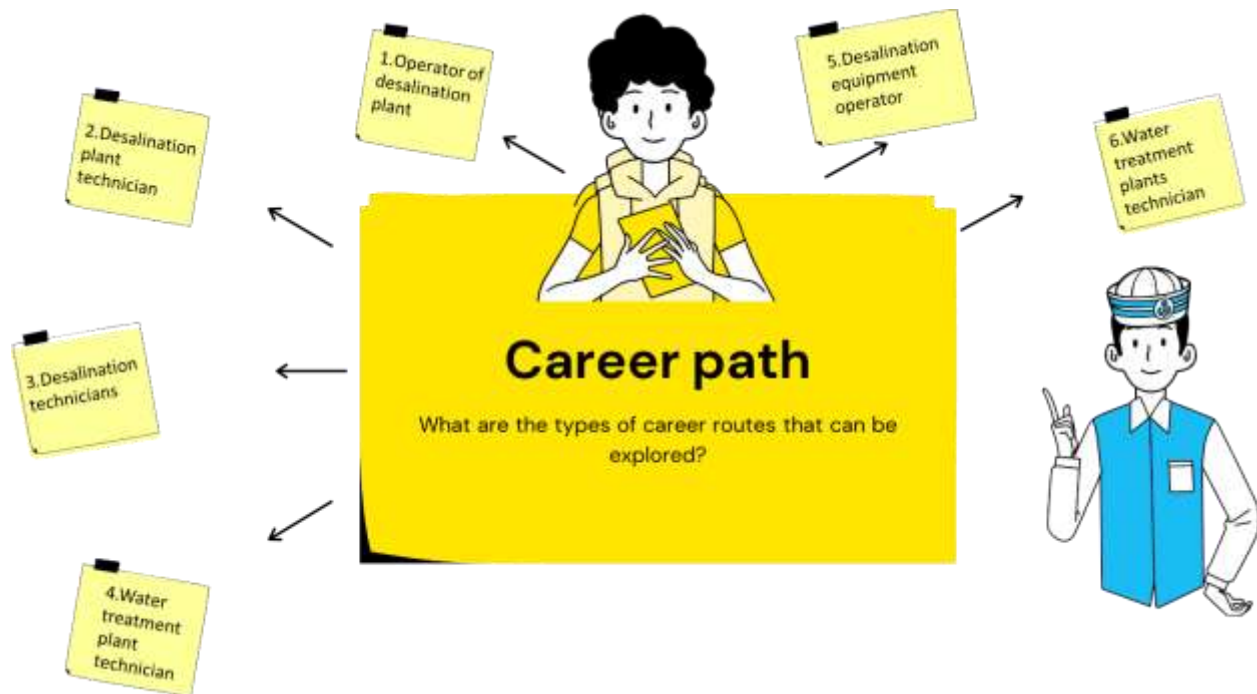
#### Technische Universität Berlin

10623 Berlin, Straße des 17. Juni 135

Desalination & Renewable Energies

[https://www.tu-berlin.de/menue/summer\\_university/term\\_3\\_on\\_campus/desalination\\_renewable\\_energies/](https://www.tu-berlin.de/menue/summer_university/term_3_on_campus/desalination_renewable_energies/)

## 8.5. Trans-sectoral working possibilities



As previously described, the desalination industry includes a wide range of roles, from technicians to operate, monitor and maintain desalination plant equipment (Schorr, 2011) to management and strategic roles to develop the company and gain new markets.

There is a variety of career paths that require different skill sets and training. From high school graduates to PhDs, no matter the background, there are opportunities for everyone to join the water workforce.

Several industries include similar unit operation processes, i.e., evaporators, condensers, flashing units, membrane separation, and chemical treatment. Examples of such industries include wastewater treatment, food, petroleum, petrochemical, power generation, and pulp and paper (El-Dessouky, 2002).

Therefore, staff working for desalination plants can direct their career path towards the wide sector of water distribution, which non-exhaustively, includes:

- **Service Line Director** focused on the service line with a strategic role, having a deep understanding of the relevant markets – current and future direction – in order to maximise the value for clients across markets.
- **Water resource recovery operators** perform a multitude of tasks necessary to ensure that treatment and resource recovery go smoothly while ensuring the continuous operation of facilities. They also direct lower-level operators and perform related work as needed.
- **Wastewater Collections Operators** perform skilled construction, repair, and maintenance of wastewater system facilities. They operate a variety of power equipment and ensure public health by preventing sewage overflows and blockages. They inspect, clean, maintain, construct, and

repair wastewater collection systems including sanitary sewers, storm drains, pump stations, pipes, manholes and catch basins.

- **Water Distribution Operator** monitors and controls water system facilities and equipment manually and/or uses information technology to regulate raw water supply and treated water distribution, control hydroelectric power generation and monitor and control water quality; and performs related work as required.
- **Mechanics and electricians** preserve and create the machinery necessary to treat water and recover resources. Electricians and mechanics work with the electrical, power and mechanical systems involved in the water industry. They are responsible for wiring, installing, maintaining and controlling mechanical and electrical equipment.

## 8.6. Facts and figures

### Changing the gender imbalance in water

Statistically, only 5 percent of water and wastewater plant operators are women and more broadly speaking, only 25 percent of civil/environmental engineering graduates are women.

The platform “Women in Water Group” is an initiative to increase the number of women involved in water treatment globally. They organize seminars and webinars to address the gender gap in the water sector and advance the discussion, setting out specific proposals to increase and support women’s representation in the water industry.

### Workforce

Globally, more than 300 million people rely on desalinated water for daily water needs. Currently, more than 20,000 desalination plants operate in 150 countries.

## 8.7. Summary

Clean-water technologies become more critical for consumable water as the climate changes, creating new patterns of water distribution across the globe. Desalination continues to move toward the forefront. Although it is effective, desalination can be complex, energy-intensive, and expensive.

The main types of desalination processes are membrane (reverse osmosis) and thermal, which include multi-effect distillation (MED) and multi-stage flash distillation (MSF). Desalination technology works with both brackish water and seawater.

## 8.8. Evaluation quiz no.8

1. What are the types of water used for desalination?
  - A. Clean Water
  - B. Freshwater

- C. Seawater and Brackish Water
2. Which of the following are the main types of desalination processes?
    - A. Reverse osmosis and thermal treatment
    - B. Chlorination and chloramination
    - C. Ultraviolet light treatment
  3. What is considered Brackish water?
    - A. Brackish water is considerably less salty than seawater and is commonly found in aquifers, which are underground stores of water, or estuaries which are lower courses where the river meets the sea.
    - B. Brackish water is considerably saltier than seawater and is commonly found in aquifers, which are underground stores of water, or estuaries which are lower courses where the river meets the sea.
    - C. Brackish water is the seawater resulting after desalination.
  4. How does Reverse osmosis work?
    - A. Uses a pressure gradient to move the high-pressure saltwater feed through a membrane that filters out chlorine, salt, and dirt
    - B. Uses multi-stage flash distillation, while the sea water is sent through multiple chambers where it is heated and compressed at high temperatures and high pressure
    - C. Uses vapour compression to evaporate the feedwater
  5. What are the characteristics of the subsurface absorption method?
    - A. Causes major damage to marine life
    - B. Causes less damage to marine life but harms nearby freshwater aquifers
    - C. Causes major damage to marine life and has the advantage of less impact on freshwater aquifers
  6. Which of the following are characteristics of the desalination processes?
    - A. Complex, energy-intensive, and expensive
    - B. Simple and cheap
    - C. Simple and efficient

## 8.9. Supplementary information

### Reading

As Water Scarcity Increases, Desalination Plants Are on the Rise, <https://e360.yale.edu/features/as-water-scarcity-increases-desalination-plants-are-on-the-rise>

Water shortage is one of the foremost and most urgent issues facing the world today. <https://processdesign.mccormick.northwestern.edu/index.php/Desalination> - Team D

### Video materials

*Blue Economy. A Manual for VET Teachers, Trainers, Career Counsellors, Learners and Professionals*  
DOI: 10.5281/zenodo.7064932

Desalination | Water Supply | Water Corporation, <https://youtu.be/JoF13nwgUvA>

Seawater desalination | Veolia, <https://youtu.be/LKmVdy9tt0I>

Industrial Seawater Reverse Osmosis Desalination Systems, <https://youtu.be/LGbUiTVKts4>

## 8.10. Self-reflection

In which areas on the planet do you expect to find a job in the desalination sector? How do you expect this to change in the next 30 to 40 years?



## 9. CAREER GUIDANCE AND MENTORING

You have learned about sectors, jobs, training opportunities and links between professions in the different blue economy sectors. We recommend you to follow the [career map](#) and read the job cards linked to each blue profession to see the relations to other blue economy sectors. We also recommend accessing the jobs platform to explore various career paths in the blue economy sectors.

Once you have a full image of blue economy sectors, you can go deeper and learn about the skills and training requirements needed for entering these sectors.

If you are a trainee, apprenticeship or professional you can find useful tips to upskill your career. If you are a mentor or career counsellor, this knowledge can flow into the advice you give about job opportunities during career guidance or mentoring.

### 9.1. Aim and objectives

The career guidance and mentoring chapter aims at offering supporting tools and methods to initiate and guide mentees to construct the career they want.

Upon completing the module, a mentor or career counsellor will be able to:

- Support mentees to identify the strengths, weaknesses, opportunities, and threats with regard to their career
- Assist learners in identifying their SMART career objectives
- Guide the students to achieve their career goals
- Create awareness among learners/mentees regarding available career options

### 9.2. General information about career guidance and mentoring

The success of mentoring initiatives depends on continual improvement and the understanding that mentoring works best alongside good training and with a long-view taken on skills and personal development.

There are several types of mentoring but three of them are well-known and effective (Seafarerswelfare, 2020):

- Traditional One-on-one Mentoring – when a mentee and mentor are matched, either through a program or on their own. Mentee-mentor partners participate in a mentoring relationship with structure and timeframe of their making or as established by a formal mentoring program.
- Distance Mentoring - is a mentoring relationship in which the two parties (or group) are in different locations. Sometimes called “virtual” mentoring.
- Group Mentoring, is when a single mentor is matched with a cohort of mentees. The initial program structure is provided while allowing the mentor to direct the progress, pace and activities.

According to a study conducted by the Nautical Institute (Le Goubin, 2012), mentoring was found to be a low-cost initiative, which promotes and supports:

- Happier and more confident staff
- Good practice and the company culture
- Improvements in safety performance
- On-going training and deeper learning
- The multi-cultural crew environment
- Sustainability of crew well-being
- The retention of staff

### 9.3. Good practices in mentoring

There are several good initiatives offering mentoring in the blue industry. Many of these initiatives are the result of the cooperation of European organizations acting in the blue economy, mainly supported by the European Commission within the implementation of EU-funded projects, such as:

#### **The BlueGeneration Project**

- The BlueGeneration Project inspires, engages and mentors young people to pursue a career in the blue economy in Spain, Portugal, Greece, Poland and Bulgaria.  
<https://www.bluegeneration.org>

#### **The MENTOR Project**

- Blue Career Centre of Eastern Mediterranean and the Black Sea jointly develop and carry out measures to close the skill gap, tackle unemployment and make “blue careers” more attractive to young people of the area.  
<http://www.bluecareers.org/>

#### **The Be-Blue Project**



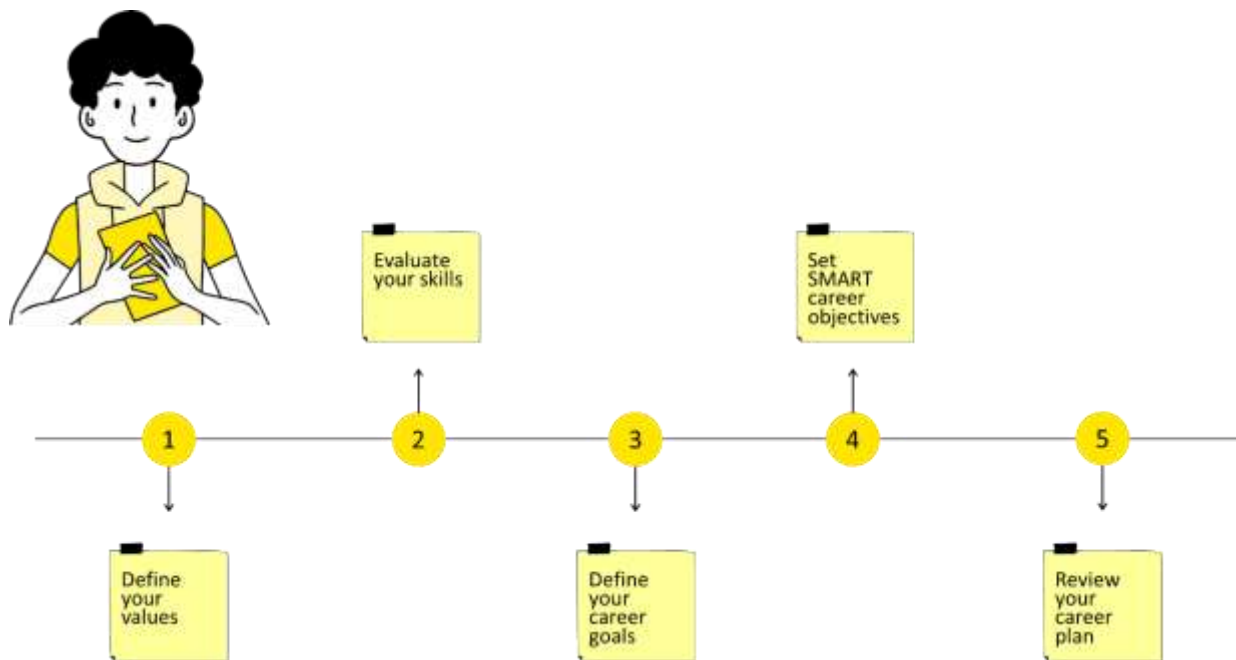
- Offer mentoring and career guidance in the Blue Economy. The e-mentoring programme includes mentoring model and documentation kit.  
<https://trainingclub.eu/beblue/>

## 9.4. Tools for career plan

A career plan is a list of steps you can take to accomplish your goals for your professional future. The plan helps you identify what fields you want to pursue, develop long-term objectives and devise a strategy for career success.

### Five-step plan

A typical career development plan shall outline the starting point, the destination, the gaps and the route (IET, 2022). By developing a personalised career plan, you will identify specific, achievable career goals and then design and implement strategies to reach your goals. Experts (Michael, 2021) recommend five easy steps for creating a career plan:



1. First, you need to define your personality, preferences and values. You can do this by asking a few questions:
  - What motivates you and what do you enjoy doing?
  - What are your personal attributes and priorities?
  - What do my family and friends see as my strengths and weaknesses?
  - Define 5 important factors or non-negotiables you are looking for in a job.
2. Secondly, evaluate your skills. Reflect on your skill set based on the SWOT analysis, using the following questions:

- What qualifications and experience do you have?
  - What are your key strengths, transferable skills and technical skills?
  - What are your biggest achievements to date?
  - What are your weaknesses and areas for development?
3. Based on your values and interests you can now start to formulate ideas on the type of roles and industries that align well with your present career goals. Try brainstorm the following:
- The industries or companies that appeal to you
  - The types of roles that you are attracted to
  - Key skills that may need development
4. Now, that you know where you want to go, it's time to go at the fourth step: set career goals. You can use the SMART objectives methodology depicted in the below section. Ask yourself:
- What do you want to achieve within the next six, 12 and 18 months?
  - How and when will you achieve your training and education goals?
5. The last, but not less important than the previous, is a continuous process: Review your career plan regularly. Once you've established your goals and how to achieve them, you now have a clearer direction in which to focus.
- It's important to monitor the progress of your career plan at least every quarter, to ensure that you are on track to meet your goals.
  - Re-evaluate and update your career plan and goals. This step is vital to both staying on track and adjusting them, based on changing economic and personal circumstances.

### SWOT analysis for career planning

The SWOT analysis is a key tool in the strategic planning process, and it can be used with career planning (CVONBERGEN, 2020). A SWOT analysis focuses on examining strengths and weaknesses in the internal environment and opportunities and threats in the external environment.

You can structure your SWOT analysis using the below table (Hansen, 2022)

	STRENGTHS	WEAKNESSES
<b>INTERNAL</b>	<p>Internal positive aspects that are under control and upon which you may capitalize in planning</p> <ul style="list-style-type: none"> <li>• Work Experience</li> <li>• Education, including value-added features</li> <li>• Strong technical knowledge within your field (e.g. hardware, software, programming languages)</li> <li>• Specific transferable skills (e.g., communication, teamwork, leadership skills)</li> </ul>	<p>Internal negative aspects that are under your control and that you may plan to improve</p> <ul style="list-style-type: none"> <li>• Lack of Work Experience</li> <li>• Low GPA, wrong major</li> <li>• Lack of goals, lack of self-knowledge, lack of specific job knowledge</li> <li>• Weak technical knowledge</li> <li>• Weak skills (leadership, interpersonal, communication, teamwork)</li> <li>• Weak job-hunting skills</li> </ul>

	<ul style="list-style-type: none"> <li>• Personal characteristics (e.g., strong work ethic, self-discipline, ability to work under pressure, creativity, optimism, or a high level of energy)</li> <li>• Good contacts/successful networking</li> <li>• Interaction with professional organizations</li> </ul>	<ul style="list-style-type: none"> <li>• Negative personal characteristics (e.g., poor work ethic, lack of discipline, lack of motivation, indecisiveness, shyness, too emotional)</li> </ul>
<b>EXTERNAL</b>	<b>OPPORTUNITIES</b>	<b>THREATS</b>
	<p>Positive external conditions that you do not control but of which you can plan to take advantage</p> <ul style="list-style-type: none"> <li>• Positive trends in your field that will create more jobs (e.g., growth, globalization, technological advances)</li> <li>• Opportunities you could have in the field by enhancing your education</li> <li>• The field is particularly in need of your set of skills</li> <li>• Opportunities you could have through greater self-knowledge, more specific job goals</li> <li>• Opportunities for advancement in your field</li> <li>• Opportunities for professional development in your field</li> <li>• The career path you've chosen provides unique opportunities</li> <li>• Geography</li> <li>• Strong network</li> </ul>	<p>Negative external conditions that you do not control but the effect of which you may be able to lessen</p> <ul style="list-style-type: none"> <li>• Negative trends in your field that diminish jobs (downsizing, obsolescence)</li> <li>• Competition from your cohort of college graduates</li> <li>• Competitors with superior skills, experience, knowledge</li> <li>• Competitors with better job-hunting skills than you</li> <li>• Competitors who went to schools with better reputations.</li> <li>• Obstacles in your way (e.g., lack of the advanced education/training you need to take advantage of opportunities)</li> <li>• Limited advancement in your field, advancement is cut-throat and competitive</li> <li>• Limited professional development in your field, so it's hard to stay marketable</li> <li>• Companies are not hiring people with your major/degree</li> </ul>

### Set SMART objectives

The SMART objectives methodology is useful for setting professional development goals that are achievable and tied to real-world outcomes. Using the SMART goal framework can establish a strong foundation for achieving success.

- **Specific:** Be as precise and clear as possible about what you want to achieve.
- **Measurable:** Have criteria in place to measure how you're progressing towards your goal.
- **Achievable:** Your goal should be achievable within a certain timeframe.
- **Realistic:** Make sure your goal can genuinely be accomplished.
- **Time-bound:** Have a deadline or timeframe for reaching your goal.

## SMART Career Goals Worksheet

<b>Draft Goal</b> <b>Where do you want to be in...?</b>	Short-term (1 Year)	Mid-Range (3-5 Years)	Long-term (10 Years)
Specific What is the desired job? (i.e., position, industry, responsibilities, benefits, hours)			
Measurable How can you quantify (numerically or descriptively) progress and completion? (i.e., title, responsibilities, pay)			
Achievable What training, certification and skills are needed? What experience is necessary? What resources (i.e., money, equipment) are needed? Do you need help from other people?			
Realistic Is the goal in alignment with your values and strengths?			
Time-bound What is the deadline? Is the deadline realistic?			
<b>Final Goal</b>			

### 9.5. Summary

The success of mentoring initiatives depends on continual improvement and the understanding that mentoring works best alongside good training and with a long-view taken on skills and personal development. In addition, setting SMART career goals is the first step towards achieving the career you want. A personal SWOT analysis can be seen as a creative way of seeing where you currently are, what you need to improve upon to achieve your goals, and also what can help along the career path or what may challenge you.

### 9.6. Evaluation quiz no.9

- Which of the following ensures the success of the mentoring?
  - The success of mentoring requires the mentoring to go alongside good training and continuous skills development
  - The success of mentoring initiatives depends on the technical competencies of the mentor
  - The success of mentoring initiatives depends on the willingness of the mentee to promote in career
- Traditional mentoring is one-on-one. Which of the following best describes one-on-one mentoring?
  - A mentee and a mentor participate in daily discussions
  - A mentee and mentor are matched, either through a program or on their own
  - A mentee and a mentor sign contractual agreements before mentoring

3. What are the main steps recommended by experts to create a career plan?
  - A. Evaluate your skills, define your values, set smart career goals and review your career plan
  - B. Analyse the opportunities, create a list of your qualities
  - C. Set smart career goals and define your value
  
4. When using SWOT analysis for career planning, which of the following can be considered THREATS?
  - A. Internal negative aspects that are under your control and that you may plan to improve
  - B. Negative external conditions that you do not control but the effect of which you may be able to lessen
  - C. Lack of goals, lack of self-knowledge, lack of specific job knowledge
  
5. When using SWOT analysis for career planning, which of the following can be considered OPPORTUNITIES?
  - A. Strong technical knowledge within your field (e.g. hardware, software, programming languages)
  - B. Internal positive aspects that are under control and upon which you may capitalize in planning
  - C. Positive external conditions that you do not control but of which you can plan to take advantage
  
6. SMART goal framework can establish a strong foundation for a successful career. What is the meaning of S.M.A.R.T.?
  - A. Simple, Measurable, Achievable, Realistic, Transversal
  - B. Specific, Measurable, Achievable, Realistic, Time-bound
  - C. Strong, Major, Achievable, Realistic, Time-bound

## 9.7. Supplementary information

### Reading

MichaelPage (2021).5 easy steps for creating a career plan

<https://www.michaelpage.com.au/advice/career-advice/career-progression/5-easy-steps-creating-career-plan>

Excellerate (2021). SWOT for career Planning,

<http://homepages.se.edu/cvonbergen/files/2020/12/Using-a-SWOT-Analysis-in-Your-Career-Planning.pdf>

Learn to sail – tips for beginners, <https://www.navigatecontent.com/sailing-adventure-blog/learn-to-sail-tips-for-beginners>

Expert advice new sailor tips and tricks, <https://www.yachtingmonthly.com/sailing-skills/expert-advice-new-sailor-tips-and-tricks-83008>

Tips for sailing in heavy weather, <https://www.lifeofsailing.com/post/tips-for-sailing-in-heavy-weather>

### Video materials

Careers Advice for Youngsters Who Want to Work in Maritime, <https://youtu.be/jFKmtho5NOK>

Preparing for Your Cruise Ship Interview, <https://www.youtube.com/watch?v=VX1owXUwe3A>

Sailor Interview Questions, <https://www.youtube.com/watch?v=I9LOhA6ZR2s>

## 9.8. Self-reflection

In your opinion, what is the difference between a career counsellor and a mentor?



## CONCLUSIONS

The growing importance of the blue economy represents a great opportunity for young people and for more experienced professionals to choose careers in one of the blue economy sectors, be it in fisheries, coastal tourism, maritime transport, marine extraction of oil and gas, offshore wind industry and other promising sectors such as blue biotechnology, deep-sea mining or desalination.

Moreover, the blue economy represents an opportunity to boost the local economy and create jobs in various industry sectors. There is a real need for a large variety of services in order to use marine resources sustainably and responsibly.

The specificity of each blue industry sector opens career positions for highly specialised personnel working in research and development, for technicians, high-skilled workers and engineers qualified to face the challenges of the new technological advancement, as well as for managers able to set long-term goals for processes that contribute to economic growth.

The education sector and training centres should therefore not hesitate to invest even more into the adoption of curricula that create the chances for learners to upskill and re-skill. In addition, the development of vocational training programmes as well as shorter training courses on topics that complement the existent studies, provide opportunities for trans-sectoral movements of staff.

Nevertheless, in order to start a career in one of the blue industry sectors, there is a stringent need to guide young people and future marine professionals. Benefitting from the expertise of career counsellors and by using easy-to-use tools and methods, the prospective employees can explore a variety of careers and the excellent career progression opportunities that the blue economy offers.

## USABILITY AND TRANSFERABILITY

The European Blue Economy currently represents around 5.4 million jobs and is set to double its employment by 2030. However, the blue economy sectors are experiencing difficulties in finding the right employees – and most sectors expect these difficulties to continue in the upcoming years.

At the same time, as any other industry, the Blue Economy works in cycles with peaks and troughs. The peak periods are usually characterized by shortage on personnel, while the unemployment rises during the trough periods. This unbalances the industry and its labour market. However, the blue economy is not homogenous. For example, the troughs periods in maritime transport may overlap with peaks of the oil and gas industry. One of the implications is that there are inefficiencies in the labour market, at times with large numbers of personnel unemployed in shipping, but with the offshore oil and gas sector not hiring them.

This course aims to help turning the challenges mentioned above into opportunities by guiding new professionals towards the blue economy and fostering the cross-sectoral mobility of existing professionals within the blue economy. In both cases, learners and experienced professionals need information about the main sectors in the blue economy, the associated job opportunities, directions on where to get educated/trained/upskilled as well as intra and inter-sector career paths.

But vocational learners and professionals need to come across the relevant information about the sectors in the blue economy. While this is provided within the present blue economy manual and the associated resources, it may not be enough. It is necessary for this information to come to them, through their teachers, trainers, mentors, career counsellors, etc. But these educators also need training, to be able to guide and advise learners in their turn. The blue economy manual helps educators in this regard because it is structured in such way that it can equally be used by learners and educators.

Moreover, in order to get results and make a large-scale impact, structured education, training, mentoring and career counselling need to be organised in schools, training facilities and career centres. These facilities could take advantage of this blue economy manual to get an overview of the blue economy, its current developments, emerging sectors and future jobs. Therefore, the manual may be a good reference material for the managers of education, training and career guidance facilities and could assist them in making informed decisions about the strategic development of their institutions, developing new courses, course curricula and services.

So far, we have seen that the course addresses to three generic categories: VET learners, educators and vocational education institutions (including their managers). Obviously, these are broad categories with are expanded upon in the following paragraphs.

VET learners may be people with virtually no work experience, as well as seasoned professionals with many years of experience in one or more sectors of the blue economy, as well as people from other industries. Therefore, this manual may be equally used by those who want to start their career, those who want to advance in their career and those who want to change their career.



Moreover, the category includes people at different education levels, e.g. levels one to eight in the European Qualifications Framework (EQF); that is because of the diverse range of jobs available in the blue economy, spanning from cleaners to PhDs, researchers and university professors.

In addition, the course may add the greatest value to the disadvantaged learners and people with fewer opportunities, including women facing difficulties in finding jobs, those living in remote locations (e.g. islands and poor inland territories within commuting distance from better developed coastal areas), people with disabilities and those facing economic difficulties. All these people may pursue careers in the blue economy, which can help them better their self-confidence, round their cultural awareness and improve their financial, physical and mental well-being.

While the generic category of educators includes primarily vocational teachers, it extends to trainers, mentors, coaches, career counsellors and advisors active in the vocational education. But the course may also be utilized (as it is or modified) in other areas including the school, higher education, adult and youth education. Therefore, the category of potential users of this manual extends to teachers, researchers, university professors, social workers and youth workers.

As previously set out, the organisations that take most benefit from this blue economy manual are the vocational education institutions (vocational highschoools, professional schools and training centres). However, this is just the obvious tip of the iceberg. In fact, the manual could be used in many other, including primary and secondary schools, theoretical highschoools, universities, career centres, NGOs, unemployment agencies, social assistance offices and adult education centres. Apart from these, a particular category of potential users of this manual are those in the employment sector, including recruitment agencies and even employers who may wish to attract, convert or retrain people in different work-based settings.

Finally, it worth mentioning that the manual may be useful to people, educators and institutions from coastal areas but not only. Given the workforce and learners' mobility, the manual could be used in non-coastal regions in the partner countries, but also in other maritime and land-locked countries as well.

In the following paragraphs, we outline the course elements that can be used by the direct target groups or transferred to other target groups. We define usability as the ways in which the content can be used to achieve the required goals effectively and efficiently (Jordan, 2002). In comparison, transferability is the degree to which the content is relevant and applicable to other similar situations (Lincoln & Guba, 1985).

The specific procedures or techniques used to identify, select, process, and analyse information about this specific topic can be transferred to any qualitative researches. The methodology used for primary and secondary research flows in a way suitable for any other research, no matter its topic.

Firstly, the structure of the manual may be transferred to many other topics. It includes summary, an overview of the subject matter, course contents for each of these, conclusions, information about the authors and partner organisations, references. The course content chapters are similarly constructed with aim, objectives, general information about each sector, job opportunities, example of education and

training providers, trans-sectoral working possibilities, facts and figures, key takeaways, evaluation quizzes, additional reading and video materials and self-reflection questions.

The course curriculum and content can easily become teaching content. The course materials about the blue economy can be transferred into formal education with valences of non-formal education. The teachers themselves have the possibility to adapt the information found in the course materials to their lessons, depending on their students' needs. The information can be transferred and adapted at different levels in order to supplement the curriculum.

The evaluation quizzes could be used in face-to-face and online settings. In addition, course designers, teachers and trainers could also create new questions following the multiple-choice structure with three answers of which only one is correct. To this end, the structure can be transferred to any other topic.

The resources included as supplementary information and references were curated and verified by blue economy professionals. These materials could be explored and expanded upon by trainers. Since these references include both reading and video materials, they are suitable to be used with target groups with different learning styles.

Finally, the self-reflection quizzes were designed to foster the critical thinking and the students' ability to formulate opinions and defend them. This approach can be transferred by trainers to any other topic. Not only that, but learners themselves can create new self-reflection questions to meet their curiosity and interests. Career advisors and alike could also use these questions (or similar ones) in their daily work with students and blue professionals.

All the items mentioned above are included in this written blue economy manual. However, this manual should be regarded as a complementary component of the entire educational package provided by the Career Guidance in Blue Economy (BeBlue) project. Although not included in this manual, the package also includes a needs analysis report with methodology, results and their evaluation, a blue career map with 100+ job cards, a massive open online course with all the course content supplemented by slide presentations and a Blue e-Mentoring Programme with methodology and online support. The methodology to design and deploy this educational package can be used in many other employment areas and with different target groups.

The methodology of the needs analysis research is primarily based on desk research and survey questionnaire. The specific procedures or techniques used to identify, select, process and analyse information about this specific topic can be transferred to any other industry or sector. The methodology used for primary and secondary research flows in a way suitable for research in other topics as well. The results themselves can be used not only by educators and career counsellors, but also by recruitment agencies and employers to understand the needs of their existing and prospect personnel. These categories of users may also find great value in the blue career map and the associated job cards, which can be used to create job offerings and define job descriptions for employees. Similarly, recruitment agencies and employers could use these as templates to define the job descriptions and career maps specific for other industries and sectors.

The course materials were integrated into the MOOC platform and can be freely accessed by anyone with a smart device and internet connection. Each course module provides its content in an attractive way to improve the course completion rates. The online course includes e-books, images, embedded video materials, embedded pdf slide presentations supplementary reading and quizzes to assess the attained competences. All these can be transferred and/or modified into other online, hybrid and face-to-face educational contexts.

Upon successful completion of the course, participants are asked to fill in a feedback survey. The survey is designed using the Net Promoter Score (NPS) framework. The NPS score is a metric used to measure employee and customer satisfaction in any sector including, for example, the business sector (e.g. Apple, Google, Microsoft, Coca-Cola), social media (e.g. LinkedIn) formal education (e.g. Harvard Business School, Wharton School of Business) and online educations (e.g. Coursera and Udemy). In essence, respondents are shown one quantitative and one qualitative question. The quantitative question collects data on how likely is the participant to recommend the course to others (on a scale of 1 to 10 scale), while the second one asks participants to motivate their choice. The survey itself is transferable to any other education or service sector, while the results could be used to benchmark students' satisfaction to other courses.

Answering the NPS survey enables course participants to receive their course certificate and access to bonus materials. The bonus materials include the complete editable slide deck, the downloadable version of the current blue economy manual and a Constructivist On-Line Learning Environment Survey (COLLES). The later helps us assess the extent to which our web teaching enriches our distance students' ways of knowing, in order to improve our online courses. COLLES, which can be transferred to any other online course, generates a benchmarkable measure of students' perceptions of both their preferred and actual on-line classroom environments.

The Blue e-Mentoring Programme is a five steps process towards a successful blue career: (1) creating individual profiles, (2) following the guidelines for mentors and mentees, (3) drafting CVs and cover letters, (4) drafting career development plans guided and reviewed by mentors, (5) evaluating the mentorship process. While this process and the associated procedures, tool and techniques were designed for the blue economy, all these can be transferred and adapted to any other face-to-face or online setting on virtually any training and employment sector.

Perhaps the ultimate evidence of the usability and transferability of the BeBlue educational ecosystem is that the online course and the e-Mentoring Programme packages can be provided upon request to other institutions and could easily be installed in any Moodle platform (Moodle accounts for over 200 million users and 151,000 websites). In addition, the course files are compatible with most online learning systems available in the market (Moodle or not).

Currently, all the educational materials are freely available in various formats on the BeBlue project webpage and the TrainingClub.eu Moodle platform (which is available in its web and mobile app versions). Upon the completion of the BeBlue project, the materials and their online references will be made available through the Erasmus+ Project Results Platform (EPRP).

But even if the materials are made available online, users' learning can take place virtually anywhere: at home in front of the computer, tablet or smartphone; at the premises of partner organisations, in schools, universities, training centres, etc. and at work (the study materials can be consulted while working on a ship in the middle of the Pacific, for example).

Another benefit of the BeBlue education ecosystem is that the online is an environment that never sleeps, the MOOC is always open (unlike other courses where registration takes place from time to time), the educational resources are always available online and anyone can learn anytime (not necessarily in the same place or at the same time). All these are made available to any teacher, trainer and career counsellor to organise classes 24/7 around the year, every year, no matter of time zone. Everything will be maintained and updated for many years from now.

So far, we presented a comprehensive image of why we developed these educational materials, for whom, what is included in the educational package, where is this available and when could be accessed. In the following, we focus on how can these educational materials be utilised by users and transferred to target groups.

From the learners' perspective, these materials are suitable for both training and self-study activities. They can be used online as an MOOC, in the synchronous and asynchronous mode, in closed groups or for face-to-face classes.

Moreover, users can study the textbook, the Moodle course, e-books, slide presentations and video materials or can follow up on academic and industry literature. Since the course includes many types of resources the course can be used by people of all types of learning styles (e.g. Activist, Theorist, Pragmatist and Reflector).

As a matter of fact, users can intentionally choose the type of materials to focus on by finding out the types of learners they are. To do so, they may answer the Learning Styles Questionnaire (LSQ) designed by Peter Honey and Alan Mumford, which is implemented in the TrainingClub.eu Moodle platform. Some may be amazed to find out that they learn better by starting with the quiz questions or exchanging ideas with others in the course forums, which are also provided in the online course. Also, the course allows participants to add new discussion topics and seek advice from other learners.

After completing the online course, learners could enrol into the e-mentoring programme, where they can get career advice from industry professionals who volunteer to help their mentees.

From the trainers' perspective, this educational package could be used online, hybrid or face-to-face. For example, some may wish to study the materials by themselves online and then download them to deliver face-to-face in class. However, to ensure that the participants followed the learning steps and attained the course learning objectives, educators could ask learners to follow the online course and present the course completion certificate. Similarly, career advisers and mentors could organise face-to-face sessions on how to write CVs, cover letter and career plans. They can then turn to the e-mentoring platform to facilitate

and supervise the mentoring process. Then, the mentees can submit their CVs, cover letter and career plans for review and feedback.

It should also be noted that the resources are available online for people with disabilities. In our Moodle we implemented an accessibility pack for those with visual impairments. The materials are compatible with machine reading software which makes them available for learners and educators with special needs.

Last, but not least, our consortium adheres to a set of guiding principles in terms of transparency, integration and copyright.

Transparency is a principle that attracts possible partners and any person who are interested in this topic or in a specific organization. The educational package that has been created can be found online and accessed by anyone. Furthermore, anybody can enrol the MOOC platform and access the e-course and the e-mentoring programme too.

The project methodologies, resources, processes, results and outcomes were incorporated into partner organizations. This is the focal point of our approach since it enhances partners' capabilities (competences and resources) and demonstrates that our educational and managerial approach works. At the end, the goal is to make sure that other organizations adapt and use successfully the tools, techniques or lessons that we developed.

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## ABOUT THE AUTHORS

**NICOLETA ACOMI, PhD.** Vice President of Association TEAM4Excellence, associate professor in the areas of STEM, digitalisation and navigation, project manager PMP® of 30+ research, education and development projects, Assoc Prof and Vice-Dean at Faculty of Navigation, Constanta Maritime University with 16+ years' experience; rapporteur for research project evaluations of International Association of Maritime Universities, Vice-President of Women's International Shipping & Trading Association, Romania, President of Romanian Intermodal Transport Association, founder and director of Constanta Maritime University Training Centre; delegate to the NCSR Sub-Committee of the International Maritime Organisation. She authored eight books and 80+ academic articles covering the topics of education, teaching methodologies and engineering.

**OVIDIU ACOMI, MBA.** President of Association TEAM4Excellence, trainer in the areas of STEM, digitalisation and entrepreneurship, Member of the Naval Supervisory Board within the Competition Council for a term of 5 years, member of the Engineering Commission of ARACIS for a term of 4 years, EFQM international evaluator for the Global EFQM Awards, manager of European projects and management consultant, expert evaluator of the European Commission for research and innovation projects, chartered engineer of the Institute of Marine Engineering Science and Technology UK, chartered manager of the Chartered Management Institute UK, project management professional PMP®.

**IVANOV LAURENTIU** Instructor at the Constanta Maritime University. Holds a degree in Faculty of Navigation, Holds IMO Training Courses, 30 years of experience as Deck Officer on various vessel types. Collaborate regarding the Blue Economy and other project activities and supports the team.

**MAX SCHMIDLE.** Max joined Sea Teach in February 2019 and is working as an international project officer. Max holds a degree in Environmental Sciences from the University of Girona and is multilingual, speaking Catalan, Castilian, German and English. Max is responsible for the development and daily management of the European Projects with an emphasis on the maritime economy. He has comprehensive project experience and is responsible for research tasks, translations, meeting organizations and target group identification. He is also responsible to make and maintain contacts with educational and administrative authorities regarding the blue economy and other project activities and supports the team with new project developments, research, translations, the organization of events and stakeholder engagement.

**MEDINE GÜNEY.** She is an English teacher and working at a VET school in Osmaniye. She is experienced at Erasmus+ projects and works as a project expert at the Research and Development Office in Osmaniye Provincial Directorate of National Education. She participated in various EU projects and seminars. She is keen on Project management. She holds training activities for the teachers and school managers on EU projects (preparation, application, administration and management, implementation and evaluation phases). She is also an English teacher trainer and gives seminars and workshops to English teachers on new technics and methods in teaching English. She is also an eTwinning ambassador which is ruled by European Commission.

**MEHMET ALI SAVCI:** He was a 22 -year geography teacher and completed his post-graduate study in business administration. He succeeded in Geographical Information Systems and Social Entrepreneurship Training courses organized by the Ministry of National Education, Information Technology Education Course, Technology Use Course in Education, Basic Training Course and Strategic Planning, Strategic Management and Planning, Strategic Plan Implementation, Monitoring and Evaluation Seminar. He has 4 years of experience in school management. He is experienced in Erasmus+ projects.

**HÜSEYİN SELAMI KAYA:** He studied Education Programming and Management at University and worked as a school counsellor and guidance teacher at schools. Since 2007 he has been working as the coordinator of the FATİH project in Osmaniye MEM as the Provincial Coordinator of Information Technologies; He worked as a trainer in Graphic Design, Digital Photography, System Management, Web Design, and Informatics. He had in-service training courses and seminars about Pardus and e-Safety. He contributed to writing a book on effective use of software, web-based content development, Photoshop course, Flash course, Excel course, web design course and Information Technology.

## ABOUT PARTNER ORGANISATIONS



TEAM4Excellence (T4E) is a Romanian association aiming to improve the quality of life through education, research and consulting activities. To address societal challenges, T4E provides learning opportunities and career advice for social inclusion, development and employability of people, and equips trainers with key competences and skills to foster personal as well as professional development. Within 30+ EU-funded projects, the association produces and transfers innovation, experience and know-how through cooperation with domestic and international partners. By hosting events, training courses and conferences, T4E strengthens collaboration between people, supports organisations and bridges gaps between generations. The wide expertise in management enables T4E staff to provide consultancy to large companies and SMEs using EFQM Model and Business Model Canvas.



Sea Teach, as a Sea School and Charter Company, has a profound understanding of the current training supply and the market needs in the Blue Economy. Through its project work, Sea Teach has also developed high levels of expertise regarding maritime education, skills assessment, validation processes and mentorship programmes. Sea Teach is actively involved in the promotion and placement of young people in different sectors of the Blue Economy. Sea Teach has developed projects to address the problem of lack of recognition of qualifications in recreational boating and has also developed unique Assessment Tools that have found wide approval by employment agencies, Human Resource departments and Maritime Universities. The wide network in Spain and beyond, including employment agencies, the VET sector and universities, enables Sea Teach to implement activities and tools in cooperation with relevant stakeholders.



Osmaniye Provincial Directorate of National Education is a governmental organisation in charge of the planning and coordination of all kinds of educational and training activities from pre-school to the end of secondary school, vocational high schools, technical schools and adult education institutions & centres in its region. There is 1 director, 9 deputy directors and 20 school inspectors. Osmaniye Provincial Directorate of National Education is responsible for about 419 schools, 6.780 teachers and 133250 students in its region and responsible for any kind of educational facilities. In Osmaniye there are 26 vocational high schools and 6 of them are in the city centre. 12580 students are attending 9-12 grades at different departments such as Furniture and Interior Design, Installation Technology and Air Conditioning, Chemistry, ICT, Accounting and Finance departments and Food and Beverage Services, etc.



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## ANNEX 1. EVALUATION QUIZ CHECK SHEETS

Evaluation quiz no.1 check sheet – correct answers

1A            2A            3C            4B            5C            6B

Evaluation quiz no.2 check sheet – correct answers

1A            2C            3B            4A            5B            6B

Evaluation quiz no.3 check sheet – correct answers

1B            2C            3A            4B            5C            6B

Evaluation quiz no.4 check sheet – correct answers

1C            2B            3A            4C            5A            6C

Evaluation quiz no.5 check sheet – correct answers

1C            2C            3C            4A            5B            6B

Evaluation quiz no.6 check sheet – correct answers

1A            2B            3A            4A            5C            6A

Evaluation quiz no.7 check sheet – correct answers

1A            2C            3C            4A            5B            6B

Evaluation quiz no.8 check sheet – correct answers

1C            2A            3A            4A            5B            6A

Evaluation quiz no.9 check sheet – correct answers

1A            2B            3A            4B            5C            6B

## CONTACT

 <https://www.facebook.com/TrainingClubT4E>

 <https://www.instagram.com/trainingclub.eu/>

 <https://trainingclub.eu/beblue/>

 +40 723 194 474

 [office@team4excellence.ro](mailto:office@team4excellence.ro)



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