Co-funded by the
Erasmus+ Programme
of the European Union

The European University of the Seas

How HEIs and PROs can foster creation of sustainable jobs and growth in aquaculture, coastal tourism, marine biotechnology, ocean energy and seabed mining

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November 2022

Content

Validity: *This document was presented at the Quality and Ethics Subcommittee on 25th November 2022.*

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1. FOREWORD: Why do you need a PhD to work in a cannery?

Marija D. is the production manager in a large cannery in Croatia. The Cannery belongs to a company "Fish Industry"[1] that deals with fishing (they own several of their own fishing boats, as well as permanent contracts with a large number of private fishermen) and fish processing. The company also has a developed activity of fish farming, so that its program includes the entire process of catching fish, farming fish, processing and selling fish and fish products.

The cannery is located in a small town on an island, and most of the town's residents are connected to the fishing industry through their work and existence. Traditionally, men work in fishing and fish farming, and women work in the cannery.

Marija was born 38 years ago in the same small town where a canning factory is located. Her entire family, as well as her husband's family, worked in the company that owns the cannery. That is why it was not surprising when Marija enrolled in the study of Marine Fishery at the Department of Marine Studies, University of Split. Granted, her mother thought it was much more normal for a woman to work as a laborer cleaning and preparing fish for canning, but she was glad that her daughter might not have to do such hard work as she did. As the child of cannery workers, Marija received a scholarship from the factory for her studies – as many children in her small town did.

A month before she graduated, Marija already started working in the "Fish Industry". Very quickly she became the chief technologist at the fish farm, where she stayed for 5 years. After that, she was transferred to work in the Cannery, to the position of technologist on the fish processing line. She worked in that position for a year, and then was appointed to the position of head of the quality assurance system. Most of her work took place in a well-equipped laboratory, where she successfully and joyfully applied the knowledge acquired during her studies.

In the meantime, Marija got married and gave birth to two children. Her husband is from the same town where Marija was born, and they have known each other since childhood. He does not work in the "Fish Industry", but his parents worked in the Cannery too. They live together in the house that Marija's husband's parents built while they were working at the Cannery, with financial help from the company. Maria's mother-in-law provides her with a lot of help

[1] The company name is fictitious.

in running the household, especially in taking care of the children. The certainty that her children are always taken care of, under the vigilance of their grandmother when they are home and when they go to school, gives Maria the opportunity to fully concentrate on her work and the problems she has to deal with there.

At the time when Marija worked as a quality system manager, the production manager was a man with a doctorate in food technology. He helped Marija a lot in gaining experience in her work and professional development. To a large extent under his influence and with his support, 5 years ago Marija came up with the idea of enrolling in doctoral studies at the Department of Marine Studies at the University of Split.

When she presented her idea and desire at home, the older family members were quite surprised. Her mother-in-law's reaction was, “So why do you need a PhD to work at the Cannery? I also worked at the Cannery, but I didn't need that kind of education." The father-in-law asked: "Do you think that among all these men in management positions, you will be able to get a better job than the one you have now? You have a nice job in your laboratory with your instruments now, and you don't have to struggle and fight with other people all the time."

Her seven-year-old daughter asked: "Does this mean that mom will go to school like me? But the school desks might be too small for you.". Maria's husband said: "If you want it and feel you can, you have my support!"

Marija also spoke with the company's management. Some of them made it clear to her that they did not see the need for such a level and type of education in the company. "You do your job very well and we are very satisfied with you. You have all the necessary knowledge for the job you do, and our company needs someone who has practical knowledge and can concretely improve our work and business." Someone even expressed fear: "When you get your doctorate, are you thinking of leaving the company and going to work at some research institute?" Marija assured them that she had no intention of leaving the company, nor that her studies would interfere with her regular work. To this, they replied that they would not oppose her doctoral studies, but remained quite sceptical about the whole idea.

Firmly convinced of the correctness of her decision, and with the unconditional support of her husband, Marija actually enrolled in doctoral studies four years ago.

Shortly after starting her doctoral studies, Marija was offered the position of production manager. After some thought and discussion with her husband, she accepted the position, but she made it clear to everyone: "This will not prevent me from continuing and completing my doctoral studies!"

The job of production manager confronted Marija with new and stronger challenges. Managing a plant with over 120 employees brings daily new problems - not only of a technical and technological nature but even more problems of work organization, working with people and solving their problems, about which she did not acquire knowledge during her studies. Unfortunately, even the courses in her doctoral studies did not help her much in coping with these problems. She simply had to learn through practice, solving problems as they arrived, but also gaining more and more knowledge and confidence after successfully solving each new problem.

In parallel with the demanding job of production manager in the company "Fish Industries", Marija successfully attended and passed the exams from the first two years of doctoral studies. In the third year of studies, in cooperation with her mentor, she defined the topic of her doctoral dissertation: "Refining of fish oils". She found the inspiration for the topic and the empirical basis for research precisely in the work she does at her workplace.

Today, as Marija's research for the preparation of her doctoral dissertation progresses, the Management of "Fish Industries" is simultaneously developing a business plan for the introduction of fish oil production. The production process for the new production is being designed, of course, by Marija D.

2. INTRODUCTION

The Blue Economy is a significant generator of economic growth and employment - directly and indirectly - not only in coastal and maritime countries. According to the EU Blue Economy Report 2021, seven 'established sectors'[2] of the Blue Economy provided 4.5 million direct jobs in the EU in 2018. Indirect employment generated in businesses that supply products and services to the Blue Economy sectors adds between 2.5 and 5 times more additional jobs, depending on the sector. 'Emerging sectors'[3] within the framework of the Blue Economy bring additional great potential for direct and indirect employment.

Technological development, as well as social and economic changes on the global level, cause fast and increasingly rapid changes both in the content and structure of jobs, as well as in the knowledge and skills needed to perform jobs, and then also in the way and dynamics of acquiring the necessary knowledge and skills.

World Economic Forum Research (https://www.weforum.org/reports/the-future-of-jobs/) points out that „65% of children entering elementary school today will work in positions that do not yet exist. These new careers will likely fall in the areas of mobile, internet, math, robotics, programming, engineering, and data analysis. The main characteristic of these jobs is critical thinking. It will be crucial for problem-solving related to intelligent machines and systems."

"In the future, job requirements will focus on qualification, creativity, resilience, and the ability to work as a team." (https://stefanini.com/en/trends/news/industry-4-a-complete-guide#maincharacteristics)

Jobs in the Blue Economy domain are no exception - in fact, the Blue Economy is probably one of the domains where changes are even faster than average. 'Emerging sectors' make up half of the list of sectors that belong to the Blue Economy and in them work processes and jobs are just developing and constantly changing. Even in the 'established sectors', new technologies are increasingly present and are constantly changing the content and shape of

[2] *Marine living resources; Marine non-living resources; Marine renewable energy; Ports activities; Shipbuilding and repair; Maritime transport; Coastal tourism.*

[3] *Ocean energy; Blue bioeconomy and biotechnology; Desalination; Marine minerals; Maritime Defence, security and surveillance; Research and Education; Infrastructure and maritime works (submarine cables, robotics, etc.).*

work processes. More and more complex knowledge and skills are required to work in the Blue Economy.

Institutions of higher education, by their nature of activity, are crucial for the creation and transmission of knowledge and skills, especially the most complex ones. However, the rapid pace of changes in technology and the organization of work increasingly highlights the question of how much the knowledge and skills provided by HEIs are in line with the needs of practice (work in the Blue Economy) today, and especially tomorrow.

Within the framework of the **European University of the Seas** (**SEA EU) Alliance** project, **Task 5.7** was defined as **Establishment of the Observatory for Sustainable Blue Growth.**

"One of the key aims of SEA-EU alliance is to act as a role model which will engage students, teachers, researchers and entrepreneurs in addressing big societal challenges through creation of transnational knowledge-creating teams." "The European Observatory for Sustainable Blue Growth will serve to facilitate regional dialogue and foster an effective network of marine and maritime stakeholders across the regions. The observatory will work on raising awareness of marine and maritime professions and their appeal to young people, promote circular migration and form strategies for matching supply and demand for jobs. One of its primary missions will be capacity building for knowledge and technology transfer from HEIs and PROs in the marine and maritime sector."

As one of the key foundations for the creation and start of the Observatory, a White Paper on how HEIs and PROs can foster creation of sustainable jobs and growth in aquaculture, coastal tourism, marine biotechnology, ocean energy and seabed mining was prepared.

This White Paper was created in collaboration with working teams from five members of the Alliance: UCA, UBO, UG, UNIST, UM, with consultations with a number of stakeholders from all partner countries.

In the first part of the White Paper, an 'inventory' was made of what the partner institutions (universities) of the Alliance offer in the creation and transfer of knowledge and skills in the area of the Blue Economy.

In the second part, the needs and opinions of stakeholders - those who create and develop jobs in the domain of the Blue Economy and who need people with appropriate knowledge and skills - were investigated.

The comparison of these two parts gives us a picture and conclusions about how HEIs (and specifically members of the SEA EU Alliance) could contribute to the creation of sustainable jobs in the area of the Blue Economy, and thereby to the sustainable development and progress of the Blue Economy.

3. ANALYSIS OF THE SITUATION (what partner institutions are doing/offering today)

3.1. Overview of study (educational) programs in the field of 'blue economy' offered by each partner university

3.1.1. Fields of study at University of Gdansk related to Blue Economy

Faculty of Chemistry

Chemistry and Technology of the Environment	The University of Gdansk was one of the first universities in Poland to begin teaching environmental protection. Currently, the studies are conducted in cooperation with the Faculties of Biology, Oceanography and Geography. During the studies at the first and second degree level, students get acquainted with the basics of many fields and disciplines, which allows them to gain the widest possible interdisciplinary perspective in the professional challenges undertaken in the future. The basis of education is based on three disciplines: biological sciences, chemical sciences and earth and environmental sciences, but the educational profile also refers to engineering and technical sciences (chemical engineering, environmental engineering, mining and power engineering), social sciences (economics and finance, legal sciences). It should also be added that the "Gdańsk" environmental protection program has its regional specificity, as students also obtain educational effects (knowledge, skills and social competencies) in the field of functioning and protection of the marine environment, with particular emphasis on the protection of marine resources. The perspective of nuclear energy development in the Pomeranian region has also led us to place special emphasis on educational results in the field of radioecology, radiochemistry and radiological protection of the environment. Graduates of this

	course take up jobs in various branches of economy as specialists / environmental protection inspectors, in laboratories and inspectorates for control and measurement, in offices of all levels of local administration, etc. The acquired skills and competencies also enable students to undertake their own business in the field of environmental protection techniques and technologies, environmental analysis and environmental education.
Environmental Protection	The graduate of bachelor studies possesses basic interdisciplinary knowledge, skills and competences in the field of general and practical issues related to environmental protection. In particular, the graduate is prepared to analyze and assess the environmental effects of the most important processes occurring in nature, identify and solve the basic problems related to environmental protection (resulting from the operation of natural laws, human activities, legal and economic aspects) and action in accordance to the principles of sustainable development. Achieving the effects of bachelor studies provides graduates with the opportunity to find employment in enterprises, organizations and institutions (public and non-governmental) interested in environmental problems as well as to start their own business. The graduate is prepared to continue education at Master level and Post-graduate studies.
Environmental Protection – the second-degree studies (4-semester master studies) – full-time studies, there are 40 places.	The undergraduate of the 2nd-degree full-time studies has got extensive knowledge, skills, and competences in the field of environmental protection. In particular, one is prepared to conduct a self-analysis concerning the mentioned branch of science. Moreover, there is an ability to conduct research and either gain or analyse environmental data of different origins. When reached their educational goals, the undergraduates can find employment in companies, organizations or public enterprises of scientific and research profiles whose activity concerns either monitoring or

	protection of the environment. The undergraduate is also prepared to continue studies at PhD or postgraduate studies. PhD studies in Chemistry and Biochemistry at the Faculty of Chemistry, conducted by the Faculty of Chemistry and the Intercollegiate Faculty of Biotechnology UG and MUG. The aim of full-time PhD studies in Chemistry and Biochemistry at the Faculty of Chemistry is the development of competences essential to conducting scientific research in the fields of science, Chemistry (Biochemistry and Environmental Protection) and life science, Biology (Biochemistry). The precise goal is to gain advanced knowledge concerning mentioned areas, advanced skills connected with conducting scientific research and social competences preparing to be a scientist. Fulfilling this goal is based on two basic activities of the students: • attending the courses conducted by specialized scientific staff (lecturers from Faculty of Chemistry, Intercollegiate Faculty of Biotechnology UG and Medical University of Gdańsk and invited speakers from other facilities also from abroad) • conducting scientific research (PhD projects) under supervision of specialists from Faculty of Chemistry of University of Gdańsk and Intercollegiate Faculty of Biotechnology UG and MUG in research teams from both faculties (or other units under the terms of scientific cooperation). It ends with a preparation of PhD thesis. Faculty of Chemistry of University of Gdańsk has the right to give PhD and PhD DSc degrees in field of Natural sciences and discipline - Chemical science.
Business and Ecological Technology –	Business and Ecological Technology – the second-degree studies (master studies) – full-time studies. The subject is conducted in cooperation with the Faculty of Economics of the University of Gdańsk. The latter is supervising this field of study. Achievement by a student of learning outcomes: A graduate of master studies possesses in-depth knowledge, skills and competences in the field of specialized knowledge in the field of

	chemical sciences. In particular, a graduate is prepared for self-resolution of chemical problems, conducting research activities and collecting and critically analyzing experimental data. Achieving the effects of second-level studies gives graduates the opportunity to work in companies and in public and non-governmental and research-based organizations and institutions whose activities are related to the use of chemistry. A graduate is prepared to pursue further studies in PhD studies and postgraduate studies.

Internship

Professional practice is carried out both in first-cycle studies and second-cycle studies.

In case of the first-degree studies, the students are obliged to do the internship after the second year of studies, during the summer holiday break. In CHEMISTRY and ENVIRONMENTAL PROTECTION, the internship lasts at least three weeks (120 hours), its workload corresponds to 6 ECTS points. ECTS; in the case of CHEMICAL BUSINESS the minimum of two weeks (75 hours), its labor intensity corresponds to 4 ECTS points. ECTS; the internship is completed during the 3rd year of studies, which is recorded in the student's transcript with an appropriate entry.

In case of the second-degree studies, students undergo obligatory in-service training after the first year of studies, during the summer holiday break. The duration of in-service training is minimum two weeks (80 hours) for full-time students and minimum 6 days (48 hours) for part-time students. ECTS points; the internship is completed during the 2nd year of studies, which is recorded in the student's transcript with an appropriate entry.

Students choose their company from a database of companies cooperating with the Faculty or look for an institution where they do their Internship on their own. The student's independence in this respect is one of the elements of realization of the learning outcomes in terms of social competence. The student may find a place for their practice either as a volunteer or as paid work. Students should take part in the internship in the workplace of their choice, i.e. production plants, heat and power plants, sewage treatment plants, environmental protection inspectorates, sanitary and epidemiological stations, water and sewage plants, waste disposal plants, environmental protection departments in municipal,

district and provincial institutions, etc. On the part of the Department, student internships are supported by Plenipotentiary for Internships and Placements.

The main mission of our faculty is the constant development of our undergraduates and making them attractive to the labor market. To support this goal there is a Consultative Council of outstanding representatives of industry, business and public administration. They help us modify the study program to give our undergraduates the most attractive competences for future employers.

Faculty of Biology; courses are conducted in Polish

Protection of Natural Resources - full-time Bachelor's course	In the course Conservation of Natural Resources, the student will gain interdisciplinary knowledge of: - threats to natural resources, as well as legal, economic and practical aspects of nature conservation, with the principle of sustainable management and conservation of biodiversity - identification of plant, animal, fungi and ecosystem species - the history of processes in the environment - methods of carrying out inventory, valuation and monitoring of nature - creation and use of modern tools for spatial data collection and analysis (GIS) - Application of environmental impact assessment procedures (EIA) - methods of renaturalisation and restoration of ecosystems on degraded areas - ability to obtain funds from financing sources for environmental projects. Graduates of the course are qualified for employment in: - institutions and specialized companies dealing with environmental and nature protection, - environmental protection departments of companies and enterprises, - public administration, environmental education institutions, - institutions responsible for financing activities in the field of nature protection, - national and landscape parks,

	- non-governmental organizations working for nature protection.

Faculty of Mathematics, Physics and Informatics

Bioinformatics	Conducted in cooperation with Faculty of Biology, Faculty of Chemistry, Intercollegiate Faculty of Biotechnology UG – UG full-time Bachelor's course This unique course of study is designed to prepare graduates to work with computer and mathematical techniques in the study of biological systems (including genetics) and their use in biotechnology. The ability to process the enormous amount of information obtained during the study of genomes and proteomes of living organisms is essential not only in scientific work, but also in practical applications in biology, biochemistry, biophysics, biotechnology and medicine. Hence the demand for bioinformaticians in scientific and research institutions as well as commercial institutions. This is an interdisciplinary interdepartmental study.

Faculty of Oceanography and Geography

Aquaculture: Business and Technology	The main goal is training for careers at companies and science laboratories connected with aquaculture, as well as highly specialized administrative staff taking care of aquaculture business. Students develop knowledge and practical skills during classes of biology, physiology of breeding organisms (fish, invertebrates and algae), food processing and aquaculture products. The content of education also includes legal aspects of aquaculture and the basics of business management. The course is practical and students acquire their first professional experiences during two 7-week internships in companies connected with broadly defined aquaculture. Study in Polish or in English. JOB PROSPECTS - Production management in domestic and foreign aquaculture facilities - processing of aquaculture products

	- laboratory analysis of aquaculture products - Setting up small and medium-sized aquaculture businesses
AquaYouth summer schools University of Gdańsk, Poland http://aquavip.edu.pl/	AquaYouth summer school introduces participants to background theoretical skills in modern aquaculture biotechnology: main types, biological and technological processes and development trends. The courses provide participants with practical hands-on experience on modern aquaculture technology and innovative blue biotechnology-based approaches to increase aquaculture development potential. The courses are based on real ongoing aquaculture experiments in recirculating aquaculture systems (RAS) at Gdańsk University. University research facilities and partner aquaculture companies. The provision of scientific and technical skills enables the exchange of know-how and good practices between experts and participants. AquaYouth summer schools programme is based on the experience of Klaipeda University, University of Gdańsk, Rostock University, and the editions ran within InnoAquaTech project.

MANAGEMENT AND PROTECTION OF WATER RESOURCES	Profile of courses is practical. We offer the whole semester of trainings in companies related to water management. Internships are thematically related to diploma thesis. Students learn about natural water cycle, monitoring methods, comprehensive management of water resources in Poland and Europe, management methods of protection process. In addition, they get training in hydrological, hydrochemical and hydrobiological measurements in the field, laboratory methods, creating hydrological records, assessing water resources and forecasting water supply, assessing the economic value of biotic and abiotic resources of the waters. The program is divided into eight thematic modules: I - Basic Courses; II - Specialized subjects; III - Monitoring and modelling of environmental phenomena; IV - Legal, social and economic aspects; V - Environmental Engineering; VI - Water resources and their protection; VII – Internship, and VIII - Classes in English. Leading

	subjects: hydrology, meteorology and climatology, water management, socio-economic aspects of water management, coastal protection, bioindication and biomonitoring of water. Study in Polish with selected classes in English. JOB PROSPECTS • local administration units (municipal and commune offices, marshal offices) • institutions dealing with water management or water resources protection (e.g. Wody Polskie S.A. together with Regional Water Management Boards and Catchment Boards, Maritime Offices, Regional Directorates for Environmental Protection, Institute of Meteorology and Water Management - PIB, Chief Inspectorate for Environmental Protection, Gdynia Aquarium MIR-PIB, land improvement companies, research laboratories) • offices preparing studies and planning documents • crisis management offices • sanitary and epidemiological stations
OCEANOGRAPHY	Oceanography at the University of Gdańsk is a unique field of study in Poland. The highest quality of education is ensured by a wide range of educational offer, well-equipped teaching base, participation in European programs and activities of the Marine Station in Hel. Students attend classes and conduct research on the specialized research vessel OCEANOGRAF, one of the most modern units in the world. The study of oceanography provides the acquisition of: - knowledge to correctly understand and interpret complex biological, physical, chemical and geological phenomena and natural processes occurring in the marine environment and coastal zone, analyze and interpret the relationships between phenomena and processes occurring in the environment; understand methods of sustainable and integrated use of marine resources, - ability to independently plan and conduct observations in the field or laboratory; perform complex analyses of the aquatic

	environment using appropriate methodology; correctly formulate conclusions - soft skills and competencies to prepare for independent and collaborative professional work. The study program includes general lectures in three basic fields: biological oceanography, physical oceanography, and chemical oceanography. Specialized courses include marine biology and ecology – resources and ecosystems, marine biotechnology, marine chemistry and atmosphere, satellite oceanography, marine dynamics, marine acoustics and optics, geophysics, marine geology and geomorphology, geodynamics and coastal zone hydrodynamics, stratigraphy of marine sediments and broadly understood human impact in marine areas. A specific form of classes are field exercises covering activities in the sea and the coastal zone. The interdisciplinary education takes place in two fields of specialization: • biological oceanography (studies in Polish) • geological- physical-chemical oceanography (studies in Polish). JOB PROSPECTS - research laboratories in scientific and research and development institutes at home and abroad - non-governmental organizations -Maritime economy - power industry, fisheries, "blue" biotechnology - Maritime Office, Chief Inspectorate for Environmental Protection, Regional Directorates for Environmental Protection - state and local administration - education and maritime tourism
The Intercollegiate Faculty of Biotechnology	The Intercollegiate Faculty of Biotechnology at the University of Gdansk and the Medical University Of Gdańsk (IFB UG&MUG) was established in 1993 by the Senates of the University of Gdansk (UG) and the Medical University Of Gdańsk (MUG). The Faculty was created on the initiative of Prof. Karol Taylor, Prof. Anna Podhajska

	and Prof. Wacław Szybalski. To this day, the Faculty remains unique in the country as a unit formed by two universities. This creates the interdisciplinary character of ongoing research and didactics, combining biomedical and bio-molecular issues and their applications in biotechnology for health and life quality. Since 1999 the Faculty has had the right to award doctorates and since 2010 post-doctoral degrees in biochemistry. The faculty teaches at the undergraduate, post-graduate and doctoral level, and has more than 320 students including 90 doctoral students. IFB UG&MUG is a leading scientific and teaching institution that since 2002 has held the status of European Centre of Excellence in Molecular Biomedicine. We were awarded this status in the international competition 5. PR UE, as one of four institutions in the country. IFB is highly placed in the Ministry of Science and Higher Education (MNiSW) rankings on scientific effectiveness. In 2017 the Committee for the Evaluation of Scientific Units assessed scientific and R&D activities. IFB received the highest possible A+ rating, which means that it has distinguished itself with the quality of its research and development. In 2013, when an evaluation was carried out according to new parameters, the faculty was awarded category A and took 3rd place, and in 2010 the Faculty was also awarded category A and took 2nd place – which was the highest position for an academic institution. The Faculty conducts the highest-rated teaching in the country. In 2011 the Polish Accreditation Commission (PKA) awarded the Faculty a distinction for its quality of education. In 2012 MNiSW awarded the title of Best Field of Study to the biotechnology conducted by IFB UG&MUG. The General Council of Science and Higher Education recognised the set of learning outcomes prepared by the Faculty for biotechnology as exemplary material. These are the only such distinctions awarded in the field of biological sciences in Poland. The Faculty's employees contribute to the high assessment of its scientific and didactic activities. Members of the Faculty perform important functions in international scientific societies and

	committees. For instance, Prof. Krzysztof Liberek is a member of EMBO, Prof. Igor Konieczny is a member of the European Committee for Cooperation in Science and Technology (COST), Prof. Ewa Łojkowska and Prof. Krzysztof Bielawski vice presidents of ScanBalt, Prof. Krzysztof Bielawski is a member of the council and Polish representative for the European Society for Translational Antiviral Research (ESAR), and Prof. Bogusław Szewczyk is a committee member for the European Food Safety Authority. Faculty members have also won prestigious programs and awards, including for young scientists (EMBO YIP, HHMI, LIDER, InnoDoktorant, TOP 500 Innovators and awards from the Foundation for Polish Science (FNP) MISTRZ, START, HOMING PLUS). Their publications have received awards and distinctions from the Committee for Microbiology PAN, the Polish Genetic Society and the Polish Biochemical Society for the best research conducted in Polish laboratories The Faculty's main premises are the laboratories in the ultra-modern Institute of Biotechnology in Gdansk (58 Abraham St., University of Gdansk Oliwa campus) and the laboratory complex on the MUG campus at 1 Dębinki St. (constructed 2002). These two research and teaching centres form the Faculty. Students and staff have access to the facilities of both universities. The Faculty has state-of-the-art laboratories for molecular research with specialized apparatus, as well as an animal house and phytotron complex. In December 2012 the University of Gdansk signed a contract (nr UDA-POIS.13.01-008/12-00) for the construction of a new building for IFB UG&MUG. In 2016 the official opening of the scientific-didactic complex took place. This complex has been designed in accordance with its planned development in research and didactics. The building is situated at the University of Gdansk in the immediate vicinity of the Faculties of Chemistry and Biology. This contributes to greater integration and stimulates interdisciplinary research and education. The total cost of the

	project was PLN 60 million and was financed by the EU Operational Programme for Infrastructure and Environment. IFB offers a second-cycle study course awarding a degree of Master of Science in Biotechnology. The education process is combined with participation in several types of research conducted at the Faculty. Students are trained in the area of molecular biotechnology, medical biotechnology, plant biotechnology, aerobes biotechnology, molecular modelling and molecular diagnostic in medicine, plant and environment protection. The graduate will have theoretical and specialised knowledge as well as practical skills and will be well prepared for working in: • R&D units • the industry sectors • the public sector.

Faculty of Economics

Characteristics of specialization International maritime transport and trade Specialization in International Maritime Transport and Trade.	The knowledge conveyed to students includes mainly issues concerning the functioning of maritime transport and the specificity of maritime trade. This specialization consists of bachelor's studies lasting three years and master's studies lasting two years. The specialization offers at undergraduate level lectures and exercises in Organization and Technique of Maritime Transport, Organization and Functioning of Sea Ports, Forwarding, Logistics, International Transport and Protection of the Marine Environment. Within these subjects, merchant ships are presented as a means of transportation that must be characterized by certain standards of construction and equipment and meet the requirements of international conventions (e.g. SOLAS, MARPOL, STCW, etc.). In addition, the principles of organization of irregular and regular shipping are covered as well as transport documentation used in the carriage of cargo and passengers. Another issue presented within the curriculum is the characteristics of seaport operations, which are an important element of the transport and economic infrastructure. The technical equipment, production processes of

	port services, as well as systems and models of seaport management are presented. An important issue discussed during lectures is the protection of the marine environment, where the principles of using natural resources in accordance with the concept of sustainable development are pointed out, and the MARPOL conventions and the Helsinki Convention (Baltic Sea) are discussed. Lectures on freight forwarding, international transport and logistics provide an overview of all activities related to the organization, implementation and management of transport and storage processes. The master's degree program offers lectures and exercises on: Maritime Transport Economics and Shipping Policy, Port Economy and Policy, Maritime Trade Transactions, Multimodal Transport. These classes deal with the international nature of shipping, especially freight markets, cost and price formation mechanisms in irregular and regular shipping, and shipping policy (including EU policy). Other issues dealt with during the lectures and exercises are issues related to port services markets, prices of port services and EU port policy. In addition, the principles of commercial transactions are discussed along with an indication of the parties' obligations and transport responsibilities arising from international trade formulas. Lectures are also given on the characteristics of modern transport solutions including multimodal transport. As part of the International Maritime Transport and Trade specialization, lectures are also conducted with customs and tax officials, and guest speakers are invited to present monographic lectures (e.g. on a particular seaport or shipping company). The specialization is also connected with the Maritime Study Group, which consists of students interested in issues related to maritime economy, including transport, seaports, maritime tourism, the specifics of work at sea and other issues. Students involved in MKN organize seminars with the participation of business representatives and publish their scientific papers.

3.1.2. Fields of study at University of Malta related to Blue Economy

M.A. in Global Maritime Archaeology	Archaeology
B.A.(Hons) in Geography	Coastal Processes and Landforms Coastal and Marine Management
M.Sc. in Maritime Engineering	Engineering Management Maritime resistance Characterisation and Propulsion Systems Health and Safety, Risk Assessment and Accidents Project in Maritime Engineering Fundamentals of Ship Science Structural Mechanics for Maritime Applications Maritime Safety and the Environment Materials for the Maritime Environment Oceanography for Engineers
B.Eng.(Hons) in Mechanical Engineering	Naval Architecture Maritime Hydrodynamics, Manoeuvrability and Interaction Maritime Resistance and Propulsion Ship Structures Maritime Safety and the Environment Manoeuvrability Modelling Techniques Condition Monitoring and Systems Offshore Renewables and Water Treatment
Bachelor of Laws (Hons) LL.B. (Hons)	Law of Commercial Procedure: Company, Shipping, Aviation and Intellectual Property Procedure International Sale, Documentary Credits and Carriage of Goods Admiralty Jurisdiction and Salvage, Towage, Pilotage and Collision Selected Topics in International law Selected Topics in the Law of the Sea Global Maritime Security and International Law
M.A. Ocean Governance	International Law of the Sea

	Contemporary Threats to Maritime Security The Human Element of Maritime Crime: Migrant Smuggling, Human Trafficking and Stowaways The Marine Environment: Biological Patterns, Processes and Resources Global Ocean Governance Framework and Managing our Relations with the Oceans Managing Marine Space and its Potential as an Economic Resource - Project Study Multilateral Diplomacy and International Rule-making and Regional Sea Governance Policy Simulation Exercise
BSc. Hons (Biology) MSc. Biology	An Introduction to Marine Biology Mediterranean Marine Environment Topics in Marine Biology An Introduction to Fisheries and Aquaculture Marine Biology Field Biology - Coastal and Marine Habitats Introduction to Agriculture, Aquaculture, Fisheries and other Biological Resources
M.Sc. in Sustainable Energy	Introduction to Sustainable Energy Renewable Energy Resources Introduction to Renewable Energy Technologies
BSc. (Hons). Physics	Introduction to Physical Oceanography Science of the Ocean Floor Acoustic Remote Sensing and its Application in Marine Science
M.Sc. Applied Oceanography	Theoretical Baseline of Oceanography Hands-on Oceanography Ocean Informatics Instrumentation and Ocean Data Systems Marine Environmental Management Ocean Modelling Ocean Science Communication Oceanography Boot Camp

	An introduction to ocean governance and policymaking Applications and Services in Operational Oceanography
B.Sc. (Hons) in Earth Systems	A Non-Technical Introduction to Renewable Energy Energy Resources: Key Concepts and Case Studies

Programmes open to public

Jellyfish spotting citizen science campaign in Malta	The programme was launched in 2010 and is coordinated by the Physical Oceanography Research Group of the Department of Geosciences of the Faculty of Science. The initiative follows a citizen science approach and relies on the collaboration of the public, sea farers, divers, and especially youngsters – through their teachers and parents – who are encouraged to assist in recording the presence and location of different jellyfish through the use of a reporting leaflet. Reporting is done by simply matching the sighted jellyfish with a simple visual identification guide, giving the date and time of the sighting, and indicating the number of individuals seen. https://oceania.research.um.edu.mt/jellyfish/
Sentinel of the Sea Programme	The "Sentinel of the Sea" activity, part of the Interreg Italia-Malta SEA MARVEL project, implements a bottom-up participatory approach involving key stakeholders and responsible citizenship to facilitate the regional valorisation and protection of the seas. It engages fishermen and travellers at sea in monitoring marine-related risks such as that of marine litter and pollution and in biodiversity and conservation through reporting sightings of cetaceans and other endangered marine species. The programme is coordinated by the Department of Biology within the Faculty of Science.

3.1.3. Fields of study at University of Split related to Blue Economy

Hydrotechnical Engineering Programme	Learning outcomes: To formulate equations of mathematical physics for engineering problems, and to solve them analytically or with numerical methods. • To integrate knowledge and handle complexity, and to formulate judgments with incomplete information, that include reflection on social and ethical responsibilities. • To apply knowledge and problem-solving abilities in new environment within multidisciplinary contexts related to the field of study. • To clearly communicate own conclusions and develop learning skills for lifelong learning. • To design and perform calculation for the geotechnical structures using the ability to assess information and parameters on the properties of soil or rock mass. • To design hydrotechnical structures, sewage systems, stormwater sewage systems as well as hydropower and coastal structures. • To plan, analyse and manage hydrotechnical and hydropower object and systems. • To structure mathematical models in hydrology and hydraulics for the analysis of catchment processes, as well as hydraulics characteristics of open channel flow and pressurised systems. • To interpret the processes in the catchment area and to model water resources systems, as well as to apply basic elements of water resources management to the catchment scale in line with EU Water Framework Directive. • To design reinforced concrete, metal, timber, masonry and geotechnical structures (buildings, bridges, tunnels, silos,

	hydrotechnical structures, dams, etc.) which are composed of different structural load bearing systems. • To analyse processes, structures and systems in particular fields of civil engineering by applying numerical modelling. • To participate in the construction of different types of structures and supervise design and construction work. • To demonstrate knowledge and understanding that is founded upon and extends and/or enhances preceding qualification's level, and that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context.
International economics and European integration	Learning outcomes: • Critically evaluate complex problems according to the relevant methodology, literature and data • Concisely and reasonably present positions, insights, ideas, problems and solutions • Select and combine quantitative methods and ICT in solving economic problems in management • Develop communication and cooperation in different business and cultural environments • Build personal and team responsibilities in solving complex economic problems • Integrate the principles of ethics and social responsibility into decision-making.
Marine Engineering	Learning outcomes: • Supervise, maintain and efficiently operate the marine propulsion systems (diesel engines, steam and gas turbines, and marine steam boilers).

	• Plan and organise the work of the engine room crew, perform supervision, assess the efficiency, and maintain the safety of the main and auxiliary machinery. • Control the operation of the marine engine systems and the ballast water system; detect and eliminate the causes of their malfunction. • Plan and organise the operation of electric, electronic and power generating devices and the operation of the automated control and supervision systems; detect and eliminate the causes of their malfunction. • Calculate the trim, stability and stress of the ship's hull. • Suggest the processes of the safe and efficient maintenance and repair of the ship's systems. • Plan and implement the safety at work measures. • Interpret and critically assess the elements of the maritime regulations aimed at the protection of life, sea and environment. • Establish and maintain the safety of the vessel, crew and passengers, and perform life-saving, fire protection and other safety measures; plan and manage the emergencies and situations involving damage. • Lead and manage the engine room crew. • Be familiar with standard seamanship, organisation of work on board, ship's expressions and practice; use professional Maritime English in all circumstances.
Marine Fishery (in English)	Learning outcomes: • Implement contemporary methods in marine research • Analyze characteristics of the living world inhabiting the marine environment, as well as complex interrelationships between marine organisms and their physical environment and relationship between living marine organisms

	• Introduce principles and criteria in biological systematics (nomenclature), especially the systematic position of economically significant species • Apply statistical modelling in marine fishery • Anticipate the impacts of fishing on the state of populations and fish community structure • Plan controlled and sustainable exploitation of marine resources • Apply the principles of rational and sustainable management of renewable marine biological resources • Apply the principles and methodology of conducting research, from planning to writing and presenting scientific papers in the field of marine fishery • Apply theoretical knowledge and practical skills to identify and solve complex problems in marine fishery practice • Design and conduct complex experiments, presentations and interpretation of results and, accordingly, make conclusions and decisions that contribute to quality and sustainability of marine fishery • Analyze and critically evaluate simulation and experimental results • Act effectively in fishery processes and activities, both independently and in a team • Independently organize and manage work processes in the field • Communicate with experts and the public about marine fishery problems and address possible solutions • Critically evaluate ethical aspects and responsibilities of the profession and the impact of human activities on the marine environment • Improve their competences in lifelong learning programmes

	• For further information about this study programme, please visit:https://more.unist.hr/Studiji-i-upisi/Diplomski-sveu%C4%8Dili%C5%A1ni-studiji/Marine-Fishery
Maritime Management / Maritime Yacht and Marina Technologies	Learning outcomes: • Independently steer a yacht powered by sails and engine in all navigation conditions. • Anticipate hazards in different navigation conditions and apply procedures to minimize risk factors. • Organize maintenance procedures for the yacht system. • Know the duties and skills of crew on yachts and other vessels in nautical tourism. • Plan a trip and boating route in nautical tourism. • Identify and differentiate sources of marine pollution and identify the impact of pollution on the marine environment. • Apply international and national regulations for the protection of human lives, the sea and the marine environment. • Take into account the legal aspects of nautical tourism business. • Compare supply and demand and interpret trends in the nautical tourism market. • Evaluate the possibility of developing an appropriate marina business strategy. • Apply management principles in business dealings of organizations in the nautical tourism market. • Analyze business activities, jobs and staff qualifications in marinas, charter agencies and other industry organizations. • Develop a marketing program for the nautical tourism port. • Understand the methods of control and benchmarks for the operation of marinas and charter agencies. • Present the financial operations of nautical tourism ports.

	• Analyze profitability in investment projects of nautical tourism ports. • Develop a business plan for a marina or other organization in the nautical tourism market. • Use professional business terminology in nautical tourism. • Use professional terminology in English. • Integration into the lifelong learning system, in accordance with the changing technical requirements of the work environment. • Understand the structural and technical-technological characteristics of different types of ships and ship's devices and equipment. • Understand the basics of first aid applicable in emergencies. • Understand the psychological challenges of working in nautical tourism. • Use information and computer technologies. • Demonstrate and explain the different types of emergencies and behaviours in complex situations (fire on board, leaving the ship, surviving at sea). • Understand and distinguish between the characteristics and types of cargo. • Distinguish between ship's electronic navigation devices and understand the operating principles of different devices. • Understand the basics of meteorological phenomena, read synoptic charts and interpret the data obtained. • Acquire theoretical bases of maritime cartography.
Nautical Studies	Learning outcomes: • Independently plan sea voyage analysing and using nautical charts and guides, weather reports, navigation information and warnings, and apply methods for optimisation of sea voyage

	• Determine ship's position and safely navigate a ship in all conditions, using instruments and aids for navigation, modern electronic navigation systems and devices, and elements of dead reckoning • Recognize and eliminate errors of navigation instruments and devices, analyse errors and reliability of navigation and other onboard systems, and act properly in the event of their failure. • Properly undertake actions of search and rescue, individually or in coordination with others; properly use rescue equipment, apply the techniques for survival at sea, first aid, medical care, etc. • Keep a safe navigational watch, use navigation, meteorological, communication and other equipment on the bridge; define appropriate procedures and a system for monitoring of their implementation. • Interpret weather reports, independently use meteorological instruments, and assess hydro-meteorological conditions. • Assess risks, especially elements endangering safety and security, and maintain them at an appropriate level, know how to deal with crises situations, and develop procedures for taking action in crisis situations. • Keep maintenance of equipment and lifesaving apparatus, fire-fighting system and other marine safety systems. • Operate and manoeuvre a vessel in all conditions, properly react in a case of an emergency during navigation, avoid collisions and other hazards at sea, use ship's communication systems and knowledge of communication protocols in usual and unusual situations. • Describe the work of basic parts of marine engineering equipment and power systems and have a practical knowledge of running of the systems.

	• Distinguish different types of cargo and technologies in maritime transport, plan and implement operations of loading, discharging, stacking, securing and storage of cargo; identify dangerous substances and properly handle them, assess damage of cargo, ship's cargo space and equipment, and take appropriate preventive actions to prevent further damage; use ballast system. • Analyse and evaluate essential elements of ship's stability and strain in ship's structure; organize procedures for maintenance of ship and ship's systems. • Interpret and critically assess elements of maritime international and national legislation, especially regarding the protection of human lives at sea, property protection and prevention of pollution of marine environment. • Manage crew and groups of people in general and operate appropriately in unusual situations. • Explain and interpret business principles in maritime industry. • Have knowledge of standard seamanship skills, organization of work on board, have knowledge of ship terms and practices, and use English for Specific Purposes - Maritime English in all situations.
Technologies in maritime affairs	Learning outcomes: • Analyse and evaluate different sources of scientific information. • To choose appropriate scientific methods for research in technical area • Apply advanced mathematical, physical and scientific principles in the research and development of new technologies, ideas or processes in technical sciences.

	• Analyse and evaluate new and specialised knowledge, methods, tools and instruments in the scientific research area. • Critically evaluate published original scientific results of other authors in the own research area. • Apply methods of defining and protecting intellectual property. • Create and evaluate new facts, procedures and theories which based on the research results lead to new knowledge in the scientific research area. • Provide arguments for an opinion and defend the attitude in discussion with other scientists in the research area. • Present and explain the results of scientific research to other scientists on international conference as author or co-author write and successfully publish a paper in a journal with international review referenced in SCI, CC or SCI-Expanded databases. • Plan and perform research independently under mentor's supervision or as part of a team. • Plan and lead multidisciplinary and international scientific projects (devising a scientific research plan, organisation of research performance, timely detection of potential problems, identification of necessary resources, leading of the research team). • To take ethical and social responsibilities for success of researching and possible consequences of influence on wider community To express personal, professional and ethical attitude. • Facing new challenges of the society and the economy, and applying scientific research results contribute to the social and economic development.

Tourism and hotel management	Learning outcomes: • Critically evaluate the activities of tourism as a generator of growth and development • Assess the impacts of tourism activities on natural and built environments, as well as humanity • Recommend suitable instruments for managing the influences/consequences of tourism activities • Critically assess the elements of managing public and private tourist operators • Establish plans for the improvement of tourism operator business.
Tourism operations	Learning outcomes: • Identify and link the business activities of small enterprise in tourism • Sketch a business idea in tourism • Analyse the characteristics and elements of the tourism system • Analyse the role of different resources in tourism business • Differentiate the financial, marketing, operational and legal specificities of a tourist offer holder • Identify indicators of success in tourism business

3.1.4. Fields of study at University of Cadiz related to Blue Economy

List of all the programs available:

OFFICIAL MASTER DEGREE	
Nautical and Underwater Archeology	
Heritage, Archeology and Maritime History	
Aquaculture and Fishing	

Water and Coastal Management / WACOMA (Erasmus Mundus)	
Integrated Management of Coastal Areas	
Comprehensive Water Management	
Oceanography	
Port Management and Logistics	
Naval and Ocean Engineering	
Marine transport	
OFFICIAL MASTER DEGREE SUBJECTS	**MASTER DEGREE**
Prevention of occupational hazards	Safety of maritime-port work
Microalgae biotechnology	Chemical engineering
Water purification using solar energy	Chemical engineering
Process engineering applied to microalgae biotechnology	Chemical engineering
Hydraulic technology	industrial engineering
Logistics and industrial infrastructures in ports	industrial engineering
Hydraulic engineer	Port, Canals and Road Engineering
Port-coast interaction	Port, Canals and Road Engineering
Physical modeling in ports	Port, Canals and Road Engineering
Planning and design of port infrastructures	Port, Canals and Road Engineering
Project and construction of port infrastructure	Port, Canals and Road Engineering
Planning, design and management of hydraulic works	Port, Canals and Road Engineering
Urban water management	Port, Canals and Road Engineering
Coastal dynamics and beach regeneration	Port, Canals and Road Engineering
Port organization and operation	Port, Canals and Road Engineering
Hydraulics, marine and geothermal	Acoustic Engineering
Energy efficiency in maritime transport	Renewable energy and energetic efficiency
Inland water management	Conservation and Management of the Natural Environment
Management of the coastal and marine environment	Conservation and Management of the Natural Environment
Microalgae biotechnology	Biotechnology

Biotechnological potential of microorganisms of marine origin	Biotechnology

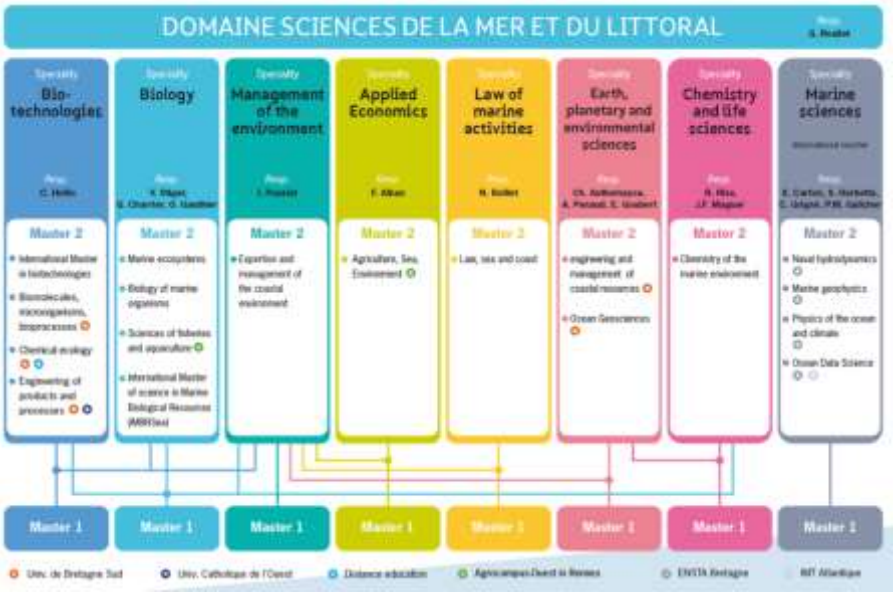
OWN MASTERS	**MODALITY**
XIII Master in maritime health	Blended
SUBJECTS OF OWN MASTERS	**OWN MASTER'S DEGREE NAME**
The water market. Economics of water management	Master executive: Energy Area
Water management system in the company	Master executive: Energy Area
Water footprint of a service or product	Master executive: Energy Area
Vector waters	Master in Environmental Management and Auditing
Vector waters	Master in Waste Management and Treatment
Vector Waters	Master in Renewable Energy Management
hydraulic energy	Master in Renewable Energy Management

PERMANENT EDUCATION	**MODALITY**
Fundamentals of maritime medicine. Basis of Maritime Medicine	Blended
Organization of medical examinations for seafarers / Management of medical examinations for seafarers	Blended
Medicine in the maritime field. Medicine in the maritime environment	From distance
Prevention of occupational risks on board. Prevention of occupational hazards on board	From distance
Underwater and hyperbaric medicine. Underwater and Hyperbaric Medicine	From distance
Nautical-sports medicine / Nautical and Sports Medicine	From distance
Treatment and reuse of wastewater	From distance

3.1.5. Fields of study at University of Western Brittany related to Blue Economy

"Blue"-related training in UBO is mainly the case at the Master level, with around 250 students involved in the 8 mentions of the MASTERS IN COASTAL AND MARINE SCIENCES. Other training pathways are related to Marine and Maritime sciences, both in (i) SCIENCES, TECHNOLOGY, HEALTH, or also in (ii) HUMAN AND SOCIAL SCIENCES, at the Bachelor and Master level.

1. Master in coastal and marine sciences



Master's degree in Biotechnology: International Master of Science in biotechnologies course	It ensures the coordination of the biotechnology training offer in the Breton perimeter, bringing the training offer in line with the current structure of research. The training is co-accredited by UBO and UBS and carried out in partnership with the Roscoff Biological Station and the University of Nantes. The multidisciplinary teaching team is based on a strong training-research link, international visibility of the teacher-researchers involved, and the participation of professionals. The objective of pathways 1 to 4 is immediate professional integration.

	Master the general knowledge and methodologies necessary for the biotechnological development of biological resources, while knowing the business world, the regulatory framework, but also the English necessary for commercial and professional exchanges.
Master's degrees in Biology (several paths)	The mention is made in co-accreditation between the UBO and Agrocampus-Ouest (Rennes site). The BEE mention is attached to IUEM – Université de Bretagne Occidentale and mainly to the Laboratory of Marine Environmental Sciences (LEMAR/UBO-CNRS-IRD-IFREMER) and the Laboratory of Microbiology of Extreme Environments (LM2E/UBO-CNRS-IFREMER). The diploma responds to a strong demand for excellence in training through fundamental and applied research in the fields of the study of marine ecosystems (route 1), the biology of marine organisms (route 2), and the field of management through an ecosystem approach to fisheries resources and aquatic environments (route 3). The objective is to prepare young doctoral scientists, representing 2/3 of the students, with a specialization in marine biological sciences and the link with environmental issues related to the evolution of the oceans. The training also leads 1/3 of the students to research careers related to the professional fields of marine biology, to which are added for the third course new professional opportunities within the organizations in charge of the upstream part of the fisheries and aquaculture sector.
Master's degree in Biology: Marine ecosystems path	The holders of this diploma are professionals who can be in charge of: carry out studies and supervise projects in the field of the marine environment (alteration, preservation, change) contribute to the dissemination of knowledge (reports, studies or surveys), inform and train various audiences (training audiences, political decision-makers, business leaders, etc.) in the field of the marine environment carry out diagnoses and provide advice to different types of interlocutors in the field of the marine environment ensure communication around a project or on a specific subject

Master's degree in Biology: Marine organisms biology path	The holders of this diploma are professionals who can be in charge of: carry out studies and supervise projects in the field of marine organism biology (management of livestock, management of living resources) contribute to the dissemination of knowledge, inform and train various audiences (training audiences, political decision-makers, business leaders,…) in the field of marine organism biology ensure communication around a project or on a specific subject carry out diagnoses and provide advice to different types of interlocutors in the field of marine organism biology design, develop and test innovative methodologies in the context of research themes in marine biology
Master's degree in Biology: Sciences of fisheries and aquaculture path	This course trains future scientists in the perspective of ecosystem-based management of living resources and marine environments. They have high-level expertise in their reference scientific fields to conduct diagnoses and act appropriately in complex situations and systems, both scientifically and in terms of the methods to be used and the diversity of interactions to be taken into account. They are at the level of scientific research but are also able to translate the results into consulting and project support. They implement relevant and innovative techniques in complex environments to act on territories and environments based on context and demand analysis. They conduct experimental work.
Master's degree in Biology: International Master of Science in Marine Biological Resources (IMBRSea)	The International Master in Marine Biological Resources (IMBRSea) is a joint Master's programme organised by ten leading European universities in the field of marine sciences. IMBRSea covers a wide range of topics related to the sustainable use of marine living resources. By focusing on marine biological and ecological processes, the programme links the biology of marine organisms to environmental studies and marine policy and planning topics: University of Ghent (BE) Sorbonne University (FR) University of Algarve (PT)

	University of Oviedo (ES) Galway-Mayo Institute of Technology (IE) University of the Basque Country (ES) Marche Polytechnic University (IT) University of Bergen (NO) Université Bretagne Occidentale (FR) Université de Côte d'Azur (FR) (NEW) The program is also supported by fourteen marine research institutes belonging to the European Centre for Marine Biological Resources (EMBRC) and other associated partners.
Master's degree in Environmental Management Expertise and management of the coastal environment	The Environmental Management (EGEL) course is founded on the skills developed in three IUEM research units: LETG (Coastal and Marine Geography), LEMAR (Biology, Chemistry, Marine Ecology) and AMURE (Law and Economics). Between 2010 and 2014, 9% of the students completed their studies. 70% found a job in the field of coastal environment. Example of jobs: project manager (cartographer, general environmentalist), biologist/scientific diver, project or mission manager (marine environment, fishing and shellfish farming, marine protected areas, Natura 2000, water development and management scheme…). With the recent proliferation of texts related to sea and coastline management (Grenelle de la Mer, Marine Strategy Framework Directive, French Maritime Strategy), sea-oriented jobs should develop in the fields of maritime spatial planning and marine energies. On the littoral, climate change issues call for skills in the field of coastal risks.
Master's degree in Applied Economics	The mention is made by two laboratories specialized in the fields of maritime economics (AMURE) and agricultural economics (SMART-LERECO), both dealing with the dimensions of sectors, markets, resources, environment and territory. The training is linked to all the strategic axes of the two laboratories, which involve researchers from five supervisory bodies: UBO, AGROCAMPUS OUEST, Ifremer, INRA and CNRS, with locations in Brest, Rennes, Nantes and Angers. The speciality Applied Economics refers to the analysis of the organization and dynamics of the agricultural and maritime sectors, agri-food sectors and coastal territories from the perspective of sustainable exploitation of resources and

	environmental and risk management. It trains the skills required to meet the needs of direct employment opportunities such as design offices, professional structures, companies, local authorities or government departments in terms of economic analysis.
Master's degree in Law of Maritime Activities	The teaching provided within the Master's degree is based on the AMURE laboratory research activity, whose three research areas are: Blue economy Ownership and responsibility Socio-ecosystem and territory The course aims at training lawyers specialized in the law of the sea, coastal and maritime activities. These professionals will be able to identify, analyse and deal with legal problems concerning the laws governing maritime areas and the various activities of the maritime world (ports, transport, insurance, fishing…). Sectors of activity: insurance, legal advice, legal studies and expertise, professional and trade union organizations, private or public companies from the maritime sector, maritime social benefit organizations, maritime banks, maritime cooperatives, Community territorial or national internal and Community administration (environment, equipment and transport – sea - , fisheries). Types of jobs: company lawyer, business manager, litigation manager, legal adviser, administrator…
Master's degree in Earth, Planetary and Environmental sciences (several paths)	We offer training in geosciences, coastal and marine environment professions through the research unit of the Ocean Geosciences Laboratory based in Plouzané (IUEM, UBO) and Vannes (UBS), in close collaboration with the IFREMER Marine Geosciences Institute. The expertise of these two units covers a wide range of topics: from coastal dynamics to the evolution of the Earth's mantle, including the dynamics of rifts, margins, ridges and sediment, paleo-climatic and paleo-environmental recording. The work is based on a multidisciplinary and multiproxy approach based on instrumental poles: ocean spectrometry pole – instrumental pole in geophysics – pole in sedimentology/micropaleontology/palynology.

	The strong points of this mention are the numerous land and sea sites carried out throughout the training, the intervention of high-level researchers from both institutes, the possibility of research internships, among other possibilities, within IUEM, IFREMER or SHOM.
Master's degree in Earth, Planetary and Environmental sciences: Ocean Geoscience path	The Ocean Geoscience learning path is strongly linked to the eponymous laboratory. The graduates of this master's degree will be able to develop and design research projects, provide expertise and consulting activities within public or private structures in the fields of geosciences and, in particular, marine geosciences. This master's degree allows students to pursue a doctorate in marine geosciences, particularly in the following fields: margins, ridges, rifts, mineral resources, sedimentology, paleoenvironments, paleo-climates, marine geochemistry.
Master's degree in Earth, Planetary and Environmental sciences: Coastal and Coastal Resource Engineering and Management (IGRECL)	The IGREC course clearly aims at a non-academic professional integration in the management of coastal and coastal resources among SMEs in the sector, local authorities and large groups whose work affects these environments. At the end of this course, students will have multidisciplinary skills in the management and exploitation of mineral and biological resources, with an understanding of the concepts of risk and vulnerability. These skills will enable them to adapt, anticipate and respond to coastal spatial planning strategies taking into account the European legal and socio-economic framework.
Master's degree in Chemistry and Life Sciences: Chemistry of the marine environment	Within IUEM, this speciality is linked to the Marine Environmental Sciences Laboratory (LEMAR/UBO-CNRS-IRD-Ifremer) and the Ocean Geosciences Laboratory (LGO/UBO-CNRS-Ifremer-UBS). Both laboratories include about fifty teachers-researchers and researchers likely to participate in teaching and/or offer internships to students. This Master's degree in Marine and Coastal Sciences prepares young scientists for a PhD with a strong background in marine and analytical chemistry. It also enables graduates to enter an engineering school program or to work directly. The professions targeted following the training are diverse: teacher-researcher in higher education, researcher in research organisms, senior environmental executive, expert for state services, project manager for local authorities…

	The professional environments that welcome these new graduates are universities, research centres, chemical and/or environmental consulting firms, chemical analysis and quality control laboratories, and public service organizations. Science, Technology, Health.
Master in Physics Sciences (several paths)	This international speciality is co-accredited by IUEM to UBO and by ENSTA Bretagne. It aims to provide students with knowledge of the physical and dynamic properties of the marine environment and related engineering elements (especially ships). It has 3 courses: Ocean and Climate Physics (POC), Marine Geophysics (GM) and Naval Hydrodynamics (HN). These 3 paths have a common block in M1: fluid mechanics, solids, applied mathematics, data analysis, numerical modelling… The specializations for each course are more important in M2. The training is based on long academic or industrial research internships at the end of M2. This speciality allows access to doctoral training within the framework of the UBL Doctoral School of Marine and Coastal Sciences, as well as to jobs as a research engineer in many regional, national or foreign companies. The context in Brest is particularly developed for marine science and technology. We hope that a new Ocean Data Sciences training path will open in September 2019, as part of the Ocean Physics and Climate course, and then in 2020 independently. Following this course and then doing a year of Marine Geomatics at ENSTA Bretagne (subject to admission on file) will open the way to the diploma of this great Engineering School. Master in Physics: Naval Hydrodynamics path The learning path is based on the Dupuy de Lôme Research Institute (IRDL, FRE, Brest) and the Institut de Recherche de l'École Navale (IRENAV). Opportunities: research, teaching and research, design offices and test centres, marine energies, architecture and shipbuilding.
Master in Physics: Marine Geophysics learning path	The course is based on the Ocean Geosciences Laboratory (LGO), which is a research unit, and the Marine Geosciences Department of IFREMER.

	Opportunities: research, teaching and research, research and development in the fields of marine energies, offshore / petroleum, marine mineral resources, and in design offices (sedimentary transport, coastal risks…). Master in Physics: Physic of the Ocean and Climate learning path The course is based on the Laboratory of Physical and Spatial Oceanography (LOPS), the Laboratory of the Marine Environment (LEMAR), both of the IUEM UMRs, the Hydrography, Oceanography and Meteorology department of SHOM, the Laboratory of Coastal Hydrodynamics of CEREMA. Opportunities: research, teaching and research, consulting firms (impact of ocean circulation, or extreme events on offshore structures, coastal erosion, marine ecology, exploitation of marine resources, or changes in pollution levels).

2/ SCIENCES, TECHNOLOGY, HEALTH

Bachelor's degrees (Licence – 3 years)

- Bachelor's degree in Earth Sciences Hydrography course Shom
- Bachelor's degree Physics, Chemistry Chemistry course
- Bachelor's degree Physics, Chemistry Physics and Chemistry course
- Bachelor's degree Physics, Chemistry Physics-Mathematics course
- Bachelor's degree Earth Sciences Geology course
- Bachelor's degree Earth Sciences Biology and Geology course

Professional Bachelor's degrees (Licence Professionnelle – 3 years) with vocation of professional insertion

- Professional Bachelor's Degree in Industrial Professions: Naval and Maritime Industry Port and Ship Maintenance Course
- Professional Bachelor degree in electronics: communication, embedded systems

Master's degrees

- Master's Degree in Environmental, Energy and Transport Economics (EEET) Economics applied to agriculture, the sea and the environment
- Master Microbiology Fundamental and Applied Microbiology course

3/ HUMAN AND SOCIAL SCIENCES

- Bachelor's degree in Geography and Urban planning: Sea, environment, tourism, development, coastline course (METAL)

- Master's degree in Tourism Management of coastal tourism activities and structures

This M2 program is based on the principle of alternating training: between university and company, between individual and collective actions.
By giving a significant place to research and through an interactive pedagogy centered on simulation, the aim is to train designers who "question" the meaning of activities carried out on their own initiative and the effects that these actions may have on others, whether foreign or local tourists.

For each semester, the training includes 4 teaching units (TU), each TU being divided into 2 constituent elements (CE). a 3-month qualifying internship in a company (420 hours) must be carried out in France or abroad. it is the subject of an analysis of practices.

Catalogue Life-long Learning – Marine and coastal sciences in UBO

List of the Blue bio-economy lifelong learning programs of the University of Western Brittany can be found here: *https://fr.calameo.com/read/006318081ae6bc7ab7808?page=5* .

In total, there are 33 available training for Life-long learners in UBO on Marine and Coastal sciences
Duration: from 1 day to 2 weeks
ECTS: no ECTS for LLL
Some are available in English
If there is an interest to apply, all information can be received at this email: fc-mer@univ-brest.fr.
• Available in English

Physical Oceanography	Big Data / Database	https://fr.calameo.com/read/00631 8081ae6bc7ab7808?page=38
	Observation of water masses and circulation.	https://fr.calameo.com/read/00631 8081ae6bc7ab7808?page=39

	In Situ measurement	https://fr.calameo.com/read/00631 8081ae6bc7ab7808?page=40
	Geophysical methods	https://fr.calameo.com/read/0063180 81ae6bc7ab7808?page=41
	Marine seismic surveys	https://fr.calameo.com/read/006318 081ae6bc7ab7808?page=42

The other ones are only Available in French
https://fr.calameo.com/read/006318081ae6bc7ab7808

Mention Biotechnology	> Flow cytometry - epifluorescence microscopy: powerful tools for studying marine cells > Marine lipids of biotechnological interest: extraction, separation and quantification > Enzymes in protein processing by the pH-stat method > Proteomics: extracting, separating and analysing proteins
Mention Biology	> Marine plants: taxonomy and ecology
Management of the Coastal Environment	> Law and economics of the sea and the coastal environment > Environmental diagnosis > Coastal risk management > Dynamic geomorphology of the coastline > Functioning of coastal ecosystems
Applied Economics	> Economics of sustainable development > Economics of fisheries sectors and seafood markets > Maritime Economics
Maritime Activities Law	> Maritime Law level 1 > Maritime Law level 2 > International and European Law of the Sea > Law of the coastline and the coastal sea > Law of the exploitation and conservation of marine resources

Earth, Planetary and Environmental Sciences	> Field and methods > Coastal instrumentation "platform or offshore > Remote sensing/GIS/Statistics > Energy Resources > Marine Geophysics > Hydrothermalism and Metallogeny > Coastal & Marine Hydrosedimentary Processes
Chemistry and Life Sciences Mention	> Methods of Marine Environmental Sciences II
Other courses	> Environmental issues of a blue economy > Python programming

3.1.6. Fields of study at Kiel University related to Blue Economy

Environmental Management	Learning outcomes: 1. The degree programme is designed to enable students with basic experience in conducting interdisciplinary and international research projects to further develop these skills so that they are able to address issues on the sustainable development of the environment. 2. The students are to learn how to analyse environmentally relevant challenges of sustainable development, taking into account social and economic aspects, in specialist interdisciplinary contexts and internationally mixed teams. 3. Using integrated and interdisciplinary approaches, they learn how to understand complex environmental problems and identify the relevant influencing factors and interactions. 4. They are to learn to assess the impact of environmental factors on natural resources in geographical and temporal terms by developing scientific hypotheses, research questions and objectives and selecting suitable research methods. 5. The students will be able to make sound scientific statements based on the skills they acquire in using suitable data entry and evaluation methods.

	6. In particular, the Master's degree programme is designed to provide and further develop training in scientific methodology and the following skills: (1) Internationality - the ability to use scientific methods to analyse problems of sustainable environmental management and develop strategies to promote sustainable development in a group of diverse specialists, linguistic and cultural backgrounds. (2) Interdisciplinarity - the ability to understand concepts and methods of various disciplines of environmental sciences and to use these for the purpose of scientifically sound and sustainable environmental management. For further information about this study programme, please visit: https://www.sustainability.uni-kiel.de/en/taught-masters/master-of-science-environmental-management

3.2. Overview of the BLUE BIOECONOMY projects

University of Malta		Detailed list of the blue economy projects of the University of Malta can be found here: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/999887059 Some of the projects are listed below:
	High-Precision Detection Technologies for Water Quality in Aquaculture (AquaDetector)	The AquaDetector project is a bilateral project between an industry partner in Malta and academic and industry partners in China. The project aims to develop new and precise detection technologies and an advanced correlation model to visualize water quality, classify fish stress behaviours and analyse environmental factors to ensure fish welfare,

		better productivity, better quality fish and help sound decisions for land-based recirculating aquaculture.
	Self-sufficient Integrated Multi-Trophic AquaPonics System (SIMTAP)	The SIMTAP project is a multilateral project coordinated by the University of Pisa in Italy, with the participation of partners from Germany, France, Malta and Turkey. Malta is represented by the Ministry for Agriculture, Food, Fisheries and Animal Rights of Malta. The project focuses on the development of self-sufficient integrated multi-trophic aquaponic systems for improving food production sustainability and brackish water use and recycling.
	Novel sustainable aquaculture technologies for the production of innovative feeds for improved fish stocks (AquaTech4Feed)	The AquaTech4Feed is a multilateral project coordinated by the Hellenic Agricultural Organisation, with the participation of partners from Italy, Spain, Ireland, Germany, Greece and Malta. Malta is represented by the University of Malta. The aim of this project is to formulate novel fish feed from alternative proteinaceous biomass sources, such as algae, duckweed, insects and microbiomes in order to improve fish production and product quality.
	Bythos – Biotechnologies for human health and blue growth	Bythos is an INTERREG Italia-Malta 2014-2020 cooperation project which aims to use fish waste to increase investment in biotechnologies for human health and blue growth. Bythos is a multilateral project consisting of a consortium of six partners: Universita degli Studi di Palermo, Comune di Lipari, Distretto Pescaturismo e Cultura del Mare in Sicily, The University of Malta, a local industry partner and The Ministry of the Environment, Sustainable Development and

		Climate Change through the Department of Fisheries and Aquaculture of Malta.
	iFishENCI – Intelligent Fish Feed through Integration of Enabling technologies and Circular principles (Horizon 2020)	iFishENCI is a Horizon 2020 project bringing together 16 partners, with the overall aim of providing new intelligent feeding technologies to support ambitious, but sustainable growth for the European aquaculture industry.
	SMARTAQUA- Development of SMART nanostructured layers for sensing corrosion in AQUAtic structure	The project aims to develop a sensing nanolayer applied directly on steel structures, to provide a cost-effective, reliable means of detecting corrosion degradation. Application scenarios for this technology include aquaculture structures, offshore wind foundations, oil and gas structures and ship hulls.
	ANDROMEDA- Analysis techniques for quantifying nano- and microplastic particles and their degradation in the marine environment	The primary objectives of ANDROMEDA are development of an instrument platform for in situ and cost-effective analysis of microplastics, the advanced characterisation of nano plastics and microplastic materials and for accelerated microplastic degradation, and the characterisation of microplastic degradation
	Hatchery Match-An Automated Marine Fish Hatchery with Innovated Water Recirculation Technologies	Conventional labour-based hatcheries often have compromised water quality and limited self-cleaning capacity, resulting in a low seeding rate. To achieve a reliable supply of marine fry, this project will adopt innovative recirculating technology and automation technology in marine hatchery design to achieve optimum rearing conditions. The main automation technologies will be automatic live feed and bottom cleaning devices and hatching image analyser.

		Investigation will be carried out to assess the potential of ultrasound to improve hatchery water quality. A pilot hatchery will be constructed at FMIRI facilities in Rudong and verified with multiple batch tests.
	VENTuRE - Virtual and physical Experimental Towing centre for the design of energy-efficient sea-faring vessels	The project will work towards the creation of a virtual and experimental towing centre. The action is to maximise use of these facilities, secure transfer of essential knowledge, to increase HR capacity and expertise in Malta in the area of 'energy efficient' ship design. Funded by: European Commission H2020. Project Coordinator - University of Malta; Project Partners University of Strathclyde, GB, University of Genoa, IT & Naval Architectural Services (NAS), Ltd, MT.
	MUSICA - Multiple Use of Space for Island Clean Autonomy	MUSICA aims to pilot a floating offshore platform which will provide 70% of the electricity and 100% of freshwater for a small island with up to 2000 inhabitants. Funded by: European Commission in Call H2020-BG-2019-1 Coordinator: University College Cork, Ireland Date: January 2020 - December December 2024 Partner from University of Malta: Institute for Sustainable Energy Other project partners: University College Cork (Coordinator); Heriot-Watt University, University of the Aegean, Municipality of Chios, Coral Ltd, International Consortium of Research Staff Associations, Network of Sustainable Greek Islands DAFNI, Platforma Oceania de Canarias, Plocan, Innosea, Aquabiotech Ltd, NeoDyne Ltd,

		SinnPower Gmbh, INSB Class International Classification Society and Forkys ELACAPA - Exploiting Local Agave Plants Funded by: Maritime Seed Award (national funds) Principal Investigator: University of Malta, Faculty of Engineering
	SmartPvB - Smart Design Software for Cost Optimisation of Pressure Vessel Bundles for Offshore Hydro-pneumatic Energy Storage (SmartPVB)	Funded by: national funds Principal Investigator: University of Malta, Institute for Sustainable Energy
	REpLACE - Renewable, sustainable & Eco-friendLy Agave CompositEs	Funded by: national funds Principal Investigator: Claire De Marco Light Weight Structures for Maritime Applications – Design, Fabrication, Characterisation, Testing & Simulation Funded by: University of Malta Research Fund Date: Jan 2015 to date Principal Investigator: Faculty of Engineering
	Spar-Type Floating Wind Turbine Platform with Integrated Deep Seawater Storage for reducing carbon footprint of LNG liquefaction	Funded by: national funds Principal Investigator: University of Malta: Institute for Sustainable Energy
	Development of a Hydro-Energy Storage System for Offshore	Funded by: national funds (+ industry sponsor) Principal Investigator: University of Malta: Institute for Sustainable Energy

	Multi-Purpose Floating Platforms, FLASC	
	Biodiversity and Sustainable Development in the Strait of Sicily - BioDiValue	The project aimed to create operational tools to support local administrators and operators of maritime traffic, useful to limit the harmful effects of operating pollution generated by shipping industrial, commercial, recreational fishing and the Strait of Sicily. Funded by: Italia-Malta 2007-2013 project Date: Jul 2012 – Jan 2015 Partner from University of Malta: Faculty of Engineering In collaboration with: ARPA (Agenzia Regionale per la protezione del'Ambiente), Consorzio Plemmirio Area Marina Protetta, International Ocean Institute - Malta Operational Centre (University of Malta), ISPRA (Istituto Superiore Protezione Ricerca Ambientale), Area Marina Protetta Isole Pelagie Sindaco del Comune di Lampedusa e Linosa, Gal XLOKK, Universita` degli Studi di Catania, Green Life Soc. Coop. a.r.l.
	HILDA – High Integrity Low Distortion Assembly	The project aimed to deliver a cost-effective, low-distortion welding process for EU shipyards to allow them to maintain competitiveness and produce light, strong, more fuel-efficient vessels. The solid-state technique was tested to enable the modular construction of dimensionally accurate, high-strength, corrosion-resistant fabrications across the entire range of steels, enabling the introduction of stronger, tougher, corrosion-resistant steels into the industry.

		Funded by: European Commission in Call FP7-SST-2012-RTD-1. Partner from University of Malta: Faculty of Engineering In collaboration with the Department of Mechanical Engineering, University of Strathclyde, U.K. (Project Coordinator), Centre de Recherche en Aeronautique ASBL (CENAERO), Belgium, The Welding Institute (TWI) Ltd., U.K., Lloyd's Register EMEA, U.K., Center of Maritime Technologies e.V. (CMT), Germany, Naval Architecture Progress, Greece, GeonX sprl, Belgium
	Damage Analysis on Marine Vessels due to Impact and Grounding	Funded by: University of Malta Research Fund Principal Investigator: Faculty of Engineering
	Consulting, advisory and similar activities offered by HEIs and PROs to stakeholders in order to improve blue economy.	Malta Maritime Platform: this is a University of Malta (UM) wide collaboration to facilitate the interaction of all university entities and individual academics interested in maritime issues. It aims to synergise, promote and facilitate research, education and training initiatives relating to maritime issues and the industry and to seek support and strengthening of relevant initiatives under the University framework and ensure long-term sustainability. https://www.um.edu.mt/platforms/maritime/
University of Split		Detailed list of the blue economy projects of the University of Split can be found here: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/999818189 . Some of the projects are listed below:

	Centre for the development of biodegradable plastics in marine applications – Innovations for fisheries and aquaculture	Research aims to reduce plastic litter and associated problems such as ghost fishing, and macro and microplastic, caused by fishing and aquaculture industries. The goal is that traditional plastics in these sectors can be replaced with new biodegradable materials.
	Sustainable development of BLUE economies through higher Education and innovation in Western Balkan Countries	The project deals with maritime education extended to the blue economy, which includes competences in maritime tourism and market adaptation, as well as competences in innovation and entrepreneurship. The main purpose of the BLUEWBC project is to improve innovation and entrepreneurship of the blue economy in the higher education system of Montenegro and Albania.
	Capacity building for Blue Growth and curriculum development of Marine Fishery in Albania	Erasmus + capacity building project in higher education, for blue growth and development of marine fisheries curriculum in Albania. Funding source: Education, Audiovisual and Culture Executive Agency; Project coordinator: University of Split
	Internationalization of the Marine Fisheries and Military Maritime study programs at the University of Split	The project plans the development and execution of an integrated undergraduate and graduate study in Military Maritime and a graduate study in Marine Fisheries in English. The project will enable the staff to improve their didactic and pedagogical competencies, ICT and language skills, and equip them with teaching literature and technical equipment. Through planned study visits to renowned European universities, the teaching staff will get to know the practices and resources of successful institutions in the area. In the part of the development and implementation

		of study programs that require specialist knowledge, the engagement of external experts is foreseen.
	Innovative sustainable organic sea fennel (Crithmum maritimum L.) – based cropping systems to boost agrobiodiversity, profitability, circularity, and resilience to climate changes in Mediterranean small farm	Halophytes are plants adapted to life in habitats characterized by high salinity, and one of the most famous Mediterranean halophytes on our coast is *petrovac* or *motar* (Crithmum maritimum L.), which has been used for food and medicinal purposes since ancient times, given that it is characterized by the presence of high concentrations bioactive compounds such as vitamin C, polyphenols and carotenoids. Through the new processes of *petrovac* raiding, the problem of various specific challenges is being resolved, especially ensuring a sustainable system of agricultural production and food production with better utilization of natural resources and biological diversity, improving economic, ecological and social characteristics, and ultimately improving production without waste and with reduced using chemical agents.
	Valorization of Mediterranean AlMond orchards through the use of intercropping integrated strategies	The Mediterranean region has strong agricultural traditions associated with conventional agronomic practices. In various countries, such practices are not effective due to climate change, leading to reduced crop yields and productivity, and thus reduced economic returns for local farmers. The goal of the VALMEDALM project is the use of intercropping within almond plantations as an integrated strategy, harmonized with economic, social and ecological aspects, which is carried out throughout the Mediterranean basin, helping to adapt small farming systems to climate change and increasing

		the income of farmers, especially in those countries with lower reported results of productivity and valorization. To achieve these goals, seven demo sites will be implemented in different Mediterranean countries (Portugal, Croatia, Egypt, Morocco, Israel, Greece, Italy), in order to evaluate the effect of intercropping in almond plantations and its role in pest and weed control.
	Reconnect science with the blue society	This project aims to bring science and scientists closer to the general public, increase visibility and raise awareness of the importance of science in the everyday life of citizens. The project aims to promote the professions of researchers among young people and generally build trust in science among the general public.
	Water management solutions for reducing microbial environment impact in coastal areas	Watercare aims to improve the quality of the microbial and environment and resource efficiency in bathing and coastal waters reducing microbial contamination by using innovative tools WATERCARE project will develop innovative system for monitoring ad-hoc infrastructure through a forecast operational model create studies to improve planning and management of marine system environmental problems develop real-time alert system able to identify potential risk from fecal contamination of bathing waters.
	An innovative, ecological approach to growing mussels on ropes made of recycled materials with eDNA barcoding and pasteurization of	The consumption of single-use plastic in the process of growing mussels represents a major environmental problem. Through the project, it is planned to test the use of rope made from used fishing nets or nets from aquaculture for the growth of mussels (with the use of degradable cotton and thread). These net ropes are reused in

	edible shells with the aim of increasing the quality and value of the final product and protecting the environment	production, and completely eliminate the use of single-use plastic. Furthermore, the problem in the life cycle of mussel cultivation is the very short shelf life of shellfish as a product, which causes difficulties in logistics and capillary distribution, and limits the market to only local. Through the project, it is planned to develop and test a pasteurization process that would allow for a significantly longer term while maintaining the organoleptic, sensorial and aesthetic characteristics of fresh mussels, which would enable the expansion of the mussel market. One of the risks in the production of shellfish in the Republic of Croatia is the appearance of pathogens and coliform bacteria, which can be of natural origin, but also the result of sanitary pollution. This project, therefore, plans to apply the innovative method of eDNA metabarcoding, which can detect the presence of pathogens in the sea by analyzing seawater, and inform growers of the necessary measures to prevent and manage the threat potential.
University of Cadiz		Detailed list of the blue economy projects of the University of Cadiz can be found here: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/999855340 . Some of the projects are listed below:
	Futureproof Skills for the Maritime Transport Secto	The proposed EMJMD course in Water and Coastal Management (WACOMA) is a two-year (120 ECTS) international, innovative, and methodologically diversified master degree, entirely taught in English and jointly designed and implemented by three EU Universities (Bologna,

		Algarve and Cadiz) in collaboration with 1 Programme Country HEI from Ireland, 6 Partner Countries HEIs from Brazil, Cuba and Russia, and 11 international non-academic Partners, including public bodies, research centers and enterprises. Building on the needs analysis conducted in tight collaboration with non-academic partners and stakeholders in the sector, and on the previous long-lasting experiences of the Consortium, an innovative academic and practical training programme in the multidisciplinary domain of water and coastal risk management has been designed. The main objective of the Master WACOMA is to train future environmental managers, increase their employment competitiveness in the multidisciplinary domain of Water and Coastal Management, providing a solid knowledge of environmental and legal competencies concerning hazard and risk mitigation, adaptation, knowledge of economic framework of climate change and green economy. Coupling these competencies with decision-making processes and policies related to the requirements of governance and market needs is the cornerstone of this initiative. A modular teaching framework is designed to enable students with different backgrounds to choose an appropriate academic pathway. In the first year of studies, students will attend compulsory basic modules (30 ECTS) taught in Bologna (1st semester) followed by an intensive advanced topic Winter School at UALG (6 ECTS) and specialized optional modules (2nd semester) in

		Cadiz (30 ECTS chosen from a wide selection of 90 ECTS). The second year is intended to be mostly ' hands-on', enabling the trainees to have closer contact with the practical aspects of coastal & water policy issues tackled by the Partners of the consortium, in different socio-economic and geographic settings. The 2nd year structure includes internship (8 ECTS) and a dissertation project (34 ECTS) complemented by transferable skills modules (12 ECTS). Internships at non-academic Partners and conferences with large participation of stakeholders are a core part of the programme. Bringing together non-educational Partners and HEIs, WACOMA aims at consolidating and developing new synergies and cooperative efforts among relevant stakeholders around a shared theme such as water and coastal risk management. This partnership will also improve the WACOMA international visibility towards the non-academic environment and enhance graduates' employment prospects. WACOMA graduates will be internationally and interculturally skilled professionals, equipped with more than predefined basic technical knowledge to thrive in rapidly evolving jobs, such as those concerning water and coastal risk management in the global scenario.
	Improving GreeN Innovation for the blue revoluTION: new tools and opportunities for a more sustainable animal farming	Animal health and welfare are issues of high research priority for European aquaculture. In particular, improving animal welfare whilst reducing the use of veterinary drugs are current research priorities in line with minimizing the environmental impact of the industry. Preventing, or reducing the impact of disease is of prime

		importance for producers, researchers and stakeholders. In addition, public awareness of aquatic animal health and welfare leads to the increased attention of policy-makers, scientific community and consumers to new methods for disease prevention. The IGNITION project aims to unveil new knowledge regarding animal welfare in the context of climate change and propose new tools to mitigate the adverse effects of stress. An improvement in animal welfare will translate in higher-quality farmed animals thus improving farming productivity and sustainability performance. Through IGNITION it is expected to provide new knowledge through genotyping and molecular phenotyping techniques to develop future breeding strategies for fish and shellfish. New innovative tools regarding immunization in fish will also be provided, aiming at improving fish welfare and targeting early life stages. Animal feeds will be formulated to include bioactive compounds extracted from halophytes through a novel upstream cascade salt removal. Special emphasis will be given to the study and discovery of new non-invasive biomarkers of health and welfare, which will in turn allow the development of biosensors and disease prediction through machine-learning approaches. The tools developed in IGNITION will be able to avoid the colonization and spread of pathogenic microorganisms, including multi-resistant microorganisms, among farmed animals and the subsequent spread to humans through the food chain.

	Morphological Impacts and COastal Risks induced by Extreme storm events	The project is specifically targeted to contribute to the development of a probabilistic mapping of the morphological impact of marine storms and to the production of early warning and information systems to support long-term disaster reduction. A review of historical storms that had a significant impact on a representative number of sensitive European sites will be undertaken. The nine sites are selected according to wave exposure, tidal regime and socio-economical pressures. They include outmost regions of the European Union at the border with surrounding states (e.g. the area of the Gibraltar Strait, the Baltic and Black Sea). All data will be compiled into a homogeneous database of occurrence and related socio-economic damages, including the following information on the characteristics of the storms, their morphological impacts, the damages caused to society, on the Civil Protection schemes implemented after the events. Monitoring of selected sites will take place for a period of one year to collect new data sets of bathymetry and topography using state-of-the-arts technology (Lidar, ARGUS, Radar, DGPS). The impact of the storms on living and non-living resources will be done using low-cost portable GIS methods. Numerical models of storm-induced morphological changes will be tested and developed, using both commercial packages and developing a new open-source morphological model. The models will be linked to wave and surge forecasting models to set-up a real-time warning system and to implement its usage within Civil Protection agencies. The most

		important product of the project will be the conception of Storm Impact Indicators (SIIs) with defined thresholds for the identification of major morphological changes and flooding-associated risks. Finally, the results of the project will be disseminated as risk maps through an effective Web_GIS system.
University of Gdansk	CENTRE OF MOLECULAR BIOTECHNOLOGY FOR HEALTHY LIFE Biotech solutions bringing health to living organisms and environment supported by mass spec-focused research platform	Detailed list of the blue economy projects of the University of Gdansk can be found here: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/999876001 . Some of the projects are listed below:
	Climate resilient and environmentally sustainable transport infrastructure, with a focus on inland waterways	It is the key objective of the project CRISTAL (36 months) to increase the share of freight transport on inland water transport (IWT) by a minimum of 20% and to demonstrate on its three pilot sites (Italy, Poland and France) strategies to improve reliability by 80%. CRISTAL project will assure IWT capacity at 50% even during extreme weather events. Towards that CRISTAL will co-create, test and implement integrated, cooperative and innovative solutions in its three pilot partners' areas identified in Italy, France and Poland. The project will include the aspects of technological innovation/development and digitalization; further advancement towards the Physical Internet, governance solution and business models, will be proposed while targeting

		sustainability and infrastructure resilience requirements.
	Exploring Marine Resources for Bioactive Compounds: From Discovery to Sustainable Production and Industrial Applications	Biodiversity in the seas is only partly explored, although marine organisms are excellent sources for many industrial products. Through close co-operation between industrial and academic partners, the MAREX project will collect, isolate and classify marine organisms, such as micro- and macroalgae, cyanobacteria, sea anemones, tunicates and fish from the Atlantic, Pacific and Indian Oceans as well as from the Mediterranean, Baltic and Arabian Seas. Extracts and purified compounds of these organisms will be studied for several therapeutically and industrially significant biological activities, including anticancer, anti-inflammatory, antiviral and anticoagulant activities by applying a wide variety of screening tools, as well as for ion channel/receptor modulation and plant growth regulation. Chromatographic isolation of bioactive compounds will be followed by structural determination. Sustainable cultivation methods for promising organisms and biotechnological processes for selected compounds will be developed, as well as biosensors for monitoring the target compounds. The work will entail sustainable organic synthesis of selected active compounds and new derivatives, and development of selected hits to lead compounds. The project will expand marine compound libraries. MAREX innovations will be targeted for industrial product development in order to improve the growth and productivity of European marine biotechnology. MAREX aims at a better

		understanding of environmentally conscious sourcing of marine biotechnology products and increased public awareness of marine biodiversity and potential. Finally, MAREX is expected to offer novel marine-based lead compounds for European industries and strengthen their product portfolios related to pharmaceutical, nutraceutical, cosmetic, agrochemical, food processing, material and biosensor applications.
	Smart Control of the Climate Resilience in European Coastal Cities	Climate change poses huge risks for European coastal cities. Rising sea levels, floods and storms can no longer be ignored. The intensification of extreme weather events, coastal erosion and sea-level rise are major challenges to be urgently addressed by European coastal cities. The EU-funded SCORE project will develop a strategy via a network of 10 coastal city 'living labs' (CCLLs) to rapidly, equitably and sustainably enhance coastal city climate resilience. In addition to developing innovative platforms to promote business opportunities and financial sustainability of coastal cities, the project will provide prototype coastal city early-warning systems to enable smart, instant monitoring and control of climate resilience in European coastal cities.
	Structural Transformation to Attain Responsible BIOSciences	STAR BIOS 2 (Structural Transformation to Attain Responsible BIOSciences), coordinated by the University of Tor Vergata (IT), has been designed to respond to the Topic ISSI 5 (Work programme Science With And For Society). The general aim of the project is that of contributing to the advancement of the Responsible Research and Innovation (RRI) strategy, which

		underpins Horizon 2020, by promoting 6 Action Plans (APs) oriented to attain an RRI structural change in research institutions from Europe and developing 3 further APs in non-European entities, all active in the field of biosciences. This strategy is geared to cope more in general with one of the main risks, for European research, i.e. its inadequate connection with society, by promoting its increasing alignment, in terms of both process and outcomes, with the needs and values of European society. This entails, from the RRI perspective, increasing involvement of stakeholders at any level of the research and innovation process. The project has three main focuses: 1) Develop RRI-oriented structural change processes in the already mentioned institutions involved in biosciences research. This aim will be pursued through designing, implementing and evaluating RRI Action Plans. In order to secure the results emerging from the APs, a sustainability strategy will be developed and implemented during the project lifespan. APs will be supported by central technical assistance and the project will be monitored and assessed. 2) Develop a learning process concerning: a) resistances and barriers to RRI (which are they, how they manifest themselves, which impact they have, etc.); b) key factors favouring or supporting RRI; c) strategic options and RRI-oriented tools. 3) Develop a sustainable model for RRI in biosciences.

	Sub-seabed CO2 Storage: Impact on Marine Ecosystems (ECO2)	The ECO2 project sets out to assess the risks associated with the storage of CO2 below the seabed. Carbon Capture and Storage (CCS) is regarded as a key technology for the reduction of CO2 emissions from power plants and other sources at the European and international levels. The EU will hence support a selected portfolio of demonstration projects to promote, at industrial scale, the implementation of CCS in Europe. Several of these projects aim to store CO2 below the seabed. However, little is known about the short-term and long-term impacts of CO2 storage on marine ecosystems even though CO2 has been stored sub-seabed in the North Sea (Sleipner) for over 13 years and for one year in the Barents Sea (Snøhvit). Against this background, the proposed ECO2 project will assess the likelihood of leakage and impact of leakage on marine ecosystems. In order to do so ECO2 will study a sub-seabed storage site in operation since 1996 (Sleipner, 90 m water depth), a recently opened site (Snøhvit, 2008, 330 m water depth), and a potential storage site located in the Polish sector of the Baltic Sea (B3 field site, 80 m water depth) covering the major geological settings to be used for the storage of CO2. Novel monitoring techniques will be applied to detect and quantify the fluxes of formation fluids, natural gas, and CO2 from storage sites and to develop appropriate and effective monitoring strategies. Field work at storage sites will be supported by modelling and laboratory experiments and complemented by process and monitoring studies at natural CO2 seeps that serve as analogues for potential CO2

		leaks at storage sites. ECO2 will also investigate the perception of marine CCS in the public and develop effective means to disseminate the project results to stakeholders and policymakers. Finally, a best practice guide for the management of sub-seabed CO2 storage sites will be developed by applying the precautionary principle and valuing the costs for monitoring and remediation.
Kiel University		Detailed list of the blue economy projects of Kiel University can be found here: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/999839529 . Some of the projects are listed below:
	COASTAL CLIMATE CORE SERVICES	Coastal flooding is a real concern that affects millions of people across Europe. It not only impacts human health but on infrastructure and services. The EU-funded CoCliCo project aims to deliver an open web-platform that will help inform decision-making on coastal risk and adaptation. The platform will look into the main risk drivers and adjust visualisation and analysis techniques to local decision contexts. It will further combine important and high-quality geospatial information layers. Users of the platform will be able to visualise, download and analyse multiple decision-oriented coastal risk scenarios.
	Climate-Induced Changes on the Hydrology of Mediterranean Basins: Reducing Uncertainty and	With regard to the objectives specified in ENV-2009.1.1.5.2 modelling capabilities must be improved and appropriate tools developed to advance the capability to assess climate effects on water resources and uses. The project consortium will employ a combination of novel field

	Quantifying Risk through an Integrated Monitoring and Modeling System	monitoring concepts, remote sensing techniques, integrated hydrologic (and biophysical) modelling and socioeconomic factor analyses to reduce existing uncertainties in climate change impact analysis and to create an integrated quantitative risk and vulnerability assessment tool. Together, these will provide the necessary information to design appropriate adaptive water resources management instruments and select suitable agricultural practices under climate change conditions. The integrated risk and vulnerability analysis tool will also enable assessment of risks for conflict-inducing actions, e.g. migration. The improved models, new assessment tools, and their results will be evaluated against current methodologies. Improvements will be communicated to stakeholders and decision-makers in a transparent, easy-to-understand form, enabling them to utilize the new findings in regional water resource and agricultural management initiatives as well as in the design of mechanisms to reduce potential for conflict (linkage to SSH-2009.4.2.1).
	Forage Fish Interactions	Removal of a forage fish has consequences for both predators and prey of forage fish. As everything is connected, every management action has a price which goes beyond the apparent, direct effect on the target species. The fishery of forage fish can therefore not be seen in isolation, as the immediate gain in profit from the fishery has to be discounted by the lowered potential for production of large piscivorous fish. Management actions on other species also influence forage fish, i.e. conservation efforts on

		marine mammals or sea birds have direct consequences for the predation pressure on forage fish. The objective of the project is to provide insight and quantitative advice on the ecosystem-wide consequences of management actions directly or indirectly related to forage fish. The two overarching questions are: 1. What are the consequences of forage fish fisheries on (a) predator growth and abundance, (b) economic output of fisheries on piscivorous species, and (c) ecosystem stability and the risk for regime shifts? 2. What are the consequences of changes in predator populations on forage fish populations and fisheries? The method is a combination of ecosystem models, process studies aimed at feeding into the models, economical models, and of data-analysis of existing data sources. The project covers four ecosystems in detail; Norwegian-Barents Sea, Baltic Sea, North Sea and Bay of Biscay. FACTS bring together leading European fisheries and university institutes working on creating the tools for ecosystem-based management. The active involvement of the institutes in the current management provides a means for the results of the project to feed into management. The project furthermore includes a network component which ensures wider dissemination of methods and results within the marine scientific community.
	GoJelly - A gelatinous solution to plastic pollution	"The objective of the GoJelly project is to develop, test and promote a gelatinous solution to microplastic pollution by developing a TRL 5-6 prototype microplastics filter (GoJelly) for commercial and public use, where the main raw

		material is jellyfish mucus. In doing so, the consortium addresses two environmental issues with one approach by removing the commercially and ecologically destructive sea and coastal pollution of both jellyfish and microplastics. This innovative approach will ultimately lead to less plastic in the ocean, municipal demand (and thereby competitive prices) for jellyfish raw material to fill the "mucus-need" by filter developers, and in turn more jobs for commercial fishers in off-seasons. The by-products of the GoJelly biomass have other uses as well, ensuring that GoJelly also delivers a green innovation, resulting in novel, valuable resources for the food and feed industry as well as agro-biological fertilizer for organic farming. The GoJelly prototype products will be tested and demonstrated in three different European seas (Norwegian, Baltic and Mediterranean), by a range of stakeholders, including commercial fishers and industry partners. Tying it together, the project will also ensure the possibilities for broader European promotion and utilization of GoJelly at the local, regional and global levels by delivering a socio-ecological methodological toolbox for forming and implementing policies. GoJelly will broadly communicate its results in several formats such as traditional social media, open lab ship cruise, and in the form of an experimental online game depicting different management scenarios under different jellyfish- and microplastics combinations. An interdisciplinary and international consortium consisting of technology developers, business

		analysts, fishing companies, research institutes, and both natural and social scientists will realize GoJelly, and will ensure the uptake of GoJelly products by industry and policy makers."
	Groundwater and dependent Ecosystems: NEw Scientific basIS on climate change and land-use impacts for the update of the EU Groundwater Directive	Groundwater resources are facing increasing pressure from consumptive uses (irrigation, water supply, industry) and contamination by diffuse loading (e.g. agriculture) and point sources (e.g. industry). This cause major threat and risks to our most valuable water resource and to ecosystems dependent on groundwater. New information is needed on how to better protect groundwaters and groundwater-dependent ecosystems (GDE) from intensive land-use and climate change. The impacts of land-use changes and climate changes are difficult to separate as they partly result in similar changes in the ecosystems affected. The effects are highly interwoven and complex. The EU groundwater directive (GWD) and the water framework directive (WFD) provide means to protect groundwater (GW) aquifers from pollution and deterioration. At present, the maximum limits for groundwater pollutant concentrations have been set for nitrate and various pesticides. Also, the water of sufficient quality and quantity should be provided to ecosystems dependent on groundwater. The European aquifers differ by their geology, climate, and threats to aquifers. This must be considered when general guidelines for management of these systems are developed. The concept of the present proposal is to base the research on different relevant aquifer sites in various European countries to test scientific issues and

		find new results for important problems. Seven WP are foreseen: WP1 Case studies on impacts and threats to GWs and GDEs WP2 Groundwater dynamics, re-charge and water balance WP3 Leaching to groundwater aquifers from different land-uses WP4 Groundwater dependent ecosystems: groundwater-surface water interaction WP5 Modelling processes in groundwater systems WP6 Concepts, scenarios and risk assessment WP7 Co-ordination
	Maximising yield of fisheries while balancing ecosystem, economic and social concerns	"The MSY concept was included as a principle in the 2009 Green Paper on the reform of the Common Fisheries Policy (CFP) in accordance with the global imperative to manage fish stocks according to the maximum sustainable yield (MSY). This implies a commitment to direct management of fish stocks towards achieving MSY by 2015. Attaining this goal is complicated by the lack of common agreement on the interpretation of "sustainability" and "yield" and by the effects that achieving MSY for one stock may have on other stocks and broader ecosystem, economic, or social aspects. MYFISH will provide definitions of MSY variants which maximize other measures of “yield” than biomass and which account for the fact that single species rarely exist in isolation. Further, MYFISH will redefine the term “sustainable” to signify that Good Environmental Status (MSFD) is achieved and economically and socially unacceptable situations are avoided, all with acceptable levels of risk. In short, MYFISH aims at integrating the MSY concept with the overarching principals of the CFP: the precautionary and the ecosystem

		approach. MYFISH will achieve this objective through addressing fisheries in all RAC areas and integrating stakeholders (the fishing industry, NGOs and managers) throughout the project. Existing ecosystem and fisheries models will be modified to perform maximization of stakeholder-approved yield measures while ensuring acceptable impact levels on ecosystem, economic and social aspects. Implementation plans are proposed and social aspects are addressed through the active involvement of stakeholders. Finally, the effects of changes in environment, economy and society on MSY variants are considered, aiming at procedures rendering the MSY approach robust to such changes. The expertise of 26 partners from relevant disciplines including fisheries, ecosystem, economic and social science are involved in all aspects of the project. Global experience is engaged from North America and the South Pacific."
University of Western Brittany		Detailed list of the blue economy projects of the University of Western Brittany can be found here: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/999902676. Some of the projects are listed below:
	Innovative training for Smart coastal management and Sustainable blue growth	In the context of rapid economic growth impacting its coastal zone, Morocco must organize a marine and coastal management plan as stipulated in the 2015 Moroccan Coastal Act. However, Morocco is facing one main challenge: to find highly qualified personnel at postgraduate level, with technical and transversal skills, fully

		able to implement this policy. For this purpose, this Erasmus + Capacity building Joint Project in the field of Higher Education intends to reduce the gap between current academic offers and the work market in the field of marine and coastal sciences. The ScolaMAR specific objective is to develop Innovative training for Smart Coastal Management and Sustainable Blue Growth at the Master level. The ScolaMAR consortium, composed of four European and four Moroccan universities, will work together to reinforce Moroccan training capacities through exchange of good practices, focusing on 3 main approaches: technical, innovative pedagogical and integrative approaches. In order to maximise the project impact and sustainability, activities will specifically target teachers through two main activities: job-shadowing that implies staff mobility from Morocco to Europe and scientific events in Morocco. The ScolaMAR final objective is the development of an Innovative Master program based on the integration of a diversity of disciplines and approaches explored during this 36-months project, that are relevant to the field of Marine and Coastal Sciences. In addition, a SPOC, an e-learning module, on Coastal Risks will be developed to be integrated into the Master program. This regional Master program will help Morrocco to face great societal challenges of both increasing youth employability and ensuring coastal and marine sustainable development.
	Joint European Research Infrastructure	The coastal area is the most productive and dynamic environment of the world ocean with significant resources and services for mankind.

	network for Coastal Observatory – Novel European eXpertise for coastal observaTories	JERICO-NEXT (33 organizations from 15 countries) emphasizes that the complexity of the coastal ocean cannot be well understood if interconnection between physics, biogeochemistry and biology is not guaranteed. Such integration requires new technological developments allowing continuous monitoring of a larger set of parameters. In the continuity of JERICO(FP7), the objective of JERICO-NEXT consists in strengthening and enlarging a solid and transparent European network in providing operational services for the timely, continuous and sustainable delivery of high-quality environmental data and information products related to marine environment in European coastal seas Other objectives are: Support European coastal research communities, enable free and open access to data, enhance the readiness of new observing platform networks by increasing the performance of sensors, showcase of the adequacy of the so-developed observing technologies and strategies, propose a medium-term roadmap for coastal observatories through a permanent dialogue with stakeholders. Innovation JERICO-NEXT is based on a set of technological and methodological innovations. One main innovation potential is to provide simple access to a large set of validated crucial information to understand the global change in coastal areas. Although JERICO-NEXT already includes industrial partners, it will be open to other research institutes, laboratories and private companies

		which could become associated partners to the project. Added values of JERICO NEXT JERICO-RI shall send data and information in an operational mode to European data systems, with dedicated service access. One of the strengths of JERICO-NEXT lies in the fact that technological and methodological developments shall be deployed in natural environment.
	Knowledge-based Sustainable Management for Europe's Seas	Europe's four regional seas (Baltic, Black, Mediterranean and NE Atlantic) have suffered severe environmental degradation due to human pressure. Existing measures to manage pressures have proven inadequate and the EC has responded by proposing a new policy (Maritime Strategy Blue Book) and environmental legislation (Marine Strategy Directive), both currently close to adoption. These instruments rely on the Ecosystem Approach, a management paradigm that encompasses humans and the supporting ecosystem. But the science base for this approach needs strengthening and practical tools must be developed and tested for policy implementation. In particular, criteria for assessing costs and benefits of management actions are poorly developed, particularly in the complex marine environment where multiple uses and management conflicts are common. The KnowSeas consortium will strengthen the science base for managing Europe's seas through the practical application of systems thinking. It will work at the two scales envisaged for emergent EU policy: the Regional Sea Scale and Member State

		Economic Exclusive Zones (EEZs). We have developed a new approach to Decision Space Analysis to investigate mismatches of scale. Knowledge created through the FP6 European Lifestyles and Marine Ecosystems project, augmented with necessary new studies of climate effects, fisheries and maritime industries - in EEZ case studies - will provide a basis for assessing changes to natural systems and their human causes. New research will examine and model economic and social impacts of changes to ecosystem goods and services and costs and benefits of various management options available through existing and proposed policy instruments. Institutional and social analysis will determine conflicts of interest and examine governance as well as stakeholder values and perceptions. Our research will develop and test an assessment toolbox through regional liaison groups and a multisectoral Project Advisory Board.
	Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy	Sustainable and clean sources of energy are needed to reduce climate change. The European Green Deal reinforces Europe's commitment to developing and improving renewable energies at home and abroad. In this context, the EU is promoting a renewable energy shift in Africa. The EU-funded LEAP-RE project will create a long-term partnership of African and European stakeholders in government, research and academia, the private sector and civil society. In its mission to develop renewable energy as a sustainable source of energy for all in Africa, the project will work to reduce fragmentation by

		aligning existing bilateral and multilateral frameworks. It brings together a large-scale consortium of 96 partners from 34 countries and two international organisations.
	Maritime Spatial Planning as enabler of the European Green Deal	The MSP-GREEN project proposal addresses the challenge "Reflect and align maritime spatial plans to the ambition of the European Green Deal" and the related priority "MSP as an enabler of the European Green Deal" (EGD). The proposal builds on the need to strengthen EGD components of MSP plans, operationalise EGD objectives within MSP, reinforce the coherence between different directives and solve conflicting objectives. It is essential to investigate further the best approach to foster the EGD ambition through all the MSP stages: implementation, monitoring and revision. MSP-GREEN aims at creating a framework for MSP plans as "marine enablers" of the EGD. The framework will address analysis and action dimensions and will provide a cross-cutting approach to the main key topics included in the EGD relevant for the marine environment and the sustainable transition of the blue economy: climate change, circular blue economy, protection of marine biodiversity, marine renewable energies, healthy and sustainable food provision. MSP-GREEN approach will build on three major components: analysis, innovation (via valuable practises and new actions), and transferability. Recommendations on how to strengthen the EGD ambition of EU MSP plans and boost EGD implementation with actions addressed by MSP will be prepared based on the project results and by consulting experts and

		practitioners at EU level. Project results will be transferred and further discussed across the EU sea basins, to strengthen the regional dimension and rise the ambition for a Sustainable Blue Economy, considering environmental, socio-economic, geopolitical, regional specificities. Dissemination of project findings among MSP and EGD stakeholders and the public across different basins will help bonding the European maritime and coastal cultural and socio-economic aspects towards sustainable and long-lasting development, for the benefit of all in the entire European Union and neighbouring countries.
	Moving towards innovative education for research-based and sustainable management of marine and freshwater ecosystems (CORRIENTE XXI)	CORRIENTE XXI aims to support the needs of both Peru and Ecuador towards the sustainable management of aquatic (both marine and freshwater) ecosystems and resources, both nationally and in a trans-boundary context. Aquatic ecosystems harbour unique biodiversity and provide key ecosystem services to people. The core idea of CORRIENTE XXI is that investment in all aspects of the HE curriculum, its research-basis, its improved international embedding, its emphasis on new teaching approaches are the primary trigger for eventual preparedness of the policy-communities, in both countries as well as jointly, to (aquatic) environmental challenges related to the 21st century. CORRIENTE XXI addresses pressing environmental issues by providing 1) research-based academic training; 2) a framework for transboundary HEI cooperation towards science-based solutions to shared challenges, as a policy-support; 3) an uplift and academisation of teaching personnel and

		improved student in/through/outflow quality.CORRIENTE XXI will result in two new Master programmes in Ecuador and three updated Master programmes in both countries. Activities (workshops, staff trainings, job-shadowing activities, an integrative conference, an innovative job fair, a Summer School) will train Peruvian and Ecuadorian staff with innovative and integrative skills, providing outputs like training modules for fieldwork practices and curriculum development, innovative pedagogical skills, transferrable and dissemination skills, training tool-kits, e-learning platform and a portfolio of competences. CORRIENTE XXI will lift the quality level of the involved master programmes, increase employability and raise awareness on the importance of aquatic sciences and management; translating to more effective guidelines for policy and management both nationally and in transboundary regions and increasing (inter)national scientific collaboration.
	PrEseRvIng and sustainably governing Cultural heritage and Landscapes in European coastal and maritime regionS	PERICLES promotes sustainable governance of cultural heritage (CH) in European coastal and maritime regions through the development of a theoretically grounded, multi-actor participatory framework. To meet this challenge, PERICLES has formed a strong interdisciplinary consortium comprised of research institutions, regional government and heritage partners representing 15 different disciplines. PERICLES addresses the following objectives: a) develop an in-depth, situated understanding of the CH of marine and coastal land/seascapes,

		including knowledge across local, spatial, environmental, social and economic aspects; b), develop practical tools, based on stakeholder involvement and participatory governance, for mapping, assessing and mitigating risks to CH and to enhance sustainable growth and increase employment by harnessing CH assets; c), provide policy advice to improve integration of CH in key marine and environmental policies and the implementation of associated EU directives; and d), develop effective knowledge exchange networks.
	Refining Higher Education Apprenticeships with Enterprises in Europe	ApprEnt addresses the problem of high youth unemployment as well as the lack of skills required by employers. It aims to bridge the gap between the world of education and business, enhancing partnerships of companies, HEIs as VET providers, and other relevant stakeholders such as public bodies and learners, with the goal of promoting work-based learning and apprenticeship. The project started a peer-learning process of knowledge and practices between partners at national level and then globally in order to identify solutions to some of the main challenges of apprenticeships or work-based learning programmes. The consortium reviewed the existing policies, strategies, priorities and implementation of apprenticeships available at their organisational, regional and/or national level and discussed the summaries of this state-of-the-art in the Peer Learning event organised in the preliminary phase of the project. To set the base of the project development, a common definition of HE apprenticeship was

		agreed and a comprehensive SWOT analysis of University-Business cooperation was prepared, with a special focus on the needs and characteristics of small and medium enterprises. The following phase consisted in the collection of 33 case studies or best practices, structured according to the criteria of relevance, transferability, impact and potential for standardisation.
	Strategic Use of Competitiveness towards Consolidating the Economic Sustainability of the European Seafood sector	SUCCESS is bringing together an integrated team of scientists from all fields of fisheries and aquaculture science with industry partners and key stakeholders to work on solutions which shall improve the competitiveness of the European fisheries and aquaculture sector. The supply-side of seafood markets is limited from both sea fisheries and aquaculture. At the same time demand for seafood products is increasing. In a globalised economy, the conjunction of these two trends should generate high opportunities for any seafood production activity. However, both fisheries and aquaculture companies are facing key challenges, which currently hinder them from reaping the full benefits of seafood markets expansion, and even question their sustainability. As a whole, the EU fisheries sector remains at low levels of profitability and sustainability.
	Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors	Marine life makes a substantial contribution to the economy and society of Europe. VECTORS will elucidate the drivers, pressures and vectors that cause change in marine life, the mechanisms by which they do so, the impacts that they have on ecosystem structures and functioning, and on the economics of associated marine sectors and

		society. VECTORS will particularly focus on causes and consequences of invasive alien species, outbreak-forming species, and changes in fish distribution and productivity. New and existing knowledge and insight will be synthesised and integrated to project changes in marine life, ecosystems and economies under future scenarios for adaptation and mitigation in the light of new technologies, fishing strategies and policy needs. VECTORS will evaluate current forms and mechanisms of marine governance in relation to the vectors of change. Based on its findings, VECTORS will provide solutions and tools for relevant stakeholders and policymakers, to be available for use during the lifetime of the project.

Projects where all partner universities or most of the SEA-EU universities participate:

SEA-EU partnership	European University of the Seas	The vision of the SEA-EU is to establish a distinctly international, pluri-ethnic, multilingual and interdisciplinary European University. This vision is rooted in the high quality and excellence in education and research of the alliance with the intent to strengthen the links between teaching, research, innovation and knowledge transfer.
	reinforcing SustainablE Actions, resilience, cooperation and harmonisation across and by the SEA-EU Alliance	This project aims to bring science and scientists closer to the general public, increase visibility and raise awareness of the importance of science in the everyday life of citizens. The project aims to promote the professions of researchers among young people and generally build trust in science among the general public.

	Beyond academia: broadening the career horizons of doctoral students in marine and maritime sciences in Europe SEA-EU DOC	Considering the lack of opportunities for permanent employment in the European academic sector and the growing uncertainty, more and more PhDs are looking for employment outside the academic sector. The university is responsible for preparing doctoral students for a diverse range of career opportunities and developing their skills to market needs. Six higher education institutions (the University of Brest, the University of Cadiz, the University of Kiel, the University of Gdansk, the University of Malta and the University of Split), which form the alliance "European Universities of the Seas" (SEA-EU), are focused in this Erasmus+ project on increasing opportunities for employment of doctoral students in the field of marine science.

4. ANALYSIS OF STAKEHOLDERS' NEEDS

4.1. Survey

A unique survey that covered a wide range of stakeholders in the field of 'blue economy' was carried out in 5 countries. The questionnaire was jointly developed in English and then translated into the languages of the countries where the research was conducted (in Malta, the English version of the questionnaire was directly used). The questionnaire was distributed in electronic form, which was supposed to facilitate access to/of the respondents, as well as the subsequent processing of the results.

Unfortunately, despite the great efforts of the local teams, the stakeholder response was poor. A total of 136 attempts to complete the questionnaire were recorded, but in the end, only 29 correctly filled questionnaires were received.

Table 1. Number of records per country

	Croatia	France	Malta	Poland	Spain	TOTAL
Total records	61	12	19	21	23	136
Valid surveys	10	2	6	7	4	29

***Source**: author*

Although the number of valid answers was relatively small, in the sample of stakeholders' various sectors from the domains of the 'blue economy' are fairly well represented - as can be seen from the following table. Therefore, although it is not statistically representative, the research sample can still be considered indicative, as well as its results.

Table 1. Analysis of the appropriate Blue Economy sector

1.- Which of the following sectors (according to EU Blue Economy Report 2021) better describes your company's main field of activity? (choose 3 sectors maximum)	Croatia	France	Malta	Poland	Spain	TOTAL
1. Marine living resources	1	0	0	0	1	2

2. Marine non-living resources	0	0	0	0	0	**0**
3. Marine renewable energy	1	1	0	1	0	3
4. Port activities	0	0	1	1	1	3
5. Shipbuilding and repair	0	1	1	0	0	2
6. Maritime transport	2	0	3	2	1	8
7. Coastal tourism	4	0	0	2	2	8
8. Blue bioeconomy and biotechnology	0	0	0	0	0	0
9. Ocean energy	0	1	0	1	0	2
10. Desalination	0	0	0	0	0	0
11. Maritime defence	0	1	0	0	0	1
12. Submarine cables	0	0	0	1	0	1
13. Research and Education (in Blue Economy)	2	0	1	2	0	5
14. Marine observation	1	0	0	0	1	2
15. Other (indicate):		0	1			1

Source: *author*

Most of the surveyed companies are micro and small companies - most of them are in the category of up to 10 employees. Only 2 companies are in the category of medium-sized companies (50 to 250 employees) and one large company (over 250 employees.

Table 3. Number of the employees

2.- How many employees does your company have?	Croatia	France	Malta	Poland	Spain	TOTAL
0 employees						
1 employee.					1	1
Between 2 to 10 employees.	8		4	4	1	17
Between 11 and 50 employees.	2	1	2	2	1	8

Between 51 and 250 employees.		1		1	0	2
More than 251 employees					1	1

Source: *author*

Considering the overall relatively small number of correctly completed surveys, the analysis of the answers by individual countries does not make much sense, so below the survey results will be analyzed (only) in summary.

In accordance with the above-observed distribution of the size of the surveyed companies, more precise data on the number of employees in the companies that responded to the survey show that the average number of permanent employees is only 13.4. However, these are obviously companies that employ highly educated employees. Also, these are companies with dynamic employment structures, which use part-time and temporary employment to a considerable extent.

Precisely because of this, it can be concluded that the attitudes and opinions about the necessary knowledge of employees expressed by these respondents can be significant and indicative for thinking about the requirements for the development of higher education in the future.

Table 4. Number of employees at the particular university education level

2.1. – How many employees your company employs at the particular university education level	
Full-time - permanent (average)	
Total number of employees	13.4
Undergraduate	3.1
Graduate (Master)	4.6
Postgraduate (specialist and doctoral)	4.0
Part-time (average)	
Total number of employees	4.5
Undergraduate	2.3
Graduate (Master)	0.2
Postgraduate (specialist and doctoral)	2.2

Temporary – short-term (average)	
Total number of employees	2.8
Undergraduate	0.7
Graduate (Master)	0.9
Postgraduate (specialist and doctoral)	1.1

Source: *author*

Over 1/3 of the companies that participated in the survey employ employees from other countries, which indicates a high degree of international mobility and integration in the observed industries.

Table 5. Employees from different countries

2.2. – Does your company employ employees from different countries	
Yes	10.0
%	34.5%

Source: *author*

Evaluating the importance of higher education (employees) for them, the respondents rated undergraduate and graduate degrees as equally important - at the level of 3.62/3.63, which is somewhat closer to the degree of 'important' than 'moderately important'. Nevertheless, when looking at the distribution by response scale, it is noticeable that the percentage of answers 'essential' (which would correspond to the highest value 5) is far higher for the graduate level than for the undergraduate level. This could be interpreted in the way that the sample includes a significant number of dynamic companies that base their business to a high extent on knowledge and technology, and for them, higher degrees of education have more importance.

On the other hand, it is interesting that the level of postgraduate education received a somewhat lower rating of importance (3.14), but this is also explainable when looking at the distribution of responses. Namely, it is obvious that the answers here are distributed between those for whom that level of education is not important and those for whom it is very important. The share of those who declared a medium value - 'moderately important' is the smallest.

Table 6. Importance of the education

4. - Rate on the scale from 1 to 5 how important education at the particular level is for your company		
Undergraduate		%
1 - Not important at all	2.0	6.9%
2- Little importance	0.0	0.0%
3- Moderately important	9.0	31.0%
4- Important	10.0	34.5%
5- Essential (very important)	5.0	17.2%
Don't Know/ No answer	3.0	10.3%
Average grade	3.62	100.0%
Graduate (Master)		%
1 - Not important at all	4.0	13.8%
2- Little importance	1.0	3.4%
3- Moderately important	7.0	24.1%
4- Important	4.0	13.8%
5- Essential (very important)	11.0	37.9%
Don't Know/ No answer	2.0	6.9%
Average grade	3.63	100.0%
Postgraduate (specialist and doctoral)		%
1 - Not important at all	5.0	17.2%
2- Little importance	6.0	20.7%
3- Moderately important	4.0	13.8%
4- Important	6.0	20.7%
5- Essential (very important)	7.0	24.1%
Don't Know/ No answer	1.0	3.4%
Average grade	3.14	100.0%

Source: *author*

In response to the question of how satisfied they are with the quality (knowledge) of staff with university-level education, which they employ today, the difference in attitude towards undergraduate and graduate level education is quite clearly visible. Satisfaction with the undergraduate level of education was evaluated with an average score of 3.38 ('Neither

satisfied nor unsatisfied'), and satisfaction with the graduate level received an average score of 3.80 (which is already at the level of 'Satisfied').

As for satisfaction with the postgraduate level of education, it was only slightly below the rating for the graduate level (3,71), but there is a noticeably high number of those who answered that they do not know or did not answer. And this is understandable, given that there is evidently a significant number of those who have no need for staff at that level of education, so they have no knowledge of the quality of education at that level.

Table 7. Satisfaction with the quality of staff with university-level education

5 - To what extent are you satisfied with the quality (knowledge) of staff with university-level education, you employ today?		
Undergraduate		%
1 – Very unsatisfied	3.0	10.3%
2- Partly unsatisfied	1.0	3.4%
3- Neither satisfied nor unsatisfied	9.0	31.0%
4- Satisfied	9.0	31.0%
5- Very satisfied	4.0	13.8%
Don’t Know/ No answer	3.0	10.3%
Average grade	3.38	100.0%
Graduate (Master)		%
1 – Very unsatisfied	1.0	3.4%
2- Partly unsatisfied	1.0	3.4%
3- Neither satisfied nor unsatisfied	8.0	27.6%
4- Satisfied	7.0	24.1%
5- Very satisfied	8.0	27.6%
Don’t Know/ No answer	4.0	13.8%
Average grade	3.80	100.0%
Postgraduate (specialist and doctoral)		%
1 – Very unsatisfied	2.0	6.9%
2- Partly unsatisfied	0.0	0.0%
3- Neither satisfied nor unsatisfied	4.0	13.8%
4- Satisfied	6.0	20.7%

5- Very satisfied	5.0	17.2%
Don't Know/ No answer	12.0	41.4%
Average grade	3.71	100.0%

Source: *author*

Answering the question on which category of knowledge and competences the employees they hire today are lacking most (that is, to what extent their current employees possess a certain category of knowledge), respondents are most satisfied with the level of competence of their employees to deal with multi-cultural workplaces. However, it should be noted that the answer to that question was given by only 41% of respondents.

Interpersonal and social skills (3.65) were rated quite high, while the worst rated was knowledge needed to develop new solutions (2.82), followed by specialized professional expertise (2.96). Practical knowledge and experience level was rated exactly at the middle level of grades (3.00), while the level of fundamental knowledge was still rated slightly above the middle level (3.45).

Table 7. Knowledge and competences of the staff

What areas of knowledge and competences do the (university-educated) staff you employ today lack the most?	
Fundamental knowledge	
Lacking very much	2.0
Partly lacking	2.0
They have them in a moderate extent	5.0
Have to a good extent	10.0
Completely having	3.0
Don't Know/ No answer	1.0
Average grade	2.71
Specialized professional expertise	
Lacking very much	4.0
Partly lacking	4.0
They have them in a moderate extent	6.0
Have to a good extent	10.0
Completely having	2.0

Don’t Know/ No answer	2.0
Average grade	2.96
Development knowledge needed to develop new solutions	
Lacking very much	2.0
Partly lacking	9.0
They have them in a moderate extent	9.0
Have to a good extent	8.0
Completely having	0.0
Don’t Know/ No answer	1.0
Average grade	2.82
Practical knowledge and experience	
Lacking very much	6.0
Partly lacking	4.0
They have them in a moderate extent	7.0
Have to a good extent	6.0
Completely having	5.0
Don’t Know/ No answer	1.0
Average grade	3.00
Soft skills	
Lacking very much	2.0
Partly lacking	2.0
They have them in a moderate extent	10.0
Have to a good extent	11.0
Completely having	1.0
Don’t Know/ No answer	3.0
Average grade	3.27
Interpersonal and social skills	
Lacking very much	1.0
Partly lacking	1.0
They have them in a moderate extent	8.0
Have to a good extent	12.0
Completely having	4.0
Don’t Know/ No answer	3.0

Average grade	3.65
Ability to deal with multi-cultural workplaces	
Lacking very much	1.0
Partly lacking	1.0
They have them in a moderate extent	1.0
Have to a good extent	3.0
Completely having	4.0
Don't Know/ No answer	2.0
Average grade	1.41

Source: *author*

When asked which categories of knowledge and competence their employees will need the most in the future, the respondents first of all clearly expressed the opinion that their employees will need a significantly higher level of knowledge and competence (in the future) than they possess today, in all categories. In most areas, the required level was assessed with an average rating above 4. The highest required level was expressed in knowledge needed to develop new solutions (4.41). As this is precisely the area in which it was assessed in the previous question that the employees are currently lacking the most, it is obvious that in this area it is necessary to work the most on raising the level of knowledge and competence through education and training.

The smallest difference between the level of existing knowledge and competences and future (expected) needs is in the area of ability to deal with multi-cultural workplaces. On the one hand, that area was evaluated as the area where the current situation was the best, and on the other hand, apparently, the respondents believe that there will be the least changes.

Table 8. Expected knowledge and competences

What areas of knowledge and competences do you expect the (university-educated) staff you will be employing in the (5-10 years) future will need the most?		
Fundamental knowledge		%
Lacking very much	3.0	10.3%
Partly lacking	2.0	6.9%
They have them in a moderate extent	5.0	17.2%

Have to a good extent	11.0	37.9%
Completely having	7.0	24.1%
Don't Know/ No answer	1.0	3.4%
Average grade	3.61	100.0%
Specialized professional expertise		%
Lacking very much	1.0	3.4%
Partly lacking	0.0	0.0%
They have them in a moderate extent	3.0	10.3%
Have to a good extent	13.0	44.8%
Completely having	11.0	37.9%
Don't Know/ No answer	1.0	3.4%
Average grade	4.18	100.0%
Development knowledge needed to develop new solutions		%
Lacking very much	1.0	3.4%
Partly lacking	0.0	0.0%
They have them in a moderate extent	1.0	3.4%
Have to a good extent	11.0	37.9%
Completely having	16.0	55.2%
Don't Know/ No answer	0.0	0.0%
Average grade	4.41	100.0%
Practical knowledge and experience		%
Lacking very much	1.0	3.4%
Partly lacking	0.0	0.0%
They have them in a moderate extent	3.0	10.3%
Have to a good extent	14.0	48.3%
Completely having	10.0	34.5%
Don't Know/ No answer	1.0	3.4%
Average grade	4.14	100.0%
Soft skills		%
Lacking very much	1.0	3.4%
Partly lacking	0.0	0.0%
They have them in a moderate extent	5.0	17.2%

Have to a good extent	9.0	31.0%
Completely having	11.0	37.9%
Don't Know/ No answer	3.0	10.3%
Average grade	4.12	100.0%
Interpersonal and social skills		%
Lacking very much	1.0	3.4%
Partly lacking	0.0	0.0%
They have them in a moderate extent	3.0	10.3%
Have to a good extent	14.0	48.3%
Completely having	10.0	34.5%
Don't Know/ No answer	1.0	3.4%
Average grade	4.14	100.0%
Ability to deal with multicultural workplaces		%
Lacking very much	1.0	3.4%
Partly lacking	1.0	3.4%
They have them in a moderate extent	4.0	13.8%
Have to a good extent	8.0	27.6%
Completely having	7.0	24.1%
Don't Know/ No answer	1.0	3.4%
Average grade	2.93	75.9%

Source: *author*

Respondents expressed their willingness to provide training for students in their company - 62%. However, it seems that the activity and initiative of the universities are still insufficient in this sense because the majority of respondents (55%) stated that they did not receive any information from the University regarding possibilities and advantages of collaborating with university.

Table 9. Training of the students within an industrial educational programme or hosting an internship

8.- Would you be willing to train university students at your company within an industrial educational programme or host an internship programme providing work-based experience to the students at your company?	

o Yes.	18.0
o No.	3.0
o I am not sure / I do not have an opinion.	8.0
% Yes	62.1%
9.- Has your company received any information from the University regarding possibilities and advantages of collaborating with university on their study programmes and the incorporation of future graduates into the labour market?	
o Yes.	13.0
o No.	14.0
o It is not applicable in my country.	2.0
% Yes	44.8%

Source: *author*

Regarding the jobs they would offer to university-educated staff, at the level of undergraduate education, the distribution is fairly even among several areas of work offered. Commercial and distribution jobs are the most represented (34.5%), but managerial jobs, product design, and innovation jobs are also very close (31% each). Respondents consider quality control jobs the least suitable for undergraduate level - only 10%. Obviously, they believe that a higher level of education is needed for these jobs.

For the master's level of education, respondents would primarily and mostly aim for innovation and managerial jobs (44.8%). Product design jobs are also significantly represented (31%), while other job categories are clearly considered not intended for employees with a master's degree.

For employees with a post-graduate level of education, respondents believe that the most suitable jobs for them are innovation, consulting and advisory work - which is quite logical and suitable for their level and type of education.

Table 10. Incorporation of the university graduate per level and field of the education

10- If you needed to incorporate a university graduate, which tasks would that person cover? Please, select a maximum of three options for each degree.		
Undergraduate		%
Commercialization and distribution work/tasks	10.0	34.5%
Managerial work/tasks	9.0	31.0%

Product design work/tasks	9.0	31.0%
Production work/tasks	6.0	20.7%
Quality control work/tasks	3.0	10.3%
Innovation work/tasks	9.0	31.0%
Consultancy and scientific advice work/tasks	6.0	20.7%
Other (indicate):		
Graduate (Master)		
Commercialization and distribution work/tasks	8.0	27.6%
Managerial work/tasks	13.0	44.8%
Product design work/tasks	9.0	31.0%
Production work/tasks	2.0	6.9%
Quality control work/tasks	7.0	24.1%
Innovation work/tasks	13.0	44.8%
Consultancy and scientific advice work/tasks	8.0	27.6%
Other (indicate):		
Postgraduate (specialist and doctoral)		
Commercialization and distribution work/tasks	7.0	24.1%
Managerial work/tasks	6.0	20.7%
Product design work/tasks	7.0	24.1%
Production work/tasks	4.0	13.8%
Quality control work/tasks	3.0	10.3%
Innovation work/tasks	14.0	48.3%
Consultancy and scientific advice work/tasks	13.0	44.8%
Other (indicate):		

Source: *author*

Thinking about changes and challenges steaming from technology and market changes in the future (5-10 years) concerning jobs and work design, respondents give the most weight to the fact that regular education cannot follow the fast pace of changes. On the other hand, they believe that technology is becoming very sophisticated and requires highly qualified workers, which additionally places higher demands on education and educational institutions. Other aspects of the impact of future changes in technology and the market are also rated by the respondents as significant or intense. The lack of qualified labor force and the pressure of competition will further increase the demand for education, which will continuously ensure new and up-to-date knowledge of employees.

Table 11. Future jobs and work design influenced by the changes

11- What changes and challenges steaming from technology and market changes do you see in the (5-10 years) future concerning jobs and work design? (Rate on the scale from 1 to 5)	
Technology is changing so fast that (regular) education cannot follow	4.01
Technology is becoming very sophisticated and requires highly qualified workers	3.94
The structure and organization of work has to be changed too often, so people are getting confused	2.86
There is not enough (not at all) qualified labor force for some jobs on the labor market	3.85
The problem with employees whose knowledge and skills have become obsolete and cannot be retrained and adapted to new jobs.	3.54
Dynamics of the competition and labor market make workplace design more and more complex and demanding	3.55

Source: *author*

The respondents see the most important soft skills that employees in 'blue economy' companies need today in teamwork management, initiative and decision making, and communication capacity. Taken together, it could be said that the critical area is the skills of cooperation and joint work, in order to achieve synergy and multiplicative effects of the joint use of knowledge and abilities. On the other hand, the respondents see the skills of conflict management, negotiation and rationalization as the least problematic. Probably the reason for this is primarily that the respondents do not see the situation in their companies as conflictual, and the need for conflict resolution is low.

It is interesting that the respondents see a similar distribution of importance in the future (question 12B), but with a slight change in importance - they attach the greatest importance to innovation and creativity in the future, and teamwork management is in second place. Communication capacity remains in third place in terms of importance. On the other hand, conflict management, negotiation and rationalization remain the least important soft skills in the future. Such a clear and consistent attitude towards the soft skills that university graduates should have gives a very clear and strong indication of what skills should be developed and improved through the education and training system.

Table 12. Identification of the important soft skills of a university graduate

12A.- Please, select the three most important soft skills of a university graduate /A- today/ from your company point of view:		
Teamwork management	14.0	48.3%
Project management	8.0	27.6%
Adaptation capacity	9.0	31.0%
Negotiation	1.0	3.4%
Stress control	4.0	13.8%
Rationalization	2.0	6.9%
Communication capacity	11.0	37.9%
Innovation and creativity	8.0	27.6%
Initiative and decision making	12.0	41.4%
Change management	3.0	10.3%
Conflict management	0.0	0.0%
Complex problems resolution	3.0	10.3%
Planning	3.0	10.3%
Critical thinking	6.0	20.7%
Other (indicate) _____		

Source: *author*

Table 13. The selection of the most important soft skills

12B.- Please, select the three most important soft skills of a university graduate / B- in the future/ from your company point of view:		
Teamwork management	12.0	41.4%
Project management	5.0	17.2%
Adaptation capacity	7.0	24.1%
Negotiation	2.0	6.9%
Stress control	6.0	20.7%
Rationalization	2.0	6.9%
Communication capacity	8.0	27.6%
Innovation and creativity	14.0	48.3%
Initiative and decision making	5.0	17.2%
Change management	5.0	17.2%

Conflict management	1.0	3.4%
Complex problems resolution	3.0	10.3%
Planning	5.0	17.2%
Critical thinking	6.0	20.7%
Other (indicate) _____		

Source: *author*

Among the interpersonal and social skills that respondents consider to be the most important for their university-educated employees today, the most prominent is teamwork capacity. Considerably behind it, but still, with a very high level of significance, they rated self-esteem and proactivity, leadership, creativity and flexibility. Emphasizing teamwork both in this and the previous question puts beyond any doubt the importance of teamwork, and the knowledge and skills necessary for success in teamwork.

The least importance was attributed to the skills of persuasion, self-assurance and optimism. When asked which interpersonal and social skills will be the most important for their university-educated employees in the future, respondents still give the greatest importance to teamwork capacity and raise the level of importance to creativity and flexibility. The opinions and signals given by the respondents are clear and consistent!

Table 14. Identification of the three most important interpersonal and social skills of a university graduate

13A.- Please, select the three most important interpersonal and social skills of a university graduate from your company point of view /A-today/:		
Empathy	7.0	24.1%
Leadership	10.0	34.5%
Creativity	10.0	34.5%
Flexibility	10.0	34.5%
Teamwork capacity	16.0	55.2%
Active listening	9.0	31.0%
Self-assurance and optimism	2.0	6.9%
Self-esteem and proactivity	4.0	13.8%
Interpersonal intelligence	11.0	37.9%
Persuasion	2.0	6.9%
Other (indicate) _____		

13B.- Please, select the three most important interpersonal and social skills of a university graduate from your company point of view /B- in the future/:		
Empathy	4.0	13.8%
Leadership	8.0	27.6%
Creativity	14.0	48.3%
Flexibility	13.0	44.8%
Teamwork capacity	15.0	51.7%
Active listening	9.0	31.0%
Self-assurance and optimism	2.0	6.9%
Self-esteem and proactivity	6.0	20.7%
Interpersonal intelligence	8.0	27.6%
Persuasion	2.0	6.9%

Source: *author*

Finally, when asked directly what subjects would they consider interesting to include in a new degree in Blue Economy so that a graduate of this degree would have a place in their company, the respondents evaluated the proposed options fairly evenly - in the range of 3.2 to 3,9. First of all, it can be stated that these are not particularly high marks, which may mean that the respondents could not see one area (subject) that would be a clear 'favourite', but perhaps also that the question did not offer the best (most important) subjects at all.
Among the subjects offered, planning techniques for the use of the marine environment and the sustainable management of resources (3.9) and practical use of marine environmental and socio-economic analysis tools, including data analysis (3,8), were rated the highest.

Table 15. Subjects that should be integrated into a Blue economy degree regarding new challenges

14.- Taking into account the new challenges of your company in the future, what subjects would you consider interesting to include in a new degree in Blue Economy so that a graduate of this degree would have a place in your company? (Rate on the scale from 1 to 5)	
To understand the environmental and socio-economic problems in the ocean based on ethical commitment and sustainability	3.4
To know the instruments and techniques for the assessment and management of impacts on the marine environment	3.2
To know the socio-economic activities of entities linked to the marine environment, from a sustainability perspective	3.3

To know the rules that regulate the use of the marine environment, its resources and diversity, as well as the tools and techniques necessary for their evaluation and management.	3.6
To apply planning techniques for the use of the marine environment and the sustainable management of resources.	3.9
To be skilled in the practical use of marine environmental and socio-economic analysis tools, including data analysis	3.8

Source: *author*

5. Visits and in-depth interviews with selected stakeholders

4.1. Analysis of interviews results

4.1.1. Local consultations University of Split

Main topic: How universities, higher education institutions and public research institutes can contribute to the sustainable development of the Blue Economy, primarily in the field of job design and creating/transferring the necessary knowledge to design and perform (future) jobs in the Blue Economy

- What will be the (future) jobs in the area of the Blue Economy?

- What knowledge will they require?

- What will happen (change) in the foreseeable future with jobs in the domain of the Blue Economy and the knowledge needed to perform them?

- How will that knowledge be (optimally) acquired?

A / Changes in jobs and necessary knowledge in the field of Blue Economy:

- The 'blue economy' includes a wide range of very different activities and areas of work: from 'classic' fisheries and fish processing, maritime transport, shipbuilding, through mariculture, coastal and nautical tourism, to obtaining 'non-living' resources from the sea (marine mining), and marine and maritime protection (environmental, safety…).

- The sustainability of these activities in an environment that is changing more and more rapidly is critical…

- Development, the progress of technology in general is accelerating, and in the area of the Blue Economy, the changes brought by the development of technology are prominent. The content of jobs is changing and will be changing, causing the obsolescence of existing knowledge and the need for continuous acquisition of new knowledge.

- Automation and robotization, digitalization and utilization of telecommunication technologies are present and increasingly expressed in many domains of the Blue Economy; on the one hand, it means squeezing out human labor from significant segments where it has

been needed and present so far, and on the other hand, it requires new knowledge from people who design and manage work (production and business) processes.

- Digital knowledge, knowledge and skills of using digital tools are becoming more and more present, and even crucial for future development in virtually all areas of the Blue Economy.

- On the other hand, 'soft skills' are becoming more important and necessary; teamwork and the ability to work together and interdisciplinary are becoming increasingly important; 'Technical knowledge' can be acquired in different ways and there are more and more of them - but the acquisition and application of knowledge and skills of working with people is becoming critical

- Communication skills (including knowledge of foreign languages), management skills (including leadership), are part of these needs for the development and application of 'soft skills'.

- The 'axis' or 'polarity' between rapid technological development and the application of new technologies on the one hand and the need to develop 'soft skills' that ensure full use of human resources in joint, team and interdisciplinary work should be noted. The two sides are not in conflict - they are complementary.

- In practically all segments of the 'Blue Economy', the importance and representation of highly professional and scientific research work is growing, which means the need for more and more educated staff, who will have fundamental professional knowledge and knowledge of creative, scientific and research work.

- Defense and security operations at sea are changing in two important respects: on the one hand, the development of technology and the use of new technologies is growing exponentially, and on the other hand, the contents and tasks of these services are changing and increasingly diversifying. Due to both, the knowledge required to work in these services is becoming increasingly complex and requires specific education - which requires the development of specific educational programs…

- "autonomous ships" are becoming a reality; AI, automation and remote control are significantly changing the role of people not only in maritime transport but also in other segments of the Blue Economy.

- Changes in the forms and contents of (coastal) tourism; changes in the tastes, requirements and preferences of tourists, bring significant changes in jobs in the sector of tourism and

hospitality, as well as the knowledge needed to perform them. This further emphasizes communication skills, knowledge of foreign languages, but also the use of digital technologies.

- Shipping technology is changing significantly - non-fossil fuel propulsion (primarily electric propulsion), automation, computerization, telecommunication technologies, seek and bring new approaches in shipbuilding, but also the operation of ships. Moreover, all this means that on the one hand, existing knowledge is becoming obsolete, and new and increasingly sophisticated knowledge is constantly being sought. This again emphasizes the need to change and improve the entire education system in the field of shipbuilding and shipping, but also to develop and strengthen the system of lifelong learning in these areas.

- There is increasing pressure on the coastal area, but also the coastal sea, where more and more activities are being developed, which brings increasing load and pressure in the area of ecology.

- The intertwining of activities and dimensions of the Blue Economy, and similar changes that occur in them, emphasize the need for interdisciplinary work and interdisciplinary education.

- Continuing and lifelong learning is a perspective in practically all areas of work. The question is what role the university should and can play in this. On the one hand, young people (students) need to be prepared for lifelong learning - given good theoretical and general foundations to be able to practice lifelong learning more effectively, but it is also possible to develop modular study programs that can modularly develop and upgrade knowledge.

B / The role of the University

- All these (and other) tendencies indicate on the one hand the constant and growing need to acquire (and even develop) new technological knowledge, and on the other hand the key role that value systems, human interaction and communication… ('soft skills'), will play in using this knowledge in creating a SUSTAINABLE BLUE ECONOMY, highlights the question of the role of the University in this future system. In a situation where technological knowledge can be collected/acquired easily and quickly from a virtually unlimited source called the 'Internet', it seems that the role of the University cannot and should not be primarily a 'source of knowledge' or a 'learning place', but increasingly as support for a systematic, comprehensive and interdisciplinary understanding of knowledge; learning how to learn and understand the environment and changes in the environment in a quality and holistic way. Issues and questions arising from there can be:

- "What can the University give/know better than Google"?
- The University must develop and support a lifelong learning dimension…
- The University must be giving students a dimension of critical thinking, precisely so that they can critically consider the meaning of the knowledge they acquire (will acquire) from different sources and creatively identify and develop the possibilities of applying that knowledge.
- The University must adapt to the changed profile and preferences of new generations of students (‘Millennials’, ‘Generation Z’).
- Precisely because of the importance (as pointed out) that will be given (and should be given) to 'soft skills', skills of working with (living) people, the University may need to be, in a sense, a place to develop and nurture 'live contact' and ‘live work’. Not denying or rejecting work in a ‘virtual environment’, using information and telecommunication technologies, the University should preserve ‘living word’ and ‘live contact’ as an added quality and added value.
- On the other hand, the University should include two aspects in its programs and working methods: multidisciplinarity and practical learning (learning in practice, through practice and for practice). Multidisciplinarity/interdisciplinarity is also the best answer to modern demands for flexibility and mobility in jobs and careers. Activities and jobs in the Blue Economy are exactly an example of such needs and requirements. The design of studies that would be gradually and sequentially intertwined with practice is certainly more appropriate to the needs and requirements of the future - in various aspects (from the concept of lifelong learning to learning through practice and for practice…)
- Although the starting point here was a discussion of job prospects and knowledge in the field of Blue Economy, it is obvious that **these conclusions may have a general meaning and importance, and fit into the general requirements and guidelines for the development and redefinition of the University.**

4.1.2. Local consultations University of Western Brittany

What are the main opportunities and obstacles (problems) to sustainable job creation and growth in the blue economy (aquaculture, coastal tourism, marine biotechnology, marine energy and seabed mining, etc.)?

The main obstacles stated by the participants are the shortage of graduates with specific technical skills, due to the lack of dedicated training. The demand for profiles with technical skills (bachelor degree) is growing in the business sector. Most graduates tend to continue their education at Master level, which does not guarantee their employability: the fact that there are many Master's level graduates creates the constraint that not all of these profiles will be recruited to managerial positions. Another problem raised is the lack of interest in scientific careers among university students. Students prefer to go to engineering schools which guarantee them higher salaries although these schools are now becoming more and more generalist. In consequence, companies have to develop intern training offers.

What changes and challenges related to changing technology and the marketplace do you see in the future (5-10 years) regarding jobs and work design?

According to the participants, the main evolutions of the job market are linked to the future relocation of activities and the reindustrialization at the local level. At the local level, the challenge will be to train profiles at Bachelor level to learn the know-how that will be necessary for these future jobs.
Also, two major challenges seem to be on the horizon for the decade: 1) the climate challenge and the issues of sustainable development and 2) the development of digital technology.
Regarding climate issues, participants agreed on the need to take these issues into account within companies in order to attract future employees. Indeed, the new generation is attached to these issues, it is, therefore, necessary to explain the environmental steps taken by the company during recruitment in order to allow the adhesion of candidates. At the academic level, it will also be necessary to integrate teaching modules in order to better understand these phenomena, but the process of changing the training models is very long.
Regarding the development of digital technology, participants expressed confidence in the transition to digital because the new generations of graduates are very comfortable with the

new tools. In the business sector, some participants stated difficulties in finding adequate digital solutions to their problems (payroll software, etc.)

How can HEI and PRO contribute to the creation of sustainable jobs and growth in the "blue economy" - in line with the needs of the identified stakeholders (categories)?

Apprenticeships (teaching period alternated with a period in a company) and work-study programs provide a link between higher education institutions and companies. An apprenticeship gives a better understanding of how the company works, the codes of the working world, and how to be better integrated.

How satisfied are you with the quality (knowledge) of the university-educated staff you employ today?

The majority of the participants are satisfied with the quality (knowledge) of the university-educated staff they employ today. They agreed on the benefits of the flexibility of the educational contents as the university offers a lot of specialisation and allows the students to rapidly evolve.

In what areas of knowledge and skills are the (university-level) staff you employ today most lacking?

According to the participants, it is necessary to integrate knowledge of the company in the training leading to a diploma (labour codes, knowledge of needs), which is currently lacking in some university courses. There is a great need for skills in the areas of digital and climate change. Training courses should take these aspects into account.

What are/will be the most important skills of a college graduate /A- today; B- in the future/ from your company's perspective?

The most important skills expected in the future will be adaptability and the ability to develop a variety of skills. In the future and with the context and the need for reindustrialisation, companies will need graduates who developed real technicity.

How important are soft, interpersonal and social skills to a college graduate /A- today; B- in the future/ from your company's perspective?

According to the participants, interpersonal skills are considered during recruitment because beyond the training received and the skills developed, future employees must be able to integrate quickly into the company's ecosystem.

What do you expect from HEIs and research institutes to support your future activities? How can they best help you in your future work? What are the main forms of collaboration with HEIs or research institutes that you would like to have in the future?

Participants agreed on the need to create more links between HEIs, research institutes and companies with for example the possibility for a doctoral student to do a PhD in companies (alternating between work in universities, research institutes and companies).

Considering your company's new challenges in the future, what subjects would you consider interesting to include in a new blue economy degree so that a graduate of this degree would have a place in your company?
The issues of sustainable development are the future challenges that will be expected in the future and in blue economy training. University courses will have to adapt and offer new teaching modules in order to train a new generation of graduates in these issues. The reality is that creating new teaching modules is a lengthy process, the introduction of new modules requires a heavy investment from the teachers, teachers themselves not being experts on these issues.

4.1.3. Local consultations University of Cadiz

To cover the needs of their business or entrepreneurial activities, do they see an advantage in having a PhD holder?

Both in the initial round of introduction of the participants and in this first question, one fact clearly emerges: it is difficult for the participating organisations (all the profiles envisaged) to recruit university PhD holders unless it is in the context of a European project. The smaller the size of the company, the greater the difficulty. They also all agree that their companies focus more on recruiting Master's Graduates than PhDs. In conclusion, “having a PhD is not a priority factor when hiring a person, but it does add up.”

What skills should a PhD holder ideally have to make the best possible contribution to their business?

Most interventions focus on soft skills ("I don't look at CVs, I look at how they write and how they perform in the emails where they send those CVs"). In addition, they highlight the need for language skills.

- The most frequently mentioned skills are:
- Problem-solving.
- Adaptability.
- Teamwork.
- Good oral and written communication.
- Project management.
- Time management.
- Customer orientation/management.
- Only in the case of public companies: vocation for public service.

It is clear from the interventions that the University does not provide the skills listed above in its doctoral programmes.

If they employed a PhD holder, what would the primary considerations be in choosing this person? (e.g., specific technical skills, in depth-knowledge, leadership, critical thinking, personality)

There was consensus on the following skills:

- Versatility, especially in small businesses and entrepreneurship (versatility is perceived by participants as the opposite of the high specialisation provided by University training).
- Proactivity.
- Adaptability.
- Involvement.
- Innovation, but limited to the business environment.
- Lastly, but detected as a great need not provided by the University: project managing skills.

Interestingly, one participant indicated that being a woman "gives you a lot of points for European grants".

What barriers might impede or obstacle the access of PhD holders to their business?

The participants identified the following barriers:

- This professional profile has the highest salaries, their training is focused on teaching and research but not on business ("profile very exigent for a company").
- Companies and entrepreneurial initiatives do not guarantee a professional career (uncertainty).

What can their respective companies or initiatives offer specifically to a PhD?

- In the case of public companies: stability and economic solvency.
- In the case of small and medium-sized enterprises and entrepreneurs: good working conditions, flexible working hours, but not high economic conditions ("a happy environment for the employee"). They explain that the few cases of PhD holders with whom they have had contact or interviews gave priority in their choice of company to those that gave them a higher salary and guaranteed the continuity of their line of research.

Another activity was made in a collaboration with stakeholders, a focus group was organised within Task 5.6. of the SEA-EU proposal, at the University of Cadiz. These were the questions posted to the stakeholders:

1. What digital skills are required, now and in the future? (e.g., elementary digital skills, advanced manufacturing, machine learning and artificial intelligence, big data and analytics, internet of things, robotics, and unmanned systems)

2. What green skills are required, now and in the future? (e.g., implementation of new green technologies, circular economy, energy management, carbon accounting, environmental awareness, and risk analysis of systems)

3. What cross-sectorial or industry specific skills are vitally important and missing, now and in the future?

The general skills detected were:

- Virtual reality.
- Data analysis.
- Proficiency in statistical analysis tools.
- Expert handling of office software (surprisingly, they detect a great weakness in the expert use of Excel, Access, Word, or equivalent software).
- Simulators and predictive techniques.
- Digital twin technology.

The green skills required were:

- New green technologies.
- Green energy transition.
- Circular economy.
- Robotics.
- Resilience.
- Climate change.
- Sustainable Development Goals.
- Increased knowledge of legislation and regulations.

4.1.4. Local consultations University of Gdansk

Conclusions and proposals resulting from consultations with stakeholders.

Seven issues were discussed during the consultation meeting held at the headquarters of the Gdansk branch of the Polish Economic Society.

The discussion resulted in the following conclusions and comments:

- *Identify possibilities for creation of sustainable jobs and growth in aquaculture, coastal tourism, marine biotechnology, ocean energy and seabed mining*

- Aquaculture - in Polish conditions there is no marine aquaculture (natural shape of sea shores, climate and lack of tradition of such activity), but inland aquaculture is developed - farm ponds of freshwater and marine fish. There is a demand for unskilled and skilled workers to operate the breeding ponds (positions related to fish feeding and pond care, and positions of trade specialists).

- Coastal tourism - an extensive sector in Pomorskie Voivodeship (large number of tourist attractions: the cities of Gdańsk, Gdynia, Sopot and the natural assets of the Bay of Puck, Gulf of Gdańsk). The main phenomenon that largely limits the development of this sector is seasonality, which affects the availability of tourist services. The tourist season starts between May and September, with the intensification of the three summer months (this is also when schools and universities have a summer break).

Considering coastal tourism in its broadest sense (as a combination of hotel, catering, shopping, cultural, sports and transport services), one can see great potential for creating seasonal jobs. The Tricity (Gdańsk, Sopot and Gdynia) is a traditional summer tourist destination for Poles and increasingly for foreign tourists. Taking into account the above-mentioned aspects, one can indicate a great potential for employment in coastal tourism in year-round jobs (hotels, catering and transport) and a large number of seasonal jobs (tourist services, catering outlets, campsites).

- Ocean energy - in connection with the execution of the offshore wind energy program by Poland, one should expect the creation of an increasing number of jobs. Taking into account the necessity of constructing offshore wind farms, one should expect an increase in demand for jobs connected with the installation of windmills (windmill installers, service vessel crews, technical service). After the construction of the wind farms workers will be employed who will deal with the maintenance and technical supervision of the offshore installation (https://www.gov.pl/attachment/be93b2e4-b6de-464b-83c3-102bdde52045).

- Seabed mining - Due to the current war crisis and previous plans of developing, this sector of the Polish maritime economy is expected to grow. Currently, Lotos Petrobaltic is engaged in direct exploration of offshore oil and gas deposits. This entity employs skilled workers manning drilling rigs (recruitment for such jobs is still ongoing). Along with the expansion of

this sector, it is planned to increase employment also in work positions supporting extraction (technical and often economic).

- *Identify local needs, threats and local challenges regarding future blue jobs*

- The Pomeranian region is strongly connected with the maritime economy (sea navigation, seaport activities, shipbuilding, transport, shipping and logistics, and food processing - fishing and aquaculture), hence the importance of infrastructure investments related to the expansion of Sea ports in Gdańsk and Gdynia; Railway lines; Road connections; Airports.

- The development of the aforementioned investments leads to opportunities for companies to create numerous jobs in the blue economy.

- A significant problem is the lack of qualified workers, mainly those representing technical fields (production engineers, chemists, technologists in various fields). This is related to the development of shipbuilding, electro-machinery and food industries in the Pomeranian Region.

- An important threat is the seasonality of some sectors of the region's economy (tourism, selected food production). The challenge is to achieve the optimal balance in the labor market, taking into account the seasonality of some jobs.

- *Identify possible niches for joint stakeholder activities (HEIs, Institutes, companies…)*

- Cooperation between stakeholders can be in the form of consultations, programs of action on specific issues, detailed studies, conducted in various forms.

- Important issues that can be addressed in joint activities are e.g:

o determinants of sustainable development of maritime economy (blue economy) of the Pomorskie Voivodeship region;

- Development of ecological transport (including sea, rail, road and air transport);
- Determinants of sustainable coastal and maritime tourism development;
- Development of intelligent green cities;
- Organic agriculture and aquaculture.

- *Discuss local strengths and opportunities for sustainable blue jobs*

- Linking the economy of Pomorskie Voivodeship to the sea and the possibility of obtaining added value from the location of cities and towns. Some of the companies operating in the region are associated with transport and generate a large part of GDP of the voivodeship. The location of the two largest Polish sea ports in the region creates the possibility of creating numerous jobs.

- The region is also known for its agricultural production and the broadly defined fish economy, represented by companies involved in fish processing, aquaculture, fishing and fish sales. In this area, there is also the possibility of creating typically manufacturing jobs.

- Poland is a party to numerous conventions related to environmental protection, which oblige the central and local administration to respect the principles of environmental protection and pursue the policy of sustainable development, including the blue economy. For this reason, institutions, organizations and companies engaged in activities related to environmental protection are established. Subjects of this type carry out activities involving the development of clean technologies in the economy (production, transport agriculture, aquaculture and fisheries). Introduction of new pro-ecological technologies is connected with creation of jobs for specialists.

- An important challenge is to introduce technical solutions to preserve marine and terrestrial ecosystems. Attention should be paid to the reduction of pollution of the sea, surface water, farmland and air. In this respect, cooperation is carried out between various entities representing state, local administration and enterprises. The obligations imposed on the mentioned entities by international, EU and national law in the field of activities connected with the protection of the natural environment (including sea environment) and the conception of sustainable development (in tum blue growth) are also fulfilled. Therefore, the assumption should be made that all economic activity should meet the conditions of taking into account the needs of the natural environment and the created workplaces should meet the condition of blue jobs.

- *Create joint local vision for development of the sustainable blue jobs*

- Blue jobs may be created in activities related to:

a) maritime transport,
employment in maritime shipping companies;
jobs in seaports;
enterprises supporting maritime transport;
closely cooperating enterprises.
b) land transportation,

employment in rail and road transport companies;
jobs in entities responsible for the maintenance of transport infrastructure;
employment in entities providing construction and maintenance services for rail and road infrastructure
c) aquaculture, fish processing and fishing,
employment in enterprises related to aquaculture (fish farms);
jobs in food processing enterprises (mainly fish processing);
employment in sea fishing
d) coastal and maritime tourism,
employment in businesses related to hospitality and catering;
jobs in cultural institutions;
other jobs supporting tourism;
e) wind energy,
f) offshore mining,
g) clean technologies.

- *Identify possibilities for raising awareness of marine and maritime professions*

- What emerged from the discussion was the concept of multi-level awareness raising for the maritime and maritime professions.
- The first, basic level, is the public awareness of the existence of professions that are associated with the sea. The professions most often identified are those directly associated with the sea: sailors (including officers with the captain of the ship at the head), fishermen and shipbuilders, less often port dockers.

- The second level is primary education, where schoolchildren learn from geography or entrepreneurship lessons about various possible professions that are in any way related to maritime economy.
- The third level is all vocational schools, where the profile education of students is conducted depending on the chosen direction of education. Some vocational schools and technical schools offer courses closely related to maritime economy, e.g. port and terminal operation technician, forwarding agent.
- The fourth is education at universities providing education in specialized fields of study e.g. Maritime Trade and Transport, Operation of Marine Power Plants and Ocean Engineering Facilities, Oceanography Hydrobiology, Oceanography Marine Geology.
- The last one is various types of postgraduate studies, doctoral studies, MBA studies, where depending on the proposed topics, professions related to the sea and maritime economy appear.
- It should also be noted that the Ministry of Family and Social Policy previously led an EU project to identify and define maritime professions.
- Apart from the mentioned sources of information about maritime professions, it is possible to conduct actions connected with deepening social awareness of the specificity of maritime professions and the necessity of further development of this type of jobs.

- *Analyze options for fostering dialogue and effective network of marine and maritime stakeholders across the regions.*

During the discussion, several solutions to the maritime networking issue were proposed.
- Three possible solutions for building networks emerged from the discussion:
a) maintaining regular contact between stakeholders;
b) organizing consultation meetings;
c) using public and private universities as an organizing element of such networks.
- Individual contacts between entities seem to be a simple solution, but it has numerous limitations related mainly to the limited range of such a network and bilateral exchange of information.
- Stakeholder consultation meetings allow for a wide exchange of information and some arrangements to be made to improve mutual cooperation.
- The inclusion of universities, or other entities (e.g., the Polish Economic Society), allows such links to be maintained on an ongoing basis and to keep information circulating and to convene

consultation meetings when necessary, or on a regular basis. Universities and other social institutions are an important part of the information infrastructure between different actors.

4.1.5. Local consultations University of Malta

Two stakeholder consultation sessions were held in Malta:

- Industry Stakeholder consultation – 23rd November 2021:
  The first focussed on industry needs for skills and training in areas related to digitalisation, green and blue economy. The consultation was held on the 23rd of November 2021 at the University of Malta Valletta Campus.
  The industry stakeholder session aimed to address university-industry collaboration in the marine and maritime sciences and approaches to nurture employable, talented, and entrepreneurial graduates and enhance the visibility and attractiveness of careers in the blue economy, discussing in particular the establishment of industrial doctorates. The consultation was organised around three thematic areas: digitalization, green economy and blue economy and the skills needs and gaps in these three areas.
- Academia/Researcher Stakeholder consultation – 25th January 2022:
  The session was an online event held on 25th January 2022. The experts discussed strengths, needs and challenges for establishing blue jobs and careers, building on the output from the industry consultation. The following topics were addressed:

    - Identity local needs, threats and local challenges regarding future blue jobs
    - Identity possible niches for joint stakeholder activities (HEIs, Institutes, companies)
    - Discuss local strengths and opportunities for sustainable blue jobs
    - Identify possibilities for raising awareness of marine and maritime professions

Strengths and opportunities for fostering blue jobs

There are a number of areas that are fast evolving and building future capacity and knowledge about future technology developments and industry-specific trends will be required to ensure these industries remain competitive heading towards the future. In the sector of renewable energy, Malta will be adding some renewables on land. However, for Malta to fulfil its targets

towards decarbonisation, it will require to invest in offshore floating wind farms and offshore photovoltaic farms, though the roadmap for offshore renewables still needs to be defined. Malta has a robust marine industry and there is a possibility for Malta to become a hub for marine services in the Mediterranean. This will require skills and graduates in engineering; as well as technical jobs and HTD-level trainees. Another avenue of opportunity lies in expanding the aquaculture industry. There is a need for specialist skills to establish a fully functional aquaculture industry. There is a lack of PhD specialisation areas such as in biostatistics as well as technicians, and scientists required to sustain an expanding aquaculture industry.

Local needs, threats and challenges regarding future blue jobs

A common denominator among PhD graduates in Malta is a need for these to adapt their transferable skills beyond the area of PhD specialisation in order to adjust to the requirements of the job. The importance of establishing interdisciplinary programmes of study represents an interesting opportunity for collaboration across disciplines and between public and private sector spheres. Equipping graduates with transferrable skills – time management, teamwork, problem-solving and analytical skills – enables them to adapt to changing working conditions.

A strength that graduates bring to the workplace is their perspective and new ways of doing things. Sense-making and critical thinking skills necessary to interpret and analyse complex problems and skills to tackle future uncertainties are crucial in sustaining blue jobs and addressing future needs of the industry.

Bridging between industry and academia:

A strong relationship with industry is crucial when developing new study programmes and for these to remain relevant in the long term. Building relations with industry requires both financial and human resources, as well as initiatives, were undertaken to raise awareness about opportunities for blue jobs and on the nature of these jobs and the skill set required. At national level, there needs to be a specific infrastructure dedicated to assessing and monitoring industry needs and the skills required 5 to 10 years in the future.

A challenge that needs addressing is the fragmentation of skills across different sectors of activity which results in skills gaps in niche areas. The skills fragmentation may also be exacerbated by inadequate channels of communication across different disciplines and scientists “speaking different languages”. Problem-solving requires graduates to develop soft

skills including negotiating skills, facilitation and communication skills as well as leadership and effective communication skills.

Another aspect is that there needs to be more awareness about career paths that do not necessarily tap PhDs. Strengthening the blue economy in Malta will require supporting diverse and broad skill set beyond that of PhDs to include vocational skills, diploma and technical skills.

The consultation sessions addressed a specific challenge linked to skills gaps, through the following question: "What skills needs, and gaps do you perceive between current graduate outputs and the skills requirements of today and tomorrow?" The question was analysed in relation to challenges towards 'digitalisation', 'green economy' and 'blue economy. These topics were discussed separately though the participants agreed several overlaps and synergies could be identified.

Digitization (big data, artificial intelligence, blockchain, machine learning, maritime security, virtual reality and maritime connectivity)
Digitalisation skills often represent a new skill set that requires 'on-the-job' training and practical experience in managing and analyzing large data sets using statistical programmes such as in fisheries and aquaculture. There appears to be a gap between the theoretical foundations offered by several university courses and the practical skills required such as for the use of statistical and software programmes adopted and implemented by the industry.
The rapid growth of ICTs and back-office support services in transport and logistics as well as in the offshore maintenance service industry offer opportunities for developing new jobs in the blue economy that need to be sustained by adequate theoretical and practice-based training.

Green Skills (energy management, risk analysis, circular economy, waste reduction, decarbonization)
The green and blue economies are relatively new and complex fields that include different sectors of activity and fields of study. This requires academia to adapt course curricula by providing opportunities for graduates to develop analytical and problem-solving skills rather than considering related subject areas in silos. Whereas graduates from the University of Malta and other higher education institutions are equipped with a good academic background, they often lack the practical and applied experience required for problem-

solving. The reasons may be two-fold. Certain academic courses are theory-oriented and, some may offer limited experience of fieldwork.

Blue Economy (preserve biodiversity, support vibrant coastal communities, develop green ports, harvest marine resources sustainably)

The blue economy is diverse, and a transdisciplinary approach is necessary in order to integrate multiple aspects related to preservation of biodiversity and cultural heritage, monitoring ocean health and sustaining blue growth and the production of food from the sea. At the same time, there are untapped opportunities related to identifying synergies between different sectors and areas of activity such as looking into the cultural heritage of fisheries and the maritime sector and the complementarities between tourism, cultural heritage and artisanal fishing as examples.

Several knowledge gaps were highlighted related to marine resources, understanding the topology of the sea and deep-sea observations. In this regard, an untapped opportunity relates to developing innovative applications for AI and machine learning in enabling deep sea observations and developing a better understanding of marine biodiversity. Several skills needs were also identified by the experts. In fisheries these related to the lack of a critical mass to undertake onboard observations. There is also a need and demand for professional divers and an opportunity to develop aquatic sports training.

Opportunities for joint stakeholder activities

University-industry collaboration

University-industry research can occur either through short-term collaboration and student internships or through longer-term collaboration in joint research and innovation partnerships. One avenue to explore further is the provision of internships both at Bachelor's and Master's level, such as those offered by the Department of Geosciences, the Faculty of Medicine and the Faculty of Education.

A drawback with organising student internships or placements is that companies are often over-stretched with operational activities and their own research agenda which leaves limited time for having someone responsible for student training and mentorship.

Industrial PhDs

The establishment of industry placements is considered a successful model to follow. There are advantages to PhD graduates and post-doctoral researchers working on an applied

research project in the industry and establishing industrial PhDs in Malta is an opportunity that needs to be tapped into. An assessment of whether different industries in Malta, are able to support an industrial doctorate would need to be undertaken in order to determine their capacity in terms of research and innovation infrastructures and human resources required to support this endeavour.

Nurturing Talent and Lifelong learning:

In order to enhance the visibility of marine and maritime professions, education institutions are required to develop or strengthen their maritime research agenda and offer professional staff working within the organisation the possibility to upskill and reskill. The latter could be achieved by establishing lifelong study programs that would require the simplification of administrative barriers. Developing and delivering upskilling programmes is seen as an opportunity to build and sustain ties with industry. Companies are often incentivized to sponsor short upskilling courses for reskilling or upskilling their own employees.

Raising awareness of marine and maritime professions

The marine and maritime industries need to be made more visible to students at all levels – bachelor, Masters, PhDs and technicians. This could be achieved in part by establishing and strengthening relations with industry stakeholders through networking and awareness-raising events, and consulting stakeholders on developments in the field when designing new or revising existing course curricula.

HEI could support the process by facilitating networking and interaction with industry and also raising awareness about job opportunities such as through student site visits to the industry sectors. Industry relations need to be sustained over time such as through dedicated activities championed by specific Institutes and departments to understand what skills are required and where the knowledge gaps lie. There is also scope for public research organisations to collaborate more with higher education institutions on emerging skills needs and gaps.

Short courses developed as part of capacity-building projects are also a means of communicating information about maritime professions and raising awareness of related opportunities.

4.2. Conclusions/lessons: what are the needs of stakeholders

The conducted survey and direct consultations with stakeholders complement each other excellently, and the consultations conducted in five different countries provided a wide spectrum and a real wealth of insight into current trends and future expectations and needs. Although different aspects of the fundamental question were considered and emphasized at different partner institutions, the answers and conclusions obtained are mutually compatible and complementary, and actually, support and better explain each other. Some of the fundamental conclusions that can be drawn from the conducted research can be summarized as follows:

- Stakeholders – companies in the area of the Blue Economy – need highly educated employees, and they will need them even more in the future. Today, the Master's profile is dominantly important to them, and the doctoral level is somewhat 'overqualified'. However, in the future, the postgraduate (doctoral) level of education will be more and more present and important for these companies, coming in importance even ahead of the undergraduate level. The need to revitalize and redefine the undergraduate level of study is emphasized, so that it provides qualifications for direct inclusion in work, and does not turn into preparation for graduate studies.

- Although they are quite satisfied with the level of knowledge that their staff bring from their university education today, stakeholders see a great need to raise the level of knowledge and competence of university-educated staff in the future. On the other hand, they are quite afraid that regular education will not be able to keep up with the pace of changes and the challenges that the future will bring (through technological development but also other aspects of change).

- Stakeholders express their willingness to be actively involved in education in cooperation with HEIs, but they often do not have enough information or initiatives on the part of universities. They emphasize the need to create more links between HEIs, research institutes and companies.

- They see the most important soft skills that employees in 'blue economy' companies need today and in the future in teamwork management, innovation, creativity, flexibility, initiative and decision making, and communication capacity; the skills of cooperation and joint

work, in order to achieve synergy and multiplicative effects of the joint use of knowledge and abilities.

- "Equipping graduates with transferrable skills - time management, teamwork, problem-solving and analytical skills - enables these to adapt to changing working conditions."

- Higher education (not only in the area of the Blue Economy) should obviously be increasingly interdisciplinary and multidisciplinary in the future. Those who study in STEM fields should also acquire a significant amount of knowledge and skills in the domain of 'soft skills' and 'interpersonal skills'. And vice versa - those who studying in social sciences should also acquire a significant amount of 'hard skills' (such as knowledge in the field of digital technologies, data analysis, technological knowledge, knowledge about climate change and ecology...)

- University education should include and integrate a high degree of practical learning (learning in practice, through practice and for practice), as well as a modular approach that allows one to continuously return to the education process during one's career. Lifelong education is not only the need of today and the imperative of tomorrow but should become the backbone of the entire higher education system.

CONCLUSIONS AND PROPOSALS - how HEI and PRO can help create sustainable jobs and growth in the 'blue economy' - in line with the needs of the identified (categories of) stakeholders

By connecting and comparing what was analyzed in part 3 concerning the 'offer' of higher education institutions that are members of the SEA-EU Alliance, with what was presented and analyzed in part 4 about the needs (current and especially future) of stakeholders from the Blue Economy domain, it is possible to derive conclusions about what HEIs and PROs can and should do in order to help create sustainable jobs in the domain of the Blue Economy. The basic guidelines can be systematized in the following way:

- HEIs and PROs should work in continuous, direct and close cooperation with stakeholders from all sectors of the Blue Economy. This means:

o Create stable and functional communication channels with stakeholders that will enable sustained assessing and monitoring of industry needs and the skills required 5 to 10 years in the future;

o Constantly update current curricula and teaching methods, and develop and introduce new ones, all in close connection with the development needs of stakeholders. Only in such a way it can be ensured that the study programs follow the rapid progress of science and technology and, at the same time, adapt it to the application needs of stakeholders from the Blue Economy.

- Study programs in the field of the Blue Economy should be designed in such a way that they have a clear learning outcome and employability at each level.

o This especially applies to undergraduate studies, which should not become primarily a preparation for entering graduate studies.

o But this also applies to doctoral study programs - the concept of 'industrial doctorate' should be applied and developed, which means PhD students and post-doctoral researchers working on applied research projects in the industry.

- Study programs should be designed as multidisciplinary and interdisciplinary. Even in those programs that are dominantly profiled in one area, students should be given enough opportunities and space to acquire multidisciplinary knowledge and skills in their education

(through compulsory or elective subjects); study programs should allow greater flexibility in the design of studying programs and their adaptation both to changes in the environment and to the needs of individual students and their employers.

- Study programs should include a clear and significant component of practical work ('internship', placement into companies and other forms of practical education and involvement of students)

o These practices should also be developed in close cooperation with industry stakeholders because they can best evaluate what practical knowledge and skills students need, but also offer ways to acquire and apply these experiences.

- Research and consulting cooperation between HEI and PROs and stakeholders should be created, encouraged and developed as a two-way channel, through which knowledge and skills will be developed and transferred in both directions:

o On the one hand, direct and quick observation of the needs (and changes in needs) of stakeholders for knowledge and skills;

o On the other hand, a path for direct and functional transfer into practice of the latest scientific and technological knowledge created and aggregated by HEIs and PROs.

- New and existing lifelong education programs should be developed and strengthened. That will offer professional staff working within companies the possibility to upskill and reskill. In addition, such activities will further strengthen the ties between HEIs and industry. Of course, stakeholders from the field of the Blue Economy should also be strongly involved in the design of lifelong education programs.

- HEIs and industry stakeholders should actively work together on raising awareness about marine and maritime professions, and job opportunities in Blue Economy. It must make more visible to students at all levels, but also to HEIs what skills are required and what are emerging skills needs and gaps.

These guidelines are only indicative and try to summarize and highlight the most important ideas and conclusions arising from the experiences of SEA-EU Alliance partners and stakeholders who were included in the survey and direct consultations. However, the real wealth of experiences and ideas is found in the details presented in the body of the White Paper, and they should be constantly returned to and referred to.

On the other hand, this White Paper represents only the initial basis for creation and launching activities of the European Observatory for Sustainable Blue Growth as a "platform for raising awareness of marine and maritime professions and their appeal to young people, promote circular migration and form strategies for matching supply and demand for jobs", through the work of the Observatory, knowledge and ideas from this White Paper will be constantly further developed, upgraded and deepened.