SustainaBlue

HEIs stands for Higher Education Institutions

HEIs for Sustainable Blue Economy in Malaysia and Indonesia

SustainaBlue

D2.2 Report of successful Quintuple Helix frameworks/models

ERASMUS Lump Sum Grants

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symplexis

Supporting Malaysian and Indonesian HEIs to boost their relevance to the labor market and society for a sustainable blue economy and green transition

PROJECT PARTNERS:

Malaysia

UNIVERSITI MALAYSIA TERENGGANU

UNIVERSITI SAINS MALAYSIA

MALAYSIA AQUACULTURE DEVELOPMENT ASSOCIATION

Indonesia

UNIVERSITY OF INDONESIA

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Greece

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AEGEAN REBREATH

SYMPLEXIS

Cyprus

UNIVERSITY OF CYPRUS

CSI CENTER FOR SOCIAL INNOVATION LTD

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Document Identification:

Work Package	2. Establishment and operation of Sustainable Blue Economy Centres for collaboration with blue industries, local authorities and other stakeholders
Task	T2.1 Collection of successful Quintuple Helix frameworks/models from the partner EU MSs and/or other EU MSs, assessment of their transferability to the Asian context, and elaboration of recommendations for effective adaptation/replication
Deliverable title	D2.2 Report of successful Quintuple Helix frameworks/models
Lead Partner	Symplexis
Author(s)	Symplexis, Aegean Rebreath, University of Aegean, University of Cyprus, CSI
Dissemination level	Public
Abstract	The current document constitutes a collection of Quintuple Helix models and practices in the EU context, especially Greece and Cyprus, as identified by the respective partners through primary and secondary research.
Status	Final
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Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE

Contents

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Executive Summary

The current Report on Successful Quintuple Helix frameworks and models was developed within the framework of the "SustainaBlue" project, whose overall and main aim is to support Malaysian and Indonesian Higher Education Institutions (HEIs) in boosting their relevance to the labour market and society for a sustainable blue economy and green transition, by strengthening the blue economy skills and capacities of HEIs' staff, enhancing the cooperation between the HEIs and the industry, and by raising awareness on sustainable blue careers.

This report presents a consolidated analysis of the data collected through primary and secondary research activities realised by the project partners in Greece (Aegean Rebreath, University of Aegean, Symplexis) and Cyprus (University of Cyprus, CSI Centre for Social Innovation). More specifically, partners conducted desk research to explore and determine the state-of-play of blue economy in the European context, with special emphasis on Greece and Cyprus, as well as to identify key successful Quintuple Helix Innovation practices in the field of blue economy. Furthermore, they also conducted field research, in the form of semi-structured interviews with 15 blue economy experts, to get further information and insight into the matters at hand (Quintuple Helix Innovation, blue economy, best practices, transferability potential, etc.).

As such, the report comprises an overview of the EU and national contexts with regard to blue economy, followed by a detailed presentation of the identified best practices and an analysis of the interview findings. The report concludes with recommendations to be taken into account in the next steps of the project, which pertain to the assessment of the transferability potential of the identified practices into the Asian contexts (Malaysia and Indonesia).

List of abbreviations

Abbreviation	Definition
BMN	Blue Municipalities Network
EACEA	The European Education and Culture Executive Agency
EGD	The European Green Deal
ESG	Environmental, Social and Governance
EU	The European Union
GVA	Gross value added
HCMR	Hellenic Centre for Marine Research
HEIs	Higher Education Institutions
MSc	Master of Science
SDGs	Sustainable Development Goals
SWOT Analysis	Strengths, Weaknesses, Opportunities, and Threats Analysis

Introduction

The present Report was developed within the scope of the SustainaBlue project, a three-year Capacity Building for Higher Education project implemented with the financial support of the Erasmus+ project of the EU. The current report constitutes a comprehensive and consolidated analysis of successful blue economy practices/models identified through the primary and secondary research activities performed by the Greek and Cypriot partners (UAEGEAN, AR, UCY, CSI, Symplexis). This report, thus, seeks to collect the identified successful Quintuple Helix frameworks/models from the EU context, with the aim to later assess their transferability potential to the Asian context. Subsequently, this report will lead to an elaboration of recommendations for their effective adaptation/replication in the Asian HEIs.

The SustainaBlue project

SustainaBlue aims to support Malaysian and Indonesian Higher Education Institutions (HEIs) in boosting their relevance to the labour market and society for a sustainable blue economy and green transition. More specifically, the project aims towards:

1. Strengthening the skills of HEIs teaching staff on curriculum development and teaching methods and content on the next generation of blue skills.
2. Improving the capacities of HEIs staff on active cooperation with stakeholders (i.e., Quintuple Helix, see sections below).
3. Strengthening the cooperation of HEIs with the industry and other stakeholders to address mismatches between the requirements of employers and the offer of HEIs, and to promote Quintuple Helix innovation (Industry-Government- Public and Civil Society-Environment).
4. Modernising the academic offer of HEIs towards a sustainable blue economy.
5. Transferring of HEIs teaching and/or research results to the local coastal communities.
6. Improving the level of skills and employability potential of students in a sustainable blue economy.
7. Enhancing reskilling/ upskilling of the active labour force in the blue industries on the next generation of blue skills.
8. Raising awareness among students, especially women, on "sustainable blue careers".

The project aims to directly and indirectly benefit HEIs staff and students, blue industries, and the local communities. SustainaBlue is being funded by the European Union & the EUROPEAN EDUCATION AND CULTURE EXECUTIVE AGENCY (EACEA), under the Erasmus LS Capacity Building in Higher Education programme, and will last from 01/12/2023 to 30/11/2026.

Overview and scope of the present report

The current report has been created within the 2nd Work Package (WP), titled "Establishment and operation of Sustainable Blue Economy Centres for collaboration with blue industries, local authorities and other stakeholders". This WP aims to (a) improve the capacities of HEIs administrative and teaching staff on active cooperation with stakeholders (Quintuple Helix); (b) strengthen the cooperation of HEIs with the industry and other stakeholders to address mismatches between the requirements of employers and the offer of HEIs; (c) promote the Quintuple Helix innovation (Industry-Government-Public and Civil Society-Environment); and (d) transfer the HEIs teaching and/or research results to the local coastal communities, thus creating social value.

In this context, this report seeks to provide a comprehensive collection of successful Quintuple Helix innovation models and practices (see sections below) in the blue and green economy in the EU (mainly in Greece and Cyprus), which will help in the design of the next project activities. More specifically, based on the findings of the present report, a set of recommendations for the effective adaptation and replication of the identified successful best practices will be developed, based on which the 4 Asian HEIs will initiate the setup and operation of their "Sustainable Blue Economy Centres".

Methodological framework

The identification of successful practices and models in the EU context was realised through primary and secondary research, for which a detailed methodological framework, including research guidelines, tools, and templates was developed by Symplexis, as the WP leader, to guarantee a shared methodological approach among the partners (namely, AR, UAEGEAN, Symplexis, UCY, CSI).

In accordance with the methodological framework, the primary goals of the mapping study were:

- To map the existing successful Quintuple Helix models in the sectors of blue and green economy in the EU, particularly in Greece and Cyprus, and
- To get deeper insights into the issue by tapping into the knowledge and expertise of blue economy, green growth, and/or Smart Specialization Strategies experts.

To that end, desk and field research (in the form of semi-structured interviews) was undertaken by the EU partners, and the respective results were summarised in brief partner reports, which resulted in the current consolidated report. The identified best practices, along with the answers of the 15 interviews with blue economy experts will be presented and analysed in the next sections.

The Quintuple Helix

SustainaBlue aims to foster structured collaboration between academic institutions in Malaysia and Indonesia, the blue economy industry and other relevant stakeholders, to promote curricula, research, and innovation that address the gaps in the market in line with ongoing technological developments, and the needs and challenges of local communities and natural environments (**Quintuple Helix innovation: University-Industry-Government-Public & Civil Society-Environment**). The adoption of the Quintuple Helix model of social innovation will pave the way for producing green (blue) knowledge and innovation, as it stresses the necessary socioecological transition of society and economy. Within the framework of the Quintuple Helix innovation model, the natural environments of society and the economy are also seen as drivers for knowledge production and innovation, therefore defining opportunities for the knowledge economy. **The Quintuple Helix supports the formation of a win-win situation between ecology, knowledge, and innovation, creating synergies between economy, society, and democracy.**

The Quintuple Helix visualizes the collective interaction and exchange of knowledge in a state by means of the following five sub-systems (i.e., helices): (1) education system, (2) economic system, (3) natural environment, (4) media-based and culture-based public (civil society), (5) and the political system (Carayannis & Campbell, 2010, pp. 46–48, 62). In essence, it constitutes a practical & theoretical model for the exchange and circulation of knowledge between the 5 aforementioned helices, aiming towards sustainable development for the society as a whole. Each of these 5 sub-systems/helices has a specific function and relevance (Carayannis, Barth, & Campbell, 2012, pp. 5-6):

a. The education system, which defines itself in reference to 'academia', 'universities', 'higher education systems', and schools. In this helix, the necessary 'human capital' (for example students, teachers, scientists/researchers, academic entrepreneurs, etc.) of a state is being formed by diffusion and research of knowledge.
b. The economic system, which consists of 'industry/industries', 'firms', services, and banks. This helix concentrates and focuses on the 'economic capital' (for example: entrepreneurship, machines, products, technology, money, etc.) of a state.
c. The political system, which formulates the 'will', where the state is heading toward in the present and future, thereby also defining, organizing as well as administering the general conditions of the state. Therefore, this helix has a 'political and legal capital' (for example: ideas, laws, plans, politicians, etc.).
d. The media-based and culture-based public integrates and combines two forms of 'capital'; On the one hand, this helix has, through the culture-based public (for example: tradition, values, etc.), a 'social capital'.

On the other hand, the helix of media-based public (for example: television, internet, newspapers, etc.) contains also 'capital of information' (for example: news, communication, social networks).

e. The natural environment is decisive for sustainable development and provides people with a 'natural capital' (for example: resources, plants, variety of animals, etc.).

The Quintuple Helix innovation model thus suggests that these 5 sub-systems/helices influence each other, and the input of knowledge in one of them creates a ripple effect that reverberates on the other ones.

The state-of-play of Blue Economy in the EU

The health and well-being of oceans are essential for the overall balance of the planet; therefore, the sustainable management of marine resources is crucial for the continued prosperity of human societies (European Investment Bank, 2023). Likewise, the health of oceans greatly benefits the European economy and contributes to overall prosperity, through various sectors such as marine living and non-living resources, offshore wind energy, port activities, shipbuilding and repair, maritime transport, and coastal tourism. Furthermore, emerging and innovative sectors like marine renewable energy, blue biotechnology, desalination, maritime defence, security, and surveillance, as well as research and infrastructure, are instrumental towards enhancing economic development, generating investment and jobs (European Commission, et al., 2023).

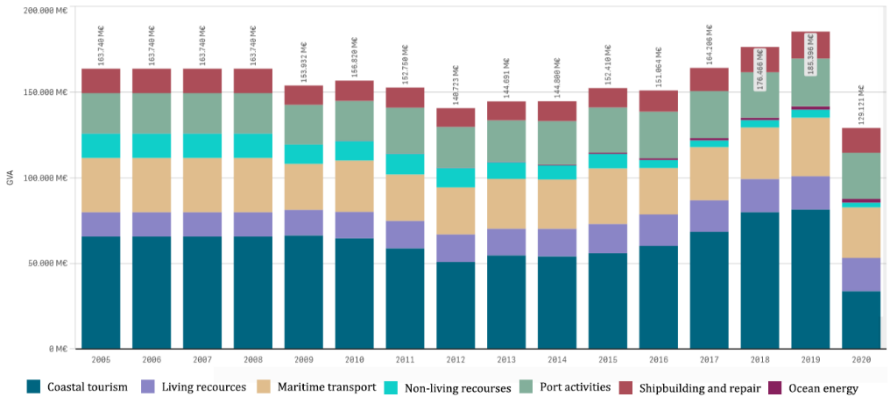
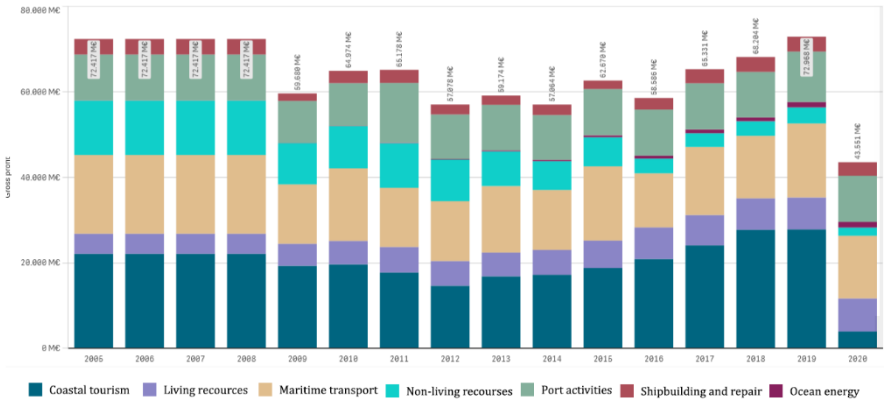


Figure SEQ Figure * ARABIC 1: EU GVA over time by sector



Source: European Commission, 2024

Figure SEQ Figure * ARABIC 2: EU Gross profit over time by sector

The annual value of the global ocean economy is estimated to be $2.3 trillion, which is approximately equivalent to the economic output of the world's fifth-largest economy (United Nations Development Programme, 2022). The significance of the Blue Economy is also particularly important in the broader EU economy. Based on 2019 data – predating the COVID-19 pandemic which led to a significant decline in the blue economy–, the Blue economy represented 1.5% of the Gross Value Added (GVA) and 2.3% of the total employment in the European economy. This indicates a noteworthy rise starting from 2012 (European Commission et al., 2022). In the year 2020, the Blue Economy well-established sectors within the European Union, encountered a remarkable reduction in their Gross Value Added (GVA), Gross Operating Surplus, total turnover and employment that can be attributed to the implementation of diverse COVID-19 measures. Nevertheless, the GVA stood at €129 billion, with Gross Operating Surplus reaching €43.6 billion and the overall turnover of these sectors totalling €523 billion. Significant decrease (26%) was identified in the employment sector as well, taking into account that approximately 3.34 million people worked in the established sectors of the EU Blue Economy in 2020. Coastal tourism experienced the most significant impact and was followed by Maritime transport and Non-living resources. The only sector that saw growth in 2020 was Offshore wind energy (European Commission et al., 2023).

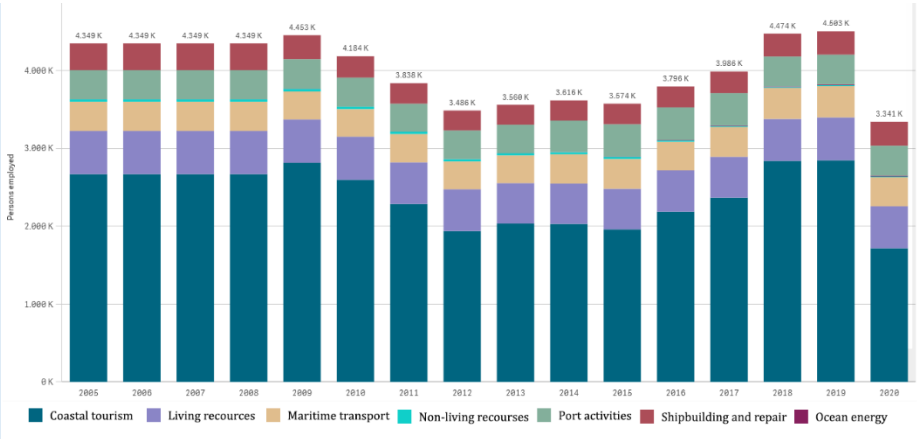


Figure 3: EU, Persons Employed by sectors

Source: European Commission, 2024

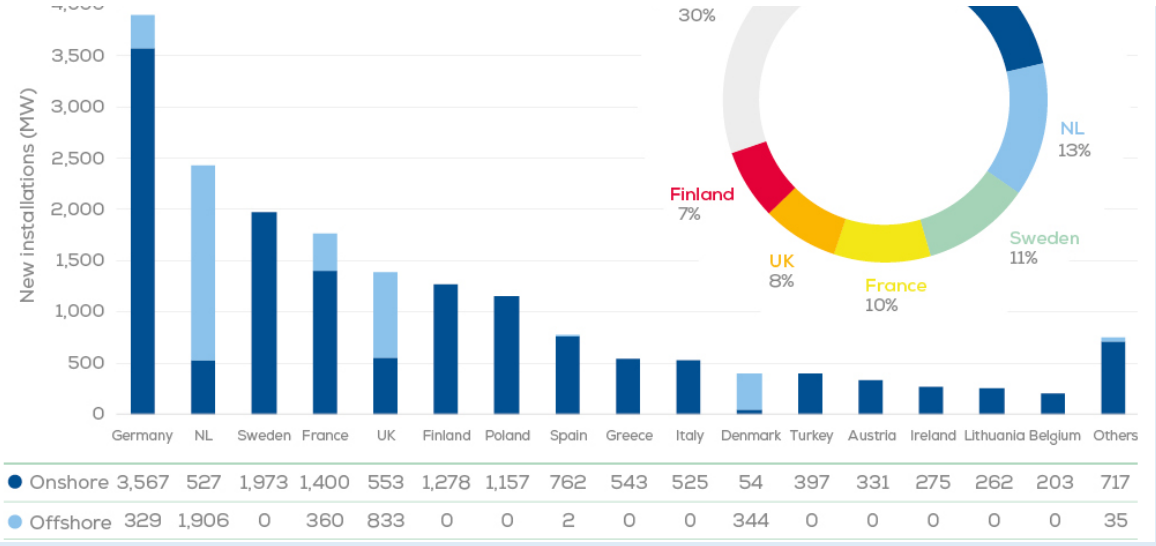
However, the economic and financial aspects that lie at the core of the activities often overshadow the social and environmental dimensions of the blue economy. Consequently, the European Commission endeavours to establish a genuinely sustainable blue economy, recognizing the need to prioritise the social and environmental aspects alongside the economic and financial considerations (European Commission, European Climate, Infrastructure and Environment Executive Agency, 2021). Several criteria and guidelines contribute to ensuring a sustainable Blue Economy in Europe which align with the EU's commitment to the United Nations' Sustainable Development Goals (SDGs). These are outlined in various EU policies and strategies, including the Blue Growth Strategy, the European Green Deal, and the EU Maritime Spatial Planning Directive. The objective is to create a Blue Economy that fosters economic growth while safeguarding the conservation of marine and coastal biodiversity. The European Commission highlights the importance of preventing overfishing by promoting responsible fishing practices, encouraging sustainable and environmentally friendly aquaculture practices, taking measures to reduce marine litter, prevent pollution, managing waste effectively, promoting the development of renewable energy sources, encouraging sustainable tourism practices and supporting research and innovation (European Commission, European Climate, Infrastructure and Environment Executive Agency, 2021; European Investment Bank, 2023; COM (2021) 240 final, 2021).

The Blue Economy is key to solving societal grand challenges while offering many solutions to achieve the EGD objectives. However, this requires some of the current activities, technologies, and processes to reduce their carbon footprint, while climate neutral activities and technologies need to significantly contribute to the EU Blue Economy (European Commission, n.d.). A great example towards this direction is the development of offshore renewable energies that demonstrates the added value of EU support and funding. However, the enhancement of offshore infrastructure highlights the need for increased funding and the instrumental role of maritime spatial planning. The challenges identified in the offshore renewable energies sector reveal the need for further policies that will also facilitate the coexistence of

different sectors at sea, the reduction of tensions with the fisheries sector, the promotion of common projects between countries sharing maritime borders, and the efficient use of marine spaces (European Court of Auditors, 2023).

The enhancement of the Blue Economy must remain sensitive to its socioeconomic and environmental impacts. Changes in marine ecosystems could lead to habitat loss and degradation, therefore the effect of offshore technologies on the environment should be further examined (European Commission, European Climate, Infrastructure and Environment Executive Agency, 2021). By integrating these considerations into the Blue Economy planning, it's possible to pursue economic growth while safeguarding marine ecosystems and the well-being of coastal communities.

Figure SEQ Figure * ARABIC 4: New Onshore and offshore wind installations in Europe in 2023



Source: (Wind Europe, 2024)

Blue Economy in Greece

Throughout the ages, Greece has been deeply intertwined with the sea, boasting a coastline that spans over 13,600 kilometres and includes islands in the Aegean and Ionian Seas (Civic Nation, n.d.). The sea has always been a cornerstone in shaping culture, economy, and sense of self.

Today, the traditional foundations of the economy, fishing and shipping, remain vital to Greece's economy by generating jobs supporting communities and adding to the country's prosperity.

Nevertheless, these sectors encounter obstacles like overfishing, marine pollution, complex regulations, and market fluctuations. Although fishing is deeply rooted in communities and cultural heritage, it faces sustainability issues due to overexploitation, habitat damage, and illegal fishing practices. Greece has taken steps, such as fisheries management plans and marine protected areas establishment, to promote sustainable fishing practices and safeguard marine environments. Furthermore, these efforts have been bolstered through innovative technologies, like satellite monitoring systems and vessel tracking.

As a top player in the maritime sector, Greece holds a prominent position with its Greek-owned ships forming a substantial part of the world's commercial fleet. Nonetheless, challenges, such as freight rates, compliance costs related to regulations, environmental concerns, and technological advancements pose hurdles for the shipping industry, which is going through changes due to digitalization, automation, and efforts to reduce carbon emissions.

Greece's blue economy is also expanding into new frontiers, one of which is marine renewable energy, which holds immense potential given the country’s abundant solar power, wind resources, and access to marine technologies. Offshore wind farms, wave energy converters, and tidal power installations represent promising avenues for clean energy production, job creation, and economic development in coastal regions. Aquaculture, the farming of fish, shellfish, and seaweed, is another burgeoning sector, which offers a sustainable alternative to meet protein needs while minimising environmental impacts (Delphi Economic Forum, 2024).

Aquaculture, the farming of fish, shellfish, and seaweed, is another burgeoning sector within Greece's blue economy. With growing demand for seafood and concerns about the sustainability of wild fisheries, aquaculture offers a sustainable alternative to meet protein needs while minimizing environmental impacts. (Aquasafe, n.d.) Greece's favorable climatic conditions, pristine waters, and expertise in marine sciences position it as an ideal location for aquaculture expansion and innovation. By investing in research, infrastructure, and capacity building, Greece can capitalize on its aquaculture potential and become a leader in sustainable seafood production.

Marine biotechnology, which involves the discovery and development of novel products and processes derived from marine organisms, offers opportunities in areas such as pharmaceuticals, cosmetics, nutraceuticals, and biomaterials. By fostering collaboration between academia, industry, and government agencies, Greece can unlock the commercial potential of its marine biodiversity while safeguarding marine ecosystems and genetic resources.

A lesser-known ecosystem service of seagrass meadows is their immense carbon sequestration and storage potential (blue carbon) which make these habitats ideal candidates for nature-based solutions

to help countries meet their climate change commitments under the Paris Agreement (The Blue Carbon Initiative, n.d.).

Maritime transport, coastal tourism and development, and the fishing industry in Greece embody a dynamic interplay of five key stakeholders, relying on the collaboration between government, academia, industry, civil society, and media. The government sets rules for safe and sustainable maritime activities and to protect marine life, while the academia conducts research to improve fishing methods and understand marine ecosystems, providing knowledge and training for maritime professionals. The shipping companies, the fishing, and coastal development sectors adapt to regulations and invest in sustainable practices, boosting the economy, while citizens embrace maritime culture, contributing to the sector through work and tourism. Civil Society Organizations advocate for responsible maritime practices and workers' rights, raise awareness about conservation, and participate in coastal management, advocating for policy changes and mobilising resources. Together, these groups drive Greece's maritime sector, balancing economic growth with environmental and social concerns (UGS, n.d.).

Greece has tried harmonising its policies with EU directives and initiatives geared towards promoting sustainable development fostering innovation and encouraging international collaboration. Nationally Greece has made progress in crafting a maritime strategy that aligns economic growth goals with environmental sustainability targets. By leveraging programmes like the European Maritime and Fisheries Fund (EMFF) and Horizon Europe, Greece taps into funding sources for research projects, innovative endeavours, and capacity-building efforts within the industry. Additionally, Greece participates in regional and global platforms like the Union for the Mediterranean (UfM) and the International Maritime Organization (IMO) to tackle mutual challenges and advance shared objectives in the blue economy. Nationally, Greece has made progress in crafting a maritime strategy that aligns economic growth goals with environmental sustainability targets. The launch of the National Strategy for the Sea and Maritime Economy in 2016 serves as a guide to drive growth, boost competitiveness and protect marine ecosystems.

The adoption of technology also plays a crucial role in driving progress, effectiveness, and eco-friendliness in various sectors of the ocean economy. Within the shipping sector, digital platforms, intelligent sensors, and predictive analysis tools allow ship owners and operators to enhance vessel performance, improve fuel efficiency, and decrease carbon emissions, while remote sensing technologies, like satellite imagery and unmanned aerial vehicles, assist in surveillance efforts, boosting awareness of maritime domains and aiding search and rescue missions. In aquaculture practices, precise farming methods along with automated monitoring systems enable farmers to optimise feed

management processes, while ensuring that water quality standards are met. Integrated aquaponics systems, that combine fish farming with cultivation, offer opportunities for resource efficiency improvements as well as income diversification through waste recycling initiatives. In addition, advancements in biotechnology, like breeding initiatives and developing disease-resistant varieties, play a key role in enhancing the longevity and robustness of aquaculture practices, not only in Greece but also globally.

The blue economy presents an economic opportunity for Greece, creating jobs, encouraging investments, and supporting the development of coastal regions. Reports suggest that the maritime industry contributes around 7% to Greece's GDP and employs more than 300,000 individuals in various maritime-related fields, like fishing, shipping, tourism, and marine services (IOBE, 2023). Additionally, the blue economy has ripple effects on other sectors like manufacturing, construction, and services by generating indirect employment opportunities and added economic value. The blue economy also brings social benefits, such as preserving culture, strengthening community resilience, and enhancing human well-being. Coastal communities in Greece not only depend on the sea for their livelihoods, but also for recreational activities, cultural traditions, preserving cultural heritage sites, supporting community-driven projects, and shaping their identity.

Blue economy offers opportunities for growth and development, but it also brings risks to marine ecosystems, biodiversity, and ecosystem services. Practices like fishing, habitat destruction, pollution, and climate change are putting the health and resilience of oceans, seas, and coastal areas at risk worldwide. To balance progress and environmental conservation in the blue economy, Greece can utilise tools like Integrated Coastal Zone Management (ICZM), Marine Spatial Planning (MSP), and ecosystem-based approaches. Furthermore, Greece must focus on strategies for both mitigating and adapting to climate change to address the effects of rising sea levels, ocean acidification, and extreme weather events on communities as well as marine ecosystems. Greece, being part of agreements like the Paris Agreement and the Convention on Biological Diversity (CBD), has pledged to decrease greenhouse gas emissions, strengthen climate resilience, and support adaptation measures based on ecosystems. By integrating climate concerns into policies, infrastructure projects, and natural resource management strategies, Greece can play a role in worldwide endeavours to address climate change and safeguard marine biodiversity.

Blue Economy in Cyprus

Cyprus' connection to the sea is fundamental to the nation's economy. The Blue Economy plays a vital role in fostering each nation's progress. Given Cyprus' status as an island, its Blue Economy is mainly driven by coastal tourism, followed by the maritime transport industry. Moreover, the aquaculture sector, particularly in Cyprus, is steadily advancing to fulfil both local and international demands for premium food products. Acknowledging the pivotal role of tourism and maritime transport in Cyprus' economic growth, the Deputy Ministry of Tourism and the Deputy Ministry of Shipping were established in 2018.

Tourism in Cyprus holds significant importance, due to the country's geographical features and historical growth. As the third largest island in the Mediterranean, after Sicily and Sardinia, Cyprus has been a prominent tourist destination since the establishment of the Republic in the 1960s. Its appeal lies in its tourism offerings, strategic location, and favourable climate, attracting a substantial number of visitors annually.

Despite recent successes, Cyprus' tourism sector faces specific challenges, notably in extending the tourist season beyond the summer months and diversifying its source markets. The traditional reliance on the "sun and sea" tourism model poses limitations. To overcome these challenges, the Deputy Ministry of Tourism has developed the National Tourism Strategy 2020-2030 (Cyprus Tourism Strategy 2030, n.d.), aiming to transform Cyprus into a year-round, high-quality, digitally savvy, and socially beneficial destination. This strategy emphasises promoting various forms of tourism where Cyprus holds a competitive edge, including sports, cultural, religious, conferences, and rural tourism. Additionally, there's a focus on developing specific tourist infrastructure projects like casino resorts, golf courses, and marinas to boost economic growth and employment opportunities.

Cyprus has also emerged as a prominent global shipping hub, contributing significantly to its economy and employment landscape. Despite challenges, shipping remains a vital sector, contributing around 7% of the GDP, with approximately €1.2 billion. The industry employs about 3% of the active workforce, including over 55,000 seafarers on Cypriot-flagged vessels and 9,000 individuals in shipping companies based in Cyprus. Cyprus boasts the 11th largest fleet globally and the 3rd largest in the EU, solidifying its position as a premier ship management centre (Shipping Deputy Ministry of Cyprus, n.d.).

The elements that have contributed to the advancement of this particular sector and the elevation of the Cypriot flag to one of the most esteemed and competitive worldwide are manifold. They encompass the strategic geographical location of the country, situated at the crossroad of three continents, its extensive maritime heritage, the ongoing enhancement of its maritime infrastructure, its membership within the

EU, the specialised expertise within its workforce, the advantageous taxation system, the presence of a robust shipping cluster dedicated to delivering top-notch services, and the strategic bilateral agreements - whether regional or international - forged between Cyprus and other countries, which hold significant importance.

The fisheries industry in Cyprus encompasses various fishing methods, including coastal fishing, bottom trawling, and multipurpose vessel fishing. Alongside professional fishing activities, amateur fishing is also common in Cypriot waters, whether conducted from the shore or from boats. The primary targets of Cyprus' fisheries sector are divided into two main categories: demersal species, and large pelagic species.

The yearly economic contribution of fisheries in Cyprus is relatively modest, estimated at around €7.4 million, with an annual fish production totalling approximately 1,200 tonnes (Department of Fisheries and Marine Research, n.d.). On average, each person in Cyprus consumes around 20 kilograms of fishery products per year. Despite its comparatively small scale, the fisheries sector holds significance for the country, as it provides economic and social advantages to coastal communities, fosters employment opportunities, and offers nutritious food options to consumers. In Cyprus, approximately 1,276 individuals are directly employed in fishing activities, comprising 803 full-time and 473 part-time workers (Department of Fisheries and Marine Research, n.d.).

The fisheries industry in Cyprus is currently struggling with significant sustainability challenges stemming from a variety of factors. These include the overexploitation of certain marine species, both benthic and pelagic, as well as the relatively low productivity of the regional water sides. Moreover, the fishing areas in Cyprus are constrained due to the ongoing Turkish occupation of the northern part of the island, while fisherpersons often lack professional training in modern fishing techniques and navigation methods. Additionally, consumer preferences for specific types of fish, coupled with resistance to embracing new species, further compound the situation. Furthermore, the proliferation of invasive alien species is exacerbating the negative impacts on marine ecosystems and the fisheries sector. Addressing these issues is crucial, including the imperative to enhance the marketing system for fisheries products.

On the other hand, Aquaculture stands out as a key segment within the Blue Economy of the island, continually evolving to meet the demands of both the local Cypriot market and the expanding global appetite for fisheries products. Over time, the significance of aquaculture has grown significantly, with its contribution to the global consumption of fisheries products rising from approximately 10% (1970s) to about 50% as of today (Department of Fisheries and Marine Research, n.d.). In Cyprus, aquaculture

plays a pivotal role, forming an integral part of the national fisheries sector by representing approximately 80% of both the quantity and value of total fisheries production. Moreover, it ranks as the third most vital export product by value within the broader agricultural primary production sector (Department of Fisheries and Marine Research, n.d.). The total value of aquaculture products in 2020 reached approximately €39.7 million, with direct full-time employment in the aquaculture sector numbering 315 individuals, complemented by a larger workforce engaged in aquaculture-related occupations.

In Cyprus, nine licensed marine open sea cage farms are currently operational, primarily focusing on the cultivation of European seabass and gilthead seabream. Additionally, there are three marine hatcheries, one land-based shrimp hatchery/farm, and eight small freshwater units specialising mainly in rainbow trout with smaller quantities of sturgeon. Besides these private fish production facilities, there are also two government-operated aquaculture research stations—one dedicated to marine species and the other to freshwater species. The primary marine species commercially cultured include gilthead seabream (Sparus aurata) and European seabass (Dicentrachus labrax), with seabream accounting for 65% and sea bass for 35% of the total production (Department of Fisheries and Marine Research, n.d.).

Significantly, the establishment of offshore aquaculture units using open sea cages is gaining popularity in Cyprus. This method, known for its environmentally friendly approach to intensive fish farming, aims to further enhance the development of marine aquaculture in Cyprus.

In summary, Greece and Cyprus' blue economy offers potential for sustainable growth, economic success, and environmental protection in the 21st century. By utilising their history, natural assets, and skilled workforce, the two countries can create new solutions, encouraging inclusive development, and strengthening resilience against global issues. Through planning, consistent policies, and cooperation among stakeholders, they can fully tap into the advantages of the blue economy, while also safeguarding marine environments, supporting coastal communities, and promoting fairness in society.

Collection of successful Quintuple Helix models and practices in blue economy

In this section, the most successful practices in the blue economy in the EU, particularly in Greece & Cyprus, will be presented, as identified by the respective project partners.

1. PROJECT AQUASAFE - Towards a precision aquaculture geoinformation system

Country:	Greece
Institution(s) involved:	• Marine Remote Sensing Group (MRSG) | Department of Marine Sciences | University of the Aegean • GEOSPATIAL ENABLING TECHNOLOGIES (GET) • PLAGTON SA • Hellenic Centre for Marine Research (Institute of Oceanography)
Short Description:	Following the trend for "precision culture", at the research level there is a growing interest in the precise definition of the most economical and effective technical management tools and the ability to control and monitor aquaculture units, even remotely. Creating a geoinformation system for monitoring aquaculture using high resolution satellite data (optical and radar) in combination with field data (historical and real time) is an innovative idea and is considered to contribute to the production of new knowledge, both nationally and internationally. **The project aimed to create an integrated geoinformatics system for remote monitoring and early warning in aquaculture.** The system developed can be used by the aquaculture manager and will inform about phenomena that may be a threat to aquaculture, directly or indirectly. Examples of such phenomena are the development of harmful algal blooms, jellyfish blooms and transfer of pathogenic microorganisms and nutrients. Monitoring will be done through analysis of high-resolution satellite imagery and in-situ data. The main objectives of the system are: (1) the use of a biological prediction model for growth and consumption of food as well as oxygen requirements, (2) the implementation of a model of measuring environmental parameters in the field by means of smart devices (internet of things) interconnecting them in multiple units, (3) the monitoring environmental parameters using remote sensing from satellite systems, (4) the development of early warning models, and (5) the development of a geoinformatics system for monitoring and early warning.
The Quintuple Helix:	1. **The education system:** the owners of aquacultures can be trained to use the platform in benefit of their production. 2. **The economic system:** By leveraging sensors, automation, and real-time monitoring systems, precision aquaculture optimises production processes,

	leading to higher yields, improved resource efficiency, and increased profitability. 3. **The political system:** from advancing sustainable development goals to bolstering food security and fostering economic growth, precision aquaculture holds the potential to shape political agendas, strengthen governance, and drive positive change for both nations and the planet**.** 4. **The media-based and culture-based public precision:** aquaculture lies in its ability to preserve cultural heritage and traditional fishing practices. In many coastal communities and indigenous societies, fishing isn't just an economic activity but a deeply ingrained cultural tradition passed down through generations. 5. **The natural environment:** by maximising production efficiency, precision aquaculture helps alleviate pressure on wild fish stocks. As the global demand for seafood continues to rise, this sustainable method provides a viable alternative to traditional fishing practices, thereby promoting the conservation of marine biodiversity
Trends & Benefits from this Best Practice	Automation, sensors, and data analytics are revolutionising aquaculture practices. Robotics assist in tasks like feeding and monitoring, cutting labour costs and enhancing efficiency. Integration of sensors and IoT devices enables real-time monitoring of water quality parameters, empowering farmers to optimise conditions for fish health. Data analytics and AI analyse large datasets to optimise feed management and disease detection. Remote monitoring systems allow for oversight from anywhere, ensuring swift responses to emergencies. Precision feeding minimises waste, improves conversion ratios, and reduces nutrient pollution. These innovations promise to reshape aquaculture for sustainable and efficient production.
Short SWOT analysis	***Strengths:*** accuracy, efficiency, real-time monitoring, automation, and customization. ***Weaknesses:*** high costs, complexity, reliability issues, maintenance, and expertise requirements ***Opportunities:*** integration with other agricultural technologies, Expansion into new markets, Adoption of sustainable practices ***Threats:*** regulatory changes, data security, competition, market fluctuations, and resistance to change
How could this Best Practice be	Accuracy and digital monitoring practices, which involve advanced technology to track and manage various aspects of fish farming operations, can be seamlessly applied to other aquaculture sectors. For instance, in shell farming, where the cultivation of molluscs like oysters and mussels takes place, similar precision in

used/transferred in other contexts?	monitoring water quality, feeding regimes, and environmental conditions could enhance efficiency and productivity. Likewise, in aquaponic cultures, which integrate fish farming with hydroponic plant cultivation, the implementation of digital monitoring can optimise nutrient levels, water circulation, and overall system performance. By leveraging these proven practices across different aquaculture domains, the industry can achieve greater sustainability, profitability, and environmental stewardship.
Link:	www.aquasafe.gr
More Resources & Info:	• Chatziantoniou A., Papandroulakis N., Stavrakidis-Zachou O., Spondylidis S., Taskaris S., Topouzelis K. (2023). Aquasafe: A Remote Sensing, Web-Based Platform for the Support of Precision Fish Farming. *Appl. Sci. 2023, 13*, 6122. https://doi.org/10.3390/app13106122 • Spondylidis S., Giannoulaki M., Machias A., Batzakas I., Topouzelis K. (2023). Can we actually monitor the spatial distribution of small pelagic fish based on Sentinel-3 data? An example from the North Aegean Sea (Eastern Mediterranean Sea). *Front. Mar. Sci., vol. 10*, 2023, doi: 10.3389/fmars.2023.1117704 • Chatziantoniou A., Spondylidis S., Stavrakidis-Zachou O., Papandroulakis N., Topouzelis K. (2022). Dissolved Oxygen estimation in Aquaculture sites using remote sensing and machine learning. Remote Sens. *Appl. Soc. Environ*., p. 100865, Nov. 2022, https://doi: 10.1016/J.RSASE.2022.100865 • Doukari, M., & Topouzelis, K. (2022). Overcoming the UAS limitations in the coastal environment for accurate habitat mapping. *Remote Sensing Applications: Society and Environment, 26*(March), 100726. DOI: 10.1016/j.rsase.2022.100726 • Doukari, M., Katsanevakis, S., Soulakellis, N., Topouzelis, K. (2021). The Effect of Environmental Conditions on the Quality of UAS Orthophoto-Maps in the Coastal Environment. *ISPRS Int. J. Geo Inf. 2021, 10*, 18. DOI: 10.3390/ijgi10010018
Contact:	https://aquasafe.gr/contact/

2. PROJECT MARRE - MARine monitoring system of the Hellenic Seas using REmote sensing satellite data and in-situ measurements

Country:	Greece

Institution(s) involved:	• Marine Remote Sensing Group (MRSG) | Department of Marine Sciences | University of the Aegean • GEOSPATIAL ENABLING TECHNOLOGIES (GET) • Hellenic Centre for Marine Research (Institute of Oceanography)
Short Description:	The project develops innovative products to monitor the status of the marine environment using free satellite observation data. These new products provide information on water quality and are derived from the in-situ measurements. Using high-resolution satellite data in combination with in-situ measurements at Greek seas, essential environmental parameters such as chlorophyll concentration and turbidity are assessed, as well as the detection of potential fishing zone areas. The combined use of satellite data and in-situ measurements evaluates and improves existing empirical algorithms. As a result, the derived products are adapted to local conditions and the specific features of Greek seas. Importance was given to the monitoring of marine biodiversity by the mapping and the monitoring of the Posidonia oceanica meadows. Chl-a maps: The calibration of specialised Chl-a calculating algorithms for the Greek seas, contributed to the production of more accurate information and to the creation of Chl-a maps. Total Suspended Matter (TSM) maps- Turbidity: Based on the application of the methodology to the areas of interest, the use of satellite data presents promising results in the maps produced. Posidonia oceanica maps: Regarding the use of Landsat-8 satellite imagery, the classification confirmed its ability to generate reliable coverage data on the spatial distribution of Poseidonia meadows for large-scale ecological and conservation studies. **Potential fishing zone maps**: The Potential Fishing Zones (PAZ) provide information on the possible location of fish populations. They usually consist of Chlorophyll and Surface Marine Temperature distribution data. They have been shown to help increase production by 2-5 times and reduce search time by 30-70%. The methodology is based on an indirect way of locating fish populations: Marine circulation (medium scale formations and fronts), chlorophyll concentration and Spatial Distribution of Surface Marine Temperature.
The Quintuple Helix:	1. **The education system:** Mapping fishing zones requires knowledge of marine ecosystems, including habitats, currents, and species distributions. Through this process, students can learn about the interconnectedness of various marine elements and how they support each other.

	2. **The economic system:** optimised fishing efforts, reduced resource wastage, improved safety, enhanced market access, and better-informed management decisions, leading to more sustainable and profitable fishing practices. 3. **The political system:** Fisheries managers can use this information to implement targeted conservation measures, such as establishing marine protected areas or regulating fishing activities in specific zones to prevent overfishing. Researchers can also use the data to study fish behaviour, habitat preferences, and ecosystem dynamics, leading to better-informed decision-making and more effective conservation strategies. 4. **The media-based and culture-based public:** By mapping fishing zones, the public becomes more aware of the environmental impact of fishing activities. They learn about sustainable practices and the importance of protecting marine biodiversity to ensure the long-term health of ecosystems. 5. **The natural environment**: sustainable resource management, ecosystem conservation, reduced bycatch, minimised habitat destruction, improved monitoring and enforcement, support for scientific research, and resilience to climate change. It helps in regulating fishing activities, protecting sensitive habitats, and preserving marine biodiversity, ultimately contributing to the health of our oceans.
Trends & Benefits from this Best Practice	Access to detailed fishing zone maps can give fishermen a competitive advantage in the market. They can use this information to differentiate their catch based on location, species, or quality, potentially commanding higher prices for fish caught in premium zones known for their abundance or sustainability. Additionally, some consumers may prefer products labelled with information about where and how the fish were caught, creating opportunities for premium branding and market differentiation.
Short SWOT analysis	***Strengths:*** Precision in locating fish populations, sustainable resource management, accuracy in production, enforcing fishing regulations. ***Weaknesses:*** Limited data availability and costly mapping and monitoring requires specialised technical expertise, facing challenges in sharing data due to privacy concerns. ***Opportunities:*** Enhances fishing efficiency and sustainability, Increased market access and profitability, promotes collaboration among stakeholders, Contributes to broader ecosystem management. ***Threats:*** Risk of overexploitation due to inaccurate maps, Potential for conflicts over fishing grounds, Climate change disrupts fish distribution patterns.

How could this Best Practice be used/ transferred in other contexts?	Fisheries monitoring is crucial for sustainable management, enforcing regulations, and preserving marine ecosystems. It provides data for informed decision-making, helps prevent overfishing and illegal activities, and supports scientific research. By ensuring compliance, maintaining ecosystem health, and supporting livelihoods, fisheries monitoring plays a vital role in the long-term sustainability of fisheries worldwide. Fishing zone monitoring involves various technologies and methods to track and manage fishing activities within designated zones, typically in marine environments. This monitoring is essential for ensuring sustainable fishing practices, preventing overfishing, protecting marine ecosystems, and enforcing regulations. Collaboration between government agencies, research institutions, non-governmental organisations (NGOs), and fishing communities is essential for effective fishing zone monitoring. Collaborative monitoring efforts can help improve data collection, enhance enforcement capabilities, and promote sustainable fishing practices. Fishing zone monitoring programs can help promote responsible fishing practices, protect marine biodiversity, and ensure the long-term sustainability of fisheries resources. Progress in fish population modelling, integrating environmental variables derived from Earth Observation and Operational Oceanography (COPERNICUS CMEMS program), has made it possible to create a demonstration of a near real-time forecast of one key tuna stock in the Atlantic Ocean. The AtlantOS use case developed a demonstrator for the albacore tuna to simulate in near real-time the change in abundance over time and space of this species by life stages i.e., larvae, juveniles, adults (Lehodey et al., 2017). The operational product is available on the seapodym model web site and is a great step toward improved real time monitoring of fishing activity and stock assessment that feed into the conservation measures, such as Total Allowable Catch, established by the International Commission for the Conservation of Atlantic Tunas.
Link:	www.marre.gr
More Resources & Info:	• Radioactivity Monitoring at North Aegean Sea Integrating In-Situ Sensor in an Ocean Observing Platform", *Journal of Marine Science and Engineering, 9*(1), pp. 77, https://doi.org/10.3390/jmse9010077. • Modelling the nutritional strategies in mixotrophic nanoflagellates (research article published at *Ecological Modelling, Elsevier journal*, https://doi.org/10.1016/j.ecolmodel.2020.109053). • Grazing effect of flagellates on bacteria in response to phosphate addition in the oligotrophic Cretan Sea, NE Mediterranean (research article published at

	FEMS Microbiology Ecology, Oxford journal, https://doi.org/10.1093/femsec/fiaa086). • Topouzelis K., Symeonidis P., Iona A., Athanasopoulou E., Karageorgis A., Chatziantoniou A., Papakonstantinou A., Spondylidis S., Vakkas T., Psarra S. (2019). Development of Local EO Algorithms for Monitoring the Greek Seas Using Copernicus Sentinel Data and in Situ Measurements, *ESA EO Φ-week, ESAESRIN*, 09-13 September 2019, Frascati, Italy. • Topouzelis K., Athanasopoulou E., Chatziantoniou A., Iona A., Karageorgis A., Mytropoulos P., Papakonstantinou A., Psarra S., Spondylidis S., Symeonidis P., Vakkas T. (2019). MARRE: A research project to monitor the Hellenic Seas using Remote sensing, 2019, 22nd AGILE International Conference on Geographic Information Science, AGILE 2019, 17-20 June 2019, Limassol, Cyprus. • Livanou, E., Oikonomou, A., Psarra, S. and Lika, K., 2021. Role of mixotrophic nanoflagellates in the Eastern Mediterranean microbial food web. *Marine Ecology Progress Series, 672*, pp.15-32.
Contact:	http://marre.gr/?page_id=85

3. PROJECT MUSICA - Multiple Use of Space for Island Clean Autonomy - Blue Growth Solutions

Country:	Greece
Institution(s) involved:	• University College Cork • Heriot Watt University • University of the Aegean • CHIOS • L-Università ta' Malta • ICORSA • DAFNI • PLOCAN • INNOSEA • Coral Energy • NeoDyne • SINN Power

	• INSB • Forky's • AquaBioTech Group
Short Description:	The overall Aim of MUSICA is to accelerate the roadmap to commercialization of its Multi-Use Platform (MUP) and Multi-use of Space (MUS) combination for the small island market, and de-risk for future operators and investors, by validation to TRL7 and providing real plans to move to mass market commercialization. The MUSICA solution will be a decarbonizing one-stop shop for small islands, including their marine initiatives (Blue Growth) and ecosystems. The overall Aim of MUSICA will be achieved by developing a replicable smart MUP. MUSICA will provide a full suite of Blue Growth solutions for a small island: • Three forms of renewable energy (RE) (wind, PV and wave) (total 870kW), providing high-RES penetration and competitively affordable electricity. Three forms of RE provide non- correlated supply. • Innovative energy storage systems on the MUP, provide all required storage for power on the island and platform, as well as electrical output smoothening (compressed air storage and batteries). • Smart energy system for the island, including demand response, modelling and forecasting based on high flexibility services from distributed generation. • Desalinated water made by a desalination unit on the MUP powered by RES providing 1000m3 fresh water for a water stressed island. • The MUP will provide "green" support services for island's aquaculture (pilot 200 tonnes production) This project will demonstrate that the MUSICA MUP is a viable enabling infrastructure for multiple RES, desalination, and BG aquaculture services for small islands, that can share the same space and work synergistically together, sharing Supply Chains and reducing Operating and Maintenance costs and solving the increasing demand for space.
The Quintuple Helix:	1. **The education system:** Develop the pilot demonstrator of the MUSICA MUP solution and install on-site at Inousses Island to test & demonstrate the validity of the MUP in a real operating environment to TRL7. 2. **The economic system:** Demonstrate, test, and validate the MUSICA MUP solution covering functional and non-functional readiness, cost reduction, shared expenditure, and increased economic, environmental, and social viability and value add.

	3. **The political system:** Support economically viable replication of the MUSICA smart MUP solution through Exploitation and Sustainability Plans for commercialization and continuation beyond the project end. 4. **The media-based and culture-based public:** Maximise the societal acceptance and use of MUSICA MUP-based RES, water supply, and aquaculture support service by the islanders by embedding the principles of Responsible Research and Innovation (RRI). This will achieve full inclusive engagement with the quadruple helix (QH), being the island citizens and society, industry, research, and government. 5. **The natural environment:** renewable energy sources offer a myriad of environmental benefits for small islands, ranging from mitigating climate change and preserving biodiversity to improving air and water quality and promoting sustainable development. By prioritising the transition to clean energy, small islands can safeguard their natural heritage for future generations while building resilient and prosperous communities in harmony with the environment.
Trends & Benefits from this Best Practice	• Energy Independence: By tapping into abundant local resources like sun and wind, islands can reduce reliance on costly imported fuels, enhancing energy security. • Cost Savings: Although initial investment is required, renewable energy systems offer long-term savings due to free and abundant natural resources. • Environmental Sustainability: Adopting renewables helps islands curb greenhouse gas emissions, preserve ecosystems, and mitigate the impacts of climate change. • Job Creation: Renewable energy projects create local employment opportunities, stimulating economic growth and fostering a skilled workforce. • Resilience: Decentralized renewable energy systems enhance resilience by reducing vulnerability to supply chain disruptions and extreme weather events. • Community Empowerment: Community-owned projects enable residents to participate in decision-making and reap economic benefits, fostering local pride and engagement. • Technological Innovation: Investing in renewables drives technological advancement, positioning islands as pioneers in the global clean energy transition.

	Embracing renewable energy enables small islands to build sustainable, resilient, and self-reliant communities for a brighter future.
Short SWOT analysis	***Strengths:*** Abundant renewable resources, Energy independence, Environmental benefits, Economic development opportunities, Innovation potential. ***Weaknesses:*** High initial costs, Intermittency of renewable sources, Infrastructure limitations, Technical expertise shortage, Land use constraints. ***Opportunities:*** Tourism promotion, Government support and incentives, Energy export potential, Community engagement, Climate resilience enhancement. ***Threats:*** Policy and regulatory barriers, Economic vulnerability, Technological risks, Dependency on external factors, Natural disasters.
How could this Best Practice be used/transferred in other contexts?	Development in clean energy innovation is essential to accomplishing the EU's goal-oriented objective of being carbon unbiased by 2050. To be eventually effective, the EU must adopt an all-encompassing strategy, representing the social development and cooperation of all partners in energy change. This incorporates drawing in purchasers, families, and EU residents to empower changes in ways of life and practices, and starting exchanges with chiefs in legislative issues, the scholarly world, and industry. This Results Pack exhibits nine EU-supported ventures that pay attention to the social and policy-centred issues that should be routed to decarbonize the EU's energy framework. The European Green Deal, presented by the European Commission in December 2019, has the ambitious goal of making Europe the first climate-neutral continent. It lays out a new growth strategy to build a fair, resource-efficient, and competitive economy where net emissions of greenhouse gases are reduced to zero by 2050. The creation and utilisation of energy represents more than 75 % of the EU's ozone harming substance discharges. Decarbonising the EU's energy framework is in this way a focal mainstay of the Green Deal. While the change to a spotless energy framework requires further scaling up of mechanical developments in energy, structures, transport, industry and farming areas, these innovations and driven procedures should be grasped by residents to have the ideal effect.
Link:	https://musica-project.eu
Contact:	musicaproject.eu@gmail.com

4. The Underwater Museum of Alonissos – Blue Med Interreg Programme

Country:	Greece
Institution(s) involved:	Municipality of Alonissos
Short Description:	The Undewater Museum is the first of its kind in Greece that is open to the public. It was launched in August 2020. The shipwreck is now open to recreational divers who will have the opportunity to explore it under the guidance of experienced divers during the summer season. The Alonissos Underwater Museum features one of the biggest Classical-era shipwrecks. It is dated around 425 to 420 B.C and was discovered in 1985 by Dimitris Mavrikis at a 25-meter depth off the coast of the islet Peristera. Due to its unique size, the ship ranks among the biggest commercial ships of its time. It was 30 meters long and 10 meters wide. It was carrying around 3,000 amphorae full of the renowned wines of Mendi (a city in modern day Chalkidiki) and Peparithos, which is modern day Skopelos. The vessel is of uttermost importance to archaeology because of the number of intact findings. It is so important that it is dubbed as "The Parthenon of Shipwrecks". The operation of this museum was made possible by the technological innovations and successful implementation of the NOUS Undersea Vision Surveillance System. Peristera's system consists of five NOUS submarine units fully equipped with cameras and windshield wipers fitted to the camera lenses. The underwater operation is controlled by multitasking computing units. Extending to a submarine hub, the network of underwater cameras is powered by a 200 m. long cable reaching to the shore, connected to a purpose-built solar power station at Peristera. Additionally, the Peristera NOUS set-up includes a weather station enhancement and a remotely controlled camera with 360-degree functionality for sea and land monitoring. The Peristera NOUS system transfers data via fibre optic and RF link from the NOUS water unit to a cloud server via a built-in internet connection. The full-scale implementation of the Peristera NOUS set-up is a pioneering feat of underwater technological engineering and shows the reality of the power of NOUS' potential.
The Quintuple Helix:	1. **The education system:** This museum teaches about submerged history, marine ecosystems, and preservation techniques. Through hands-on experiences and educational programs, students gain interdisciplinary

	knowledge and a deeper appreciation for marine conservation efforts. The involvement of the education system enriches learning experiences and fosters a sense of stewardship towards our underwater cultural heritage. 2. **The economic system**: Once operational, underwater museums contribute to local economies through tourism. Visitors drawn to these unique attractions spend money on accommodations, dining, transportation, and recreational activities, stimulating growth in surrounding communities. Additionally, underwater museums often create job opportunities for dive guides, archaeologists, museum staff, and support personnel. 3. **The political system:** political involvement in underwater museums encompasses financial support, regulatory oversight, legal negotiations, and stakeholder coordination, all aimed at preserving our shared cultural legacy beneath the waves. Furthermore, the establishment of underwater museums frequently involves navigating complex legal frameworks, including international agreements such as UNESCO's Convention on the Protection of the Underwater Cultural Heritage. 4. **The media-based and culture-based public:** the involvement of the cultural system in underwater museums reflects a holistic approach to heritage preservation—one that recognizes the interconnectedness of culture, environment, and society. Through their innovative blend of art, history, and marine science, underwater museums enrich our collective understanding of the past while inspiring stewardship for the future. 5. **The natural environment**: These museums often double as artificial reefs, providing habitats for marine life and promoting biodiversity. Over time, the submerged structures become encrusted with corals, sponges, and other marine organisms, contributing to the restoration and enhancement of underwater ecosystems. Submerging cultural artefacts in underwater museums can help safeguard them against the impacts of climate change, such as rising sea levels and coastal erosion. By integrating cultural preservation efforts with adaptive strategies, these museums contribute to the resilience of coastal communities and heritage sites.
Trends & Benefits from this Best Practice	In recent years, the establishment of underwater museums has emerged as a captivating trend in the realm of cultural preservation and tourism. These submerged galleries offer a unique fusion of art, history, and marine conservation, drawing enthusiasts and scholars alike to explore their depths. One notable trend driving the creation of underwater museums is the desire to protect and showcase submerged cultural heritage. Many historical artifacts and archaeological sites lie beneath the waves, vulnerable to decay, looting, or environmental damage. By creating underwater museums, these precious

	remnants of human history are not only preserved but also made accessible to the public in an immersive and novel way. Moreover, underwater museums contribute to marine ecosystem conservation by providing artificial reefs that attract diverse marine life. Over time, these submerged installations become hubs of biodiversity, fostering the growth of coral reefs, and serving as habitats for fish and other marine species. In this way, the creation of underwater museums aligns with broader efforts to promote marine conservation and sustainability. From a tourism perspective, underwater museums offer an unparalleled experience, enticing adventure seekers and culture enthusiasts to dive into the depths of history. Visitors can explore sunken ships, ancient ruins, and art installations amidst the serene underwater landscape, creating lasting memories and fostering a deeper appreciation for our shared heritage.
Short SWOT analysis	***Strengths*** 1. Unique, immersive experience. 2. Preservation of cultural heritage. 3. Environmental benefits as artificial reefs. 4. Potential for tourism development. 5. Educational opportunities. ***Weaknesses*** 1. High initial investment. 2. Maintenance challenges. 3. Accessibility limitations. 4. Environmental impact concerns. 5. Safety and risk management issues. ***Opportunities*** 1. Collaboration with stakeholders. 2. Technological advancements. 3. Diversification of tourism. 4. Cultural tourism development. 5. Public awareness and engagement. ***Threats***

	1. Natural disasters. 2. Human activities like looting and vandalism. 3. Regulatory hurdles. 4. Competition from other attractions. 5. Climate change impacts.
How could this Best Practice be used/transferred in other contexts?	Firstly, the concept of underwater museums underscores the importance of cultural heritage, showcasing artefacts and historical sites in an immersive and unconventional setting. This approach not only enhances public engagement but also fosters a deeper appreciation for the interconnectedness of human history and the natural world. This aspect can be transferred to other contexts, such as terrestrial environments or urban spaces, where historical sites or artefacts can be integrated into public parks, city squares, or even abandoned buildings, revitalising these spaces, and creating new cultural hubs. Secondly, the establishment of underwater museums involves collaboration between various stakeholders, including government agencies, conservation organisations, local communities, and tourism operators. This collaborative approach ensures the sustainable management of underwater sites, balancing conservation efforts with tourism activities and economic development. Similar partnerships can be forged in other contexts to address diverse challenges, from urban revitalization and heritage preservation to environmental conservation and community development. Furthermore, the innovative use of technology in underwater museums, such as virtual reality exhibits and underwater cameras, opens new possibilities for education, research, and outreach. These technological advancements can be leveraged in other contexts to enhance learning experiences, promote scientific exploration, and raise awareness about pressing issues, from climate change and biodiversity loss to cultural diversity and social justice.
Link:	https://museum.alonissos.gov.gr/en/about/
More Resources & Info:	• https://bluemed.interreg-med.eu/ • National Geographic: Diving into Greece's first underwater museum A national marine park protects wildlife and now offers tours of "the Parthenon of shipwrecks" off the island of Alonissos. https://www.nationalgeographic.com/travel/article/diving-into-the-first-underwater-museum-in-greece

	• https://nous.com.gr
Contact:	Information Center +30 2424066502 City Hall +30 2424350201 museum@alonissos.gov.gr

5. Aegean Rebreath (AR)

Country:	Greece
Institution(s) involved:	Ministries, Municipalities, Private firms, Universities, Research centres, Civil Society
Short Description:	Aegean Rebreath was established in 2017 by a small group of active citizens that shared the same concerns about the preservation of the marine environment. Under the principles of environmental democracy and intergenerational justice, Aegean Rebreath targets marine ecosystem pollution through a holistic circular economy model, ensuring sustainable and integrated responses at every step. Its unique and award-winning model engages communities across six key areas: 1. **Clean Ups:** More than 90 underwater and coastal clean ups have been conducted since 2017. Over 100 professional and amateur volunteer divers have removed more than 150 tons of marine litter. 2. **Recycle the Seas:** The organisation has developed the first multi-purpose Marine Litter Stations Network in Europe. The stations act as education and awareness raising hubs with their distinctive "Aegean Rebreath" designs and accessible information. 3. **Develop Network:** In 2021, AR, based on the memoranda of cooperation with the Municipalities that have installed Marine Litter Collection Stations, created the first "Blue" Municipalities Network in Greece. Today the Network consists of 18 member-municipalities throughout Greece and is coordinated by our organisation. In 2023, the network acquired a legal entity. 4. **Educate and Advocate:** The organisation involves younger generations in protecting the oceans by bringing environmental education courses to local schools. The organisation also consults with coastal and island communities on the climate crisis and individual responsibility using interactive workshops and related educational materials. 5. **Research to Rebuild:** To date, AR has developed a database that tracks information on 217 materials (Hanke, et al., 2013) collected during the

	implementation of activities across 45 regions in Greece, as well as data derived from research on the quality of seawater and on microplastics. 6. **Develop pilot projects:** AR develops pilot research projects in cooperation with private entities that give important primary data and substantively contribute to the development of policies based on ESG regulations and relevant United Nations Sustainable Development Goals.
The Quintuple Helix:	1. **The education system:** Aegean Rebreath is dedicated to educating individuals of all ages about the importance of protecting the marine environment and empowering them with actionable solutions. AR has meticulously designed suitable educational materials for every stage of learning, emphasising that effective measures exist to safeguard our oceans. The educational approach involves a structured methodology designed to immerse students in the intricacies of marine pollution, helping them comprehend its causes and effects. Through interactive learning experiences, students are encouraged to brainstorm and implement small-scale initiatives within their schools, fostering a sense of ownership and responsibility for environmental conservation. Additionally, AR organises workshops targeted at personnel from private firms and members of local communities, which serve as platforms for dialogue and collaboration, aiming to mobilise communities towards the adoption of sustainable practices. By engaging stakeholders from diverse sectors, AR strives to catalyse a collective effort towards preserving marine ecosystems for future generations. Through these educational initiatives and collaborative workshops, AR endeavours to instil a sense of environmental stewardship and drive positive change towards a more sustainable future. 2. **The economic system**: Through strategic partnerships with private firms and international entities, AR is committed to conveying the message that economic prosperity and sustainable practices are intrinsically linked. From the outset, AR has engaged companies in pioneering pilot projects aimed at raising awareness for environmental issues and catalysing positive change. These pilot projects, conducted in collaboration with several companies, serve as testbeds for innovation and technology, while also generating valuable primary data. This data is utilised to advocate for policy development among companies, aligning their practices with international Environmental, Social, and Governance (ESG) criteria and the 17 Sustainable Development Goals outlined by the United Nations. Furthermore, AR has established the first network of marine litter collection stations, showcasing the principles and benefits of a circular economy to local communities. These stations not only provide practical solutions to marine

pollution but also serve as educational tools, highlighting the economic and environmental advantages of adopting sustainable practices.
By fostering collaboration with private firms and international entities, AR endeavours to drive systemic change towards a more sustainable future, where economic prosperity and environmental conservation go hand in hand.

3. **The political system:** Aegean Rebreath has forged bilateral memoranda of cooperation with numerous municipal authorities, cementing partnerships aimed at fostering sustainable practices and preserving the marine environment. Additionally, the organisation spearheads the Blue Municipalities Network (BMN), which has recently attained legal entity status. Within the framework of the B.M.N., AR offers expertise in developing evidence-based policies concerning the marine environment. Through collaborative efforts with municipal authorities, they facilitate the creation of concrete work plans designed to address pressing environmental challenges.
   By coordinating with municipal authorities and leveraging the collective wisdom of the Blue Municipalities Network, AR strives to enact meaningful change and ensure the long-term health and vitality of our oceans.
4. **The media-based and culture-based public:** At Aegean Rebreath, the core principles are rooted in the promotion of intergenerational justice, environmental democracy, and civic responsibility. The organisation operates with a dedicated team of volunteers, who have diligently worked to establish a robust network of volunteers across Greece.
   Through field operations, AR actively engages local communities, empowering them to participate in monitoring the quality of the marine environment and advocating for change at the grassroots level.
   The impact of AR's work has garnered global recognition, with coverage not only from domestic Greek media but also from renowned international outlets, acknowledged for its dedication and achievements in marine conservation.
   By communicating its practices and messages on a global scale, AR reaches diverse audiences, inspiring individuals and communities worldwide to join in protecting and preserving our oceans for future generations.
5. **The natural environment**: Aegean Rebreath is deeply committed to the preservation of the marine environment. Through its efforts, significant strides have been made in the realms of depollution, prevention, and restoration of the marine ecosystem. One of the organisation's key focuses is the proper management of marine litter, addressing this pressing issue through innovative practices and collaborative initiatives. By implementing effective strategies for waste management and cleanup efforts, AR works towards reducing the harmful impacts of marine litter on marine life and coastal habitats.

   Furthermore, AR recognizes the immense potential of the blue economy and actively promotes its benefits for local societies and economies. By fostering

	sustainable practices and initiatives that harness the resources of the marine environment in a responsible manner, the organisation seeks to create economic opportunities while safeguarding marine ecosystems.
Trends & Benefits from this Best Practice	The inception of Aegean Rebreath in 2017 marked a significant milestone in Greece, heralding the dawn of environmental democracy and emphasising the imperative of safeguarding the marine ecosystem. Through its operational and institutional endeavours, AR galvanised local communities and municipal authorities, shedding light on the hitherto overlooked plight of marine degradation. These initiatives paved the way for the formation of the Blue Municipalities Network, fostering collaborative efforts to tackle pressing environmental challenges. AR's endeavours garnered widespread recognition, earning coverage in prominent international media outlets. Moreover, the organisation spearheaded initiatives to monitor the marine environment's health at the grassroots level. Presently, AR serves as a nexus, orchestrating synergistic actions among local authorities, governmental bodies, communities, and private enterprises. Together, they strive to devise and implement targeted interventions aimed at nurturing and preserving the marine environment for generations to come.
Short SWOT analysis	***Strengths:*** Commitment by local authorities and local societies | Development of best practices | Expanded network at national level | Databases | Transparency | Innovative practices | Acknowledgment at European level ***Weaknesses:*** Limited resources ***Opportunities:*** Development of best practices addressing a global challenge | Further expanding practices at European level ***Threats:*** Unstable political environment
How could this Best Practice be used/transferred in other contexts?	Aegean Rebreath stands as a tangible embodiment of environmental democracy, advocating for a grassroots approach to marine conservation. At its core, the organisation champions practices rooted in transferability and sustainability, striving to introduce a comprehensive model adaptable to local communities. Central to this model is the emphasis on enhancing civic engagement and fostering collaboration among diverse stakeholders. AR's field initiatives, including clean-up efforts, research endeavours, educational programmes, establishment of marine litter stations, and consultations with local societies, are driven by volunteers actively involved in implementation, monitoring, and evaluation activities. Through these endeavours, AR strives to depollute the seas, promote blue economy initiatives, and raise awareness about marine conservation. Importantly, the organisation aims for scalability, with practices at both operational and

	institutional levels designed for replication at regional and national scales. Key to this approach is the prioritisation of knowledge exchange, ensuring that insights and expertise are shared across communities, fostering a collective effort towards a sustainable future for our oceans.
Link:	www.aegeanrebreath.org
Contact:	info@aegeanrebreath.org

6. Blue Municipalities Network (BMN)

Country:	Greece
Institution(s) involved:	Ministries, Municipalities, Private firms, Universities, Research centres, Civil Society
Short Description:	The Blue Municipalities Network is a platform of coastal municipalities that aims at addressing marine environment issues. The network includes the "Committee of Mayors" from the participating municipalities. They provide strategic direction, leadership, and decision-making authority for the network's initiatives. The Committee of Mayors sets the overall agenda and priorities for the network. The BMN also includes the "Technical Team" that consists of experts in various relevant fields and offers technical expertise and support for planning, implementing, and monitoring initiatives focused on marine environmental protection. The Technical Team ensures that initiatives are based on sound scientific principles and best practices. The network includes a diverse range of stakeholders, such as mayors, deputy mayors, and presidents of port authorities. Additionally, representatives from civil society organisations, the fishing community, universities, and research institutions are involved. This broad representation ensures that various perspectives and expertise are considered in decision-making and implementation. Furthermore, representatives from relevant government ministries participate in the technical team of the network. Their involvement indicates government support and collaboration, essential for the success and sustainability of the network's initiatives. The BMN acquired legal entity status in 2023. By promoting cooperation and sharing best practices, the network aims to achieve tangible outcomes in marine conservation, public awareness, and sustainable resource management at local and national level.

The Quintuple Helix:	1. **The education system**: The educational programmes and workshops implemented in schools and local communities within the BMN are crucial components of the initiative's broader goals of marine environmental protection and community engagement. By engaging schools and local societies, the network enhances its impact and contributes to broader efforts for marine conservation and environmental sustainability in Greece's coastal regions. 2. **The economic system**: The Marine Litter Stations established in the members of the BMN serve as important hubs for addressing marine litter and promoting sustainability through circular economy principles and upcycling. By incorporating circular economy principles, the Marine Litter Stations aim to minimise waste and maximise resource efficiency. Through upcycling, materials that would otherwise be discarded are transformed into new products of higher value, extending their lifecycle, and reducing environmental impact. This approach not only helps to address marine pollution but also promotes economic opportunities by creating value from waste materials. By acknowledging the importance of the blue economy, local authorities and communities within the BMN recognise the potential for economic development and job creation. The collaboration with private entities allows the BMN to leverage expertise, resources, and innovation for implementing pilot projects aimed at addressing marine litter and promoting sustainability. Private sector involvement can bring additional funding, technological solutions, and business expertise to the table, enhancing the effectiveness and scalability of initiatives. By fostering partnerships with private entities and implementing pilot projects, the network demonstrates its commitment to advancing the blue economy and protecting marine ecosystems for future generations. **3. The political system:** The BMN plays a vital role in empowering local communities and influencing policymaking at both the local and national levels. By uniting almost 20 municipalities, the network provides a platform for local communities to actively participate in discussions and decision-making processes related to marine environmental issues. The network also collaborates with the Central Union of Municipalities in Greece and relevant ministries to influence policy formulation and implementation. By advocating for evidence-based policies for the marine environment, the network ensures that local voices are heard and considered in the development of national strategies and regulations. By working together, stakeholders can coordinate efforts, share best practices, and develop comprehensive approaches to marine conservation and sustainable development. Collaboration with research institutions, universities, and other experts provides the opportunity to gather scientific data to inform policy decisions. Overall, the BMN serves as a bridge between local communities, governmental institutions, and other stakeholders, facilitating dialogue, collaboration, and action for the protection

	of the marine environment. By advocating for evidence-based policies and building institutional synergies, the network contributes to more sustainable and resilient coastal communities in Greece. 4. **The media- and culture-based public**: The BMN exemplifies environmental democracy by empowering local communities and volunteers to actively engage in field practices and contribute to evidence-based policymaking. The network facilitates active participation of local communities and volunteers in field practices aimed at marine environmental protection. By involving stakeholders at the grassroots level, the network ensures that decision-making processes are transparent, inclusive, and reflective of local interests and concerns. The field practices generate valuable data and insights that inform evidence-based policymaking. Through initiatives such as coastal clean-ups, marine conservation projects, and monitoring efforts, participants contribute to the accumulation of scientific evidence necessary for developing effective policies and interventions. The impactful work of the BMN and its partners in promoting environmental democracy and marine conservation is covered by international media that raises awareness on a global scale, amplifying its message and inspiring action beyond national borders. 5. **The natural environment**: The clean-up initiatives, organised in the members of the BMN, play a crucial role in not only cleaning up coastal and marine areas but also in raising awareness and mobilising communities to act. By actively engaging local communities and visitors in clean-up activities, the BMN helps foster a sense of responsibility and stewardship towards the environment. These events serve as important educational opportunities, highlighting the importance of preserving marine ecosystems and the detrimental effects of pollution. Moreover, when individuals participate in clean-up efforts, they often develop a deeper connection to their surroundings and become more invested in protecting these valuable natural resources. This can lead to long-term behavioural changes, such as reducing waste and adopting more sustainable practices in daily life. Overall, the collaborative efforts of the BMN not only contribute to the physical cleanup of coastal and marine areas, but also inspire meaningful change at the grassroots level, creating a ripple effect of environmental awareness and action.
Trends & Benefits from this Best Practice	The BMN represents a significant milestone in addressing marine pollution through collaborative efforts among municipalities. By establishing a legal framework for cooperation, this initiative has not only facilitated joint action against pollution but has also sparked interest and involvement from various sectors including universities, research centres, and academia. The active participation of all key stakeholders demonstrates the recognition of the importance of interdisciplinary collaboration in tackling environmental challenges. Their involvement contributes to the development of best practices

	and innovative solutions to address marine pollution effectively. Moreover, the engagement of private firms in the network underscores the potential of public-private partnerships in achieving tangible outcomes. By leveraging resources and expertise from both sectors, these partnerships can deliver concrete results in combating marine pollution and promoting sustainable practices. Furthermore, the BMN has empowered local communities to take an active role in environmental stewardship. By leading efforts to manage natural resources, municipalities have inspired citizens to follow suit and participate in initiatives aimed at preserving marine ecosystems. Overall, the network serves as a prime example of environmental democracy in action, showcasing how collaborative efforts between government, academia, private sector, and local communities can lead to meaningful outcomes in environmental conservation and sustainable development.
Short SWOT analysis	**Strengths:** Commitment by local authorities and local societies | Development of best practices | Expanded network at national level | Transparency | Innovative practices | Acknowledgment at European level **Weaknesses:** Limited resources **Opportunities:** Turning a national network into a European network **Threats:** Unstable political environment
How could this Best Practice be used/transferred in other contexts?	The Blue Municipalities Network (BMN) appears to be a promising initiative aimed at promoting sustainable practices for the marine environment through collaboration among various stakeholders. In this context, establishing a clear legal framework for the BMN is essential to define its purpose, governance structure, rights, and obligations of participating entities. This legal status can provide legitimacy and accountability, facilitating smoother operations and resource allocation. The development of a detailed work plan with specific objectives, timelines, and measurable milestones is crucial for addressing key environmental challenges. Engaging in on-the-ground field activities is essential for demonstrating tangible outcomes and fostering community involvement. Actively involving local communities is fundamental for fostering ownership, generating grassroots support, and ensuring the relevance and effectiveness of interventions. Leveraging the experiences and successes of the BMN to inspire similar practices at the European level, partnerships and collaboration with relevant stakeholders across Europe should remain priority. By addressing these aspects, the BMN can enhance its impact and become a model for collaborative, community-driven approaches to marine conservation, both at local and European level.
Link:	www.bluemunicipalities.org

Contact:	info@bluemunicipalities.org

7. Port Museum of Tricase

Country:	Italy
Institution(s) involved:	Municipality of Tricase, Magna Grecia Mare Association, Mediterranean Agronomic Institute of Bari (CIHEAM Bari), University of Salento, Regional Park "Costa Otranto - S. Maria di Leuca e Bosco di Tricase"
Short Description:	The Port Museum of Tricase is situated in the coastal town of Tricase, which has a long-standing fishing tradition dating back to the 1400s and a well-developed port infrastructure. Through the establishment of this museum, a fruitful collaboration between scientific and institutional entities has been achieved, resulting in a development model that aligns with the principles of the blue economy. This model places great emphasis on social, cultural, and environmental aspects to foster local development. It particularly highlights the importance of preserving traditional fishing boats, ancient arts, the way of life in the fishing village, fishermen's customs and stories, as well as the conservation of the area's natural heritage. By doing so, the museum aims to promote inclusiveness and sustainable development. The Port Museum of Tricase serves as a dynamic institution that showcases the significance of the port, the sea, the coastal area, and the local community's heritage as fundamental pillars for economic, social, and environmental development in terms of sustainability (Plan Bleu, 2020). The Port Museum operates through the following components: i. The Permanent Cultural Center on sea ancient traditions ii. The museum of sea art and traditional boats iii. The municipal school of lateen sailing and ancient seafaring iv. The Rena and the Sette Bocche v. The media-library of the sea vi. MARE - the Mediterranean outpost for monitoring coastal and marine ecosystems vii. The yard of taste viii. Fisheries and fishermen

The Quintuple Helix:	1. **The education system**: Education serves as the foundational element within a museum. At the same time, the museum encompasses "The Permanent Cultural Center on Sea Ancient Traditions" which is dedicated to the research, collection, and dissemination of knowledge pertaining to maritime customs and coastal societies (Interreg MUSE, 2020). This centre facilitates a range of cultural activities, including conferences, seminars, courses, and workshops, with the aim of promoting Mediterranean culture. Moreover, the "The Municipal School of Lateen Sailing and Ancient Seafaring" provides comprehensive training programs in traditional seafaring. These programs offer insights into navigational techniques, seafaring practices, boat maintenance, culinary traditions, and the communal life of coastal regions. It is interesting that during the winter season, individuals of all age groups have the opportunity to engage in boat maintenance and the reconstruction of ancient tools using traditional methodologies (Interreg MUSE, 2020). Additionally, "The Media-library of the Sea" boasts an extensive collection of books, texts, recordings, photographs, videos, interviews, and other forms of media that delve into subjects related to the sea and the cultural heritage of coastal communities. 2. **The economic system**: The museum has a significant impact on the economic progress of the entire region, transforming it into a captivating tourist spot where individuals can gain knowledge and immerse themselves in the socio-cultural heritage of centuries. Within this framework, "The Rena and The Sette Bocche" represents a collection of buildings that, among various endeavours, emphasises cultural diffusion through gastronomic experiences and the promotion and trade of customary goods (Interreg MUSE, 2020). By doing so, it not only highlights the cultural facets of the area but also underscores the significance of its natural resources. At the same time, a related study has shown that the establishment of the museum had a clear impact on economic progress at various levels (Plan Bleu, 2020). The number of fishermen and especially young fishermen has increased, leading to a greater participation of women and young individuals in the economic activities of the area. Moreover, there has been a notable rise in the direct sales of local and traditional goods, bolstering both the tangible and intangible aspects of maritime cultural heritage and fishing tourism. Additionally, the establishment of the museum has resulted in the creation of numerous employment opportunities within the catering and hospitality sectors. 3. **The political system:** The institutional cooperation and active involvement of the institutions in the establishment and operation of the Museum is a key feature. The development model of the Museum follows the national strategies for the development of coastal areas, ensuring community cohesion. The "Tricase branch of "The International Centre for Advanced Mediterranean Agronomic Studies, CIHEAM", has as its main objective the achievement of the

	objectives of the 2030 Agenda by implementing the Italian cooperation program (Mediterranean Agronomic Institute of Bari, 2023). This is done through various activities aimed at promoting the sustainable development of rural and coastal ecosystems. These actions are always aligned with the strategic guidelines of the CIHEAM member states and the overall concept of "Blue Growth". 4. **The media- and culture-based public**: The Port Museum serves as a museum that embraces civil society as a vital component, fostering dialogue, advancement, and advocacy. It actively encourages sustainable growth within the community by offering educational opportunities, training initiatives, research projects, and collaborative programs that engage the local community (Interreg MUSE, 2020). 5. **The natural environment**: The preservation and improvement of traditional coastal and marine habitats play a crucial role in the Port Museum's primary goals. The Museum recognizes the significance of the natural environment in shaping the economic and cultural development of the local community (Interreg MUSE, 2020; Plan Bleu, 2020). Moreover, it acknowledges that the natural surroundings not only influence the cultural and economic identity but also have a profound impact on the daily lives and practices of the local residents, including their religious, cultural, and recreational traditions. To achieve these objectives, the Port Museum effectively utilises modern technologies to integrate traditional knowledge, foster environmental education, and cultivate a deep respect for the marine and coastal landscapes.
Trends & Benefits from this Best Practice	The establishment and functioning of the "Port Museum" exemplifies a Quintuple helix of innovation by showcasing the interaction and exchange of knowledge through the five subsystems. The museum contributes to the sustainable development of the local community, cultural, scientific, and educational institutions, economic activities, bodies, and associations. It actively supports and implements various education, training, research, and cooperation programs, along with educational workshops aimed at fostering the active engagement of the local community. Furthermore, the museum advocates for environmental conservation as a fundamental aspect of cultural preservation and advancement, while also playing a pivotal role in fostering new economic ventures. Additionally, it fosters social interaction and intergenerational dialogue, both within the local community and with individuals from neighbouring Mediterranean countries (Interreg MUSE, 2020).
Short SWOT analysis	**Strengths:** Empowerment of local communities by fostering social integration | Preservation of marine and coastal ecosystems | Economic growth in the area, fostering the establishment of new employment opportunities and enterprises | Reinforcing both the natural and cultural legacy of the region | Advocating for

	education and research | Generating novel realms of knowledge by examining traditional societies. **Weaknesses:** Enhancing the fishermen community's capacity | Raising awareness among all community members about the Port Museum concept | Boosting the community's tourist appeal and developing the skills of its members. **Opportunities:** Establishment of new employment opportunities | Emerge of new economic sectors | Partnership between scientific institutions and local communities | Integration of local customs and traditions in the generation of scientific insights | Advocacy for cultural preservation and environmental conservation | Coexistence of modern technological advancements with traditional practices. **Threats:** Enhancing the quality of life for coastal populations relies on more than just economic considerations; it also hinges on various intangible elements | The development model must be in harmony not only with national strategies for the development of coastal areas, but also with the vision of the communities. Coherence must be ensured; needs must be prioritised and environmental and social impacts must be monitored and mitigated.
How could this Best Practice be used/transferred in other contexts?	The Port Museum of Tricase serves as a tangible example of a museum that embodies the principles of sustainable development for the local coastal community. It not only focuses on social development but also emphasises the protection and utilisation of the coastal environment. Additionally, the museum plays a crucial role in fostering economic development and promoting collaboration among various organisations. Each component of the museum is well-defined and can be thoroughly examined and customised to the specific requirements of any region.
Link:	https://www.portomuseotricase.org/en/home-gb/
More Resources & Info:	https://portmuse.eu/selected-ecomuseums/porto-museo-di-tricase/ Plan Bleu (2020). Blue economy in the Mediterranean: case studies, lessons, and perspectives. Plan Bleu Paper n°19
Contact:	info@portomuseotricase.org servizi@portomuseotricase.org

8. SEA Change 2030

Country:	Cyprus
Institution(s) involved:	Shipping Deputy Ministry of Cyprus
Short Description:	The "SEA Change 2030" is a strategy by the Shipping Deputy Ministry that signals Cyprus' dedication to sustainability, global involvement, and flexibility. This forward-thinking strategy aims to bolster the competitiveness of the Cypriot Registry and the maritime sector while tackling emerging challenges. Key goals include fortifying international ties, fostering dialogue via the "Cyprus Open Maritime Exchange" platform, improving security protocols, streamlining business establishment processes, modernising maritime facilities, embracing digital advancements, mitigating cybersecurity threats, promoting research and innovation, and enhancing the skill sets of seafarers. Through cultivating a culture that respects maritime professions and initiatives in the blue economy, Cyprus aims to position itself as a significant influencer in global maritime policies and a model of sustainable development and excellence in the shipping industry. Sea Change 2030 establishes a seamless, dynamic, and organised method to realise this vision. Under each strategic pillar (Extrovert/Adaptable/ Sustainable), various actions and initiatives are pledged to be executed that will facilitate transformation.
The Quintuple Helix:	1. **The education system*:*** Sea Change 2030 responds to educational needs in several ways. First, concerning maritime cyber risks, it established a structure or platform and amenities to offer education and training in cybersecurity, in collaboration with the Cyprus Digital Security Authority and with backing from the European Maritime Safety Agency (EMSA) and the European Union Agency for Cybersecurity (ENISA). To ensure high quality training and provision of skills for seafarers, the strategy will promote e-Education, e-Training and e-Learning leveraging on available technologies. Sea Change 2030 will also support and promote a maritime culture among the younger generation through engaging interactive initiatives and focused campaigns tailored for elementary and secondary school students. Conclusively, in order to foster a culture that values seafaring, maritime, and blue professions, the strategy will offer direction to top-tier educational institutions to develop undergraduate and postgraduate programs related to

	maritime affairs. It will also promote stronger connections between the shipping industry, academia, and research and innovation hubs. 2. **The economic system:** To cultivate a culture that embraces seafaring, maritime, and blue professions, the strategy will educate the public about the significance of maritime transport and the blue economy through focused awareness campaigns. Furthermore, by securing diplomatic safeguarding for vessels under the Cyprus flag, it will also advocate for and advance Cyprus shipping interests through economic diplomacy. 3. **The political system:** Through the implementation of the objectives of this strategy, the aim is to enact and formulate policies that will further enhance the blue economy of the region. The Sea Change 2030 strategy will assist in the effort to legislate and adopt better policies for this sector. 4. **The media-based and culture-based public:** The strategy seeks to foster a culture of curiosity within the shipping industry by establishing a "Research Innovation Shipping Environment" (RISE) through the allocation of funding resources and programs to promote research and innovation in shipping, supported by the Research and Innovation Foundation of Cyprus. It aims to cultivate a culture of research and innovation within the shipping sector through specific initiatives designed to identify opportunities and create innovative solutions to address existing and future challenges. These initiatives will be covered by the media to ensure better public outreach. 5. **The natural environment*:*** Sea Change 2030 will consistently assess the Green Tax Incentives, which are part of the EU-approved Cyprus Tonnage Tax System, to incentivise efforts in actively reducing greenhouse gas emissions. It will also grant Green Achievement awards for proactive environmental ship performance.
Trends & Benefits from this Best Practice	Through the implementation of the Sea Change 2030 strategy the vision for the shipping industry in Cyprus is to become stronger and more resilient on three different strategic pillars: - **Extrovert**: It's crucial to foster collaboration by systematically gathering industry insights, consulting with stakeholders, including individuals, industry professionals, regulators, and other nations to make beneficial, well-informed decisions. - **Adaptable**: By adjusting policies, direction, priorities, organisational framework, and operational procedures in line with assessment of shifts and developments in the global, regional, and local maritime landscape will benefit the shipping sector.

	- **Sustainable**: Transform policies into enduring actions and initiatives with a focus on sustainability, aimed at supporting the long-term beneficial vision of the shipping industry.
Short SWOT analysis	***Strengths:*** Implementation of new initiatives and formulation of new policies. ***Weaknesses:*** Limited response from the official authorities and stakeholders. ***Opportunities:*** Collaborations with other states to exchange views and ideas on issues of common interest. ***Threats:*** The unstable political situation of the area around the country's waters that could affect the shipping industry.
How could this Best Practice be used/transferred in other contexts?	In the shipping industry, change is a constant process. Thus, it's crucial to consistently engage in consultation, respond effectively, and proactively adjust to secure a sustainable future for shipping. The vision for Cyprus' shipping transformed into the Sea Change 2030 strategy. This strategy emerges from an extensive public consultation process, spanning several months, engaging stakeholders both locally and globally. Additionally, it stems from internal brainstorming sessions involving the team at the Shipping Deputy Ministry. All the above initiatives and actions could be applied/transferred to other similar contexts with the same beneficial outcomes.
Link:	https://cyshippingstrategy.com
More Resources & Info:	https://www.dms.gov.cy/dms/shipping.nsf/home_en/home_en?openform
Contact:	maritimeadmin@dms.gov.cy

9. Cyprus Marine and Maritime Institute

Country:	Cyprus

Institution(s) involved:	**CMMI** – Cyprus Marine & Maritime Institute **CMMI** – Limassol Liaison Office
Short Description:	Established in April 2019, the Cyprus Marine and Maritime Institute (CMMI) serves as a hub for marine and maritime research, innovation, and technology advancement, operating as a Centre of Excellence. Situated in Larnaca, Cyprus - an island strategically positioned at the intersection of three continents and major maritime pathway, boasting a rich maritime heritage and a thriving maritime industry - CMMI has secured funding from the EU's Horizon 2020 Research and Innovation Programme, supplemented by matching funds from the Cyprus Government. CMMI's overarching goal is to drive sustainable Blue Growth by addressing industry and societal needs across various marine and maritime sectors. Comprising of ten Research and Innovation Centres, CMMI delves into areas such as marine technology, robotics, digitalisation, observation, coastal ecosystems, biotechnology, aquaculture, maritime human factors, cultural heritage, policies, and regional collaboration. The scientific team at CMMI is actively engaged in significant projects geared towards resolving challenges pertinent to both industry and the society. These projects deal with initiatives targeting decarbonisation, marine biodiversity conservation, pollution prevention, establishment of an oceanic digital knowledge repository, and cultivation of a skilled blue economy workforce. With expertise spanning naval architecture, marine and electrical engineering, aquaculture management, oceanography, marine sciences, robotics, and artificial intelligence, CMMI aims to drive impactful advancements in the marine and maritime domain of Cyprus.
The Quintuple Helix:	**1. The education system:** CMMI is periodically involved in several educational programs. Currently, CMMI offers vocational education and training programs to unemployed groups for acquiring knowledge and skills related to the Blue Economy under a contract with the Human Resource Development Authority of Cyprus and within the framework of the Cyprus Recovery and Resilience Plan for the period 2021-2026 (Next Generation EU). Some of the topics covered by the programs involve ocean literacy and integrated STEAM education, marine robotics, green transition in the cruise sector, understanding blue economy policies at local, national, and European level, coastal, marine, and benthic ecology, decarbonisation in shipping and other relevant topics.

2. The economic system: One of CMMI's centres - the Marine & Offshore Science, Technology & Engineering Centre (MOSTEC) - is dedicated to tackling engineering challenges and requirements within the marine and maritime industry through its research and innovation actions.

MOSTEC's scope of work encompasses various areas including naval architecture and ship design, investigations into ship efficiency and environmental impact reduction, as well as efforts to minimise life cycle costs.

Research interests and activities at MOSTEC extend to engineering applications relevant to offshore fish-farming, renewable energy and hydrocarbon technologies, coastal protection, and underwater structures such as artificial reefs. Additionally, MOSTEC is enhancing its capabilities in high-level computational fluid dynamics (CFD) simulation software and tools, including virtual and numerical wave tanks, as well as thermodynamic combustion models integrated with chemical kinetics. These activities could benefit economically every institution/business willing to adopt them.

3. The political system: CMMI was established by the CMMI/MaRITeC-X project as a "Centre of Excellence in Marine and Maritime Research, Innovation and Technology Development" and has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 857586; as well as matching funding from the Government of the Republic of Cyprus.

The organisation's ties with the government are robust and close, facilitating collaborations between the two at multiple levels. The state's political system can benefit from the centre's initiatives by incorporating them into its own actions. Additionally, the centre can serve as a knowledge hub for the political system to bolster the blue economy.

4. The media-based and culture-based public: Marine cultural heritage comprises both tangible and intangible evidence of people's enduring relationship with the sea throughout history. Studying and safeguarding this heritage is crucial for understanding and reinforcing past and present cultural identities, as well as for charting new pathways for the future.

The CMMI Marine Cultural Heritage Centre (MCHC) is dedicated to promoting and deepening understanding of Cyprus' marine cultural heritage. It contributes to researching, protecting, and preserving tangible marine heritage, including underwater and coastal archaeological sites and contemporary cultural landmarks. Concurrently, the MCHC actively works to advance the island's intangible marine heritage, encompassing oral histories, artistic and linguistic expressions, local expertise, and traditional knowledge pertaining to marine and maritime domains.

	With the aim to foster appreciation for marine heritage, the MCHC organises outreach and community engagement events such as seminars, workshops, marine-themed exhibitions, and the establishment of underwater museums. Moreover, the Centre strives to raise awareness about the significance of marine cultural heritage in contemporary society and to facilitate further research in the field by leveraging its involvement in marine sciences. **5. The natural environment***:* Another centre, the Marine and Coastal Ecosystems Centre – MarCEC is dedicated to devising effective and sustainable strategies for our distinctive coastal and marine environments, engaging in environmental research to foster an economically and ecologically viable future aligned with the United Nations' (UN) Sustainable Development Goals (SDGs). To achieve this objective, MarCEC will adopt a comprehensive approach, collaborating closely with other CMMI Centres to monitor the status of the marine environment. Concurrently, it will conduct proactive applied research to address the challenges facing coastal and marine ecosystems. This research will encompass the study of ecological processes, with a focus on vulnerable or priority species and habitats, as well as the establishment and management of Marine Protected Areas. Furthermore, MarCEC will actively contribute to the national Marine Spatial Planning agenda in partnership with relevant authorities and stakeholders. Another centre of CMMI, the Marine Biotechnology and Aquaculture Centre – MBAC, explores cutting-edge advancements in the realms of "Blue" Biotechnology and Aquaculture. Leveraging Cyprus's unique geographic position in the eastern Mediterranean Sea - which boasts a rich array of endemic marine and coastal organisms with untapped biotechnological potential - MBAC conducts applied research to further these fields. Additionally, the Center focuses on applied research within the aquaculture industry, emphasising reproductive biology in controlled environments, sustainable production enhancement practices, Integrated Multitrophic Aquaculture (IMTA), and multidisciplinary approaches to assess the bioremediation capabilities of select marine species. In pursuit of these goals, MBAC collaborates closely with esteemed academic and research institutions as well as industry leaders to address the most pressing challenges in marine biotechnology and aquaculture.
Trends & Benefits from this Best Practice	CMMI drives sustainable blue growth by addressing the needs of industry at the national and EU level, as well as addressing the needs of society on different aspects. At a glance, the institute aims to boost marine technology through the promotion of several actions that include the incorporation of decarbonisation in shipping,

	vessel design, vessel performance optimisation, maritime alternative fuels, emissions monitoring and others. Marine sciences and marine social sciences are also promoted through alternative actions that boost marine ecology and biodiversity, sustainable fishing practices and the aquaculture, environmental monitoring, the promotion of culture and heritage, policy making and legislations etc.
Short SWOT analysis	***Strengths:*** The involvement of the institute in several projects and the establishment of various and diverse centres, makes it a centre of excellence, from which the state can gain and benefit significantly. ***Weaknesses:*** As CMMI is not heavily involved in the political system, one weakness could potentially be the unwillingness of the responsible state entities and relevant stakeholders to respond to the institute's calls for collaborations and alliances. ***Opportunities:*** A large range of initiatives through the implementation of various projects that the institute undertakes, give the opportunities to entities and stakeholders to get involved, learn and advance. The institute also offers job vacancies to young researchers. ***Threats:*** Sudden cuts in grants due to unexpected political and social circumstances.
How could this Best Practice be used/ transferred in other contexts?	The institute collaborates with organisations across the marine and maritime sectors, as well as other industries, to develop and deliver solutions tailored to their challenges and requirements. The institute's partners can come from a large spectrum, ranging from startups to medium and large corporations, government agencies, academic and research institutions, and non-governmental organisations. As they maintain an extensive national and international network of partners capable of addressing diverse needs, their business development unit and the knowledge and innovation and entrepreneurship centre (KInEC) could serve as primary points of contact within the organisation.
Link:	https://www.cmmi.blue/
Contact:	Business Development Unit: BDU@cmmi.blue Knowledge, Innovation, and Entrepreneurship Centre: KINEC@cmmi.blue

10. Good practices for sustainable cruise tourism – Report by the European Commission

Country:	Produced for the Directorate-General for Maritime Affairs and Fisheries to be used on the EU level
Institution(s) involved:	- European Commission - Directorate-General for Maritime Affairs and Fisheries - Directorate A - Maritime Affairs and Blue Economy - Unit A2 – Blue Economy Sectors, Aquaculture and Maritime Spatial Planning
Short Description:	This report collated and assessed existing data concerning cruise tourism with the aim of aiding cruise stakeholders in advancing sustainability initiatives. Set within the context of the European Green Deal, the European Commission's renewed focus on sustainable marine economy, and the establishment of a Transition Pathway for tourism, the study examined the current situation across economic, social, and environmental dimensions. It delved into potential solutions for pertinent challenges, evaluated economic impact, and documented both regulatory and non-regulatory frameworks dealing with environmental and social aspects. This study suggested a sustainability roadmap featuring measures with minimal regret potential, aimed at guiding the industry towards a more sustainable trajectory. Additionally, it outlined a framework for recognising exemplary practices among various stakeholders, offering valuable insights for different sectors of the industry to draw upon for guidance and improvement.
The Quintuple Helix:	1. **The education system:** The outcomes of this report could be used for educational and training purposes of maritime education. 2. **The economic system:** The European cruise tourism sector holds significant economic importance, driving economic activity and job creation. While representing a relatively small portion (around 2%) of global tourism, Europe stands as the second-largest cruise market worldwide, both as a source of passengers and a destination. In 2019, a quarter of global cruise travellers explored European waters, particularly in the Mediterranean and northern regions, resulting in a 2 billion Euro industry solely from the direct and indirect economic impacts of cruise lines, passengers, and crew, excluding the influence on Europe's shipbuilding sector, which predominantly constructs large cruise liners. Prior to the COVID-19 pandemic, cruising experienced rapid growth, averaging a 7% annual

increase over the past three decades. However, the pandemic brought the industry to a standstill - though it is anticipated to recover to pre-pandemic levels soon, contingent upon external factors such as the situation in Ukraine and unforeseen events. The industry's resilience, together with favourable demographics among cruisers, suggests continued growth prospects, albeit accompanied by challenges related to environmental pressures and tourism congestion. As the industry continues to expand, it is imperative for sustainability efforts to evolve and permeate throughout the sector to meet climate targets. Effective collaboration among all stakeholders within the cruise tourism industry will be pivotal in achieving these goals.

3. **The political system:** As regulations continue to develop, the EU provides an extensive framework within which cruise tourism must operate. This framework comprises three main components: the EU Green Deal, aimed at fostering a sustainable economy; the approach to the Sustainable Blue Economy; and the EU's Transition Pathway for Tourism.

   The European Green Deal serves as the overarching sustainability strategy for Europe, striving for net zero carbon emissions by 2050, greenhouse gas neutrality by 2050, and economic growth independent of resource consumption, all while ensuring inclusivity and equity. A key aspect of this initiative is the Fit-for-55 package, which targets a 55% reduction in emissions by 2030. This package includes measures like the FuelEU Maritime initiative, revisions to the Alternative Fuels Infrastructure Directive, and the expansion of the Emissions Trading System (ETS) to cover transportation, including shipping.

   Within the context of the blue economy, the EU is adopting a new approach to transform it into a sustainable entity. This sustainable blue economy aims to foster economic growth, social inclusivity, and improved livelihoods while safeguarding the environmental integrity of oceans and seas. This entails addressing external factors impacting coastal and island tourism in Europe, such as global tourism growth (potentially leading to over-tourism), evolving market segments, changing demand patterns, demographic shifts, increasing emphasis on sustainability and quality, and geopolitical instability.

   The EU's Transition Pathway for Tourism constitutes a third pillar of this framework. It calls upon the tourism industry to invest in circularity to reduce energy consumption, waste, water usage, and pollution, while also meeting the rising demand for sustainable tourism. Additionally, it emphasises data sharing to facilitate the introduction of innovative tourism services, enhance sustainable destination management, and advocates for investment in skills development to ensure a skilled workforce and attractive career opportunities within the tourism ecosystem.

4. **The media-based and culture-based public:** The social dimension of cruise tourism encompasses four main aspects: the minimum qualifications

required for seafarers, employment conditions, living standards, and health, medical care, welfare, and social security protections. There exist extensive regulations to uphold minimum standards in these areas. The findings of this study indicate that the cruise industry generally complies with these regulations, with most issues arising from potential abuses in recruiting junior crew members from source countries. However, cruise lines have implemented effective practices to prevent such abuses in their recruitment processes. Areas for potential enhancement include improving welfare provisions and developing structured career pathways beyond the minimum requirements.

5. **The natural environment:** Environmental evaluations were conducted as part of this study between 2020 and 2021 to gauge the current landscape regarding challenges and potential responses. The challenges are multifaceted. Airborne issues primarily stem from propulsion and emissions of CO2, NOx, SOx, and particulate matter resulting from fossil fuel combustion. Waterborne challenges include black water, grey water, waste water, and ballast water discharge, posing risks to aquatic ecosystems, such as the introduction of invasive alien species (IAS) that could disrupt native species. Managing the substantial waste generated by increasingly large cruise ships carrying more passengers presents a significant challenge.

   Various solutions exist, each with its own drawbacks, such as cost, technological immaturity, or incompatibility with cruise ship designs requiring ample deck space. There is no one-size-fits-all solution. While the industry is gravitating towards liquified natural gas (LNG) use with scrubbers to mitigate toxic emissions, this approach relies on fossil fuels and may not be sustainable in the long run. Connecting to onshore power supply (OPS) reduces emissions in ports, but its energy efficiency depends on renewable power sources and requires joint investment from cruise lines and ports, which may be hindered by space constraints in smaller ports.

   Longer-term options include hydrogen, biofuels like biomethanol, battery-powered ships, or integrating auxiliary power from renewables, but these technologies are not yet mature for cruise ship application, and their future cost-effectiveness and regulatory acceptance remain uncertain.

   Similarly, waste management solutions, both in waste reduction and treatment, exist but are costly and not universally implemented. Effective waste management relies on advanced technologies at ports and collaboration between ports and cruise lines.

   While measures like energy efficiency, OPS, and data optimisation are easily implementable, decarbonisation efforts cannot rely solely on these approaches. The industry must establish clear environmental objectives, adopt circular economy principles, phase out sulphur from fuels, develop low-emission fuels, enhance fuel flexibility, and implement zero-emission

	technologies. Promoting innovation in waste management and expediting infrastructure and supply chain development are also crucial steps.
Trends & Benefits from this Best Practice	The benefits of adopting the strategies suggested by the report are multiple for the cruise industry. Some of these are: - Maximise economic and social benefits whilst minimising environmental impacts - Benefits to local economies - Benefits to coastal communities - Environmental and financial benefits - Cost savings and local environmental benefits - Measuring the economic contribution - Decent work and career opportunities - Preventing exploitation and discrimination
Short SWOT analysis	***Strengths:*** The report is supported by evidence already in practice with successful outcomes therefore it can be applied to several contexts. ***Weaknesses:*** Low dissemination activities by the involved states to promote it across relevant stakeholders. ***Opportunities:*** Through the promotion of this report to the national level and the use of this for training and educational purposes. ***Threats:*** The reluctance of some states to utilise the knowledge included in the report.
How could this Best Practice be used/ transferred in other contexts?	When considering which routes to follow, those involved in the cruise industry can draw insights from the beneficial methods highlighted in this research. These methods encompass various cruise entities throughout the EU, selected for their foundation in inter-sector cooperation, specificity to the cruise sector, implementation within the EU, quantifiable impact, and alignment with one or more objectives of the EU Green Deal. Moreover, the study identified several proactive measures that the industry can undertake now, encompassing both planning strategies and the adoption of technologies that are either already mature or in the process of maturing. Maintaining a delicate equilibrium among the interests of all cruise stakeholders is paramount in this process. Achieving the right balance to safeguard and improve resources while also meeting the diverse needs of stakeholders- both

	presently and in the future - poses a formidable challenge. Over time, the European Commission has played a significant role in fostering a more sustainable cruise tourism industry by evaluating the impact of initiatives, incentivising endeavours through various schemes, and implementing regulations. Such actions can be applied by other authorities that can learn from and act accordingly.
Link:	https://blue-economy-observatory.ec.europa.eu/document/download/9e4b84f1-eaf3-4bdf-9fa2-d648deaf6394_en?filename=good%20practices%20for%20sustainable%20cruise%20tourism-KL0322272ENN%20%281%29.pdf
More Resources & Info:	https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en https://www.unep.org/topics/ocean-seas-and-coasts/ecosystem-based-approaches/sustainable-blue-economy https://ec.europa.eu/docsroom/documents/49498
Contact:	Heino Nau E-mail: MARE-A2@ec.europa.eu European Commission B-1049 Brussels

11. Marine and Environmental Research (MER) Lab

Country:	Cyprus
Institution(s) involved:	Marine and Environmental Research (MER) Lab
Short Description:	MER is a well-established small to medium enterprise (SME) comprising marine scientists offering specialised marine and environmental research and consulting services. Over the past 15 years, MER has executed numerous projects and research initiatives along the coastal and offshore areas of Cyprus, focusing on marine biologyecology, aquaculture, and fisheries. It currently dealing with marine research in Cyprus, serving also as a governmental advisor and maintaining

	close ties with stakeholders in the fishing industry, divers, and other maritime users. Equipped with a comprehensive array of field instruments, its team conducts underwater surveys, sampling, and monitoring of physical, chemical, and biological parameters in both water columns and benthic environments. The lab's facilities are outfitted for the collection, analysis, and processing of biotic and abiotic data, crucial for marine environmental monitoring and research.
The Quintuple Helix:	1. **The education system:** MER can provide a range of essential services including, marine educational excursions involving boat trips, snorkelling, diving, and coastal field trips, opportunities for environmental volunteering, development of educational materials in various formats such as print, video clips, and online resources. It also offers collaboration with universities to offer dissertation guidance and practical training, as well as public outreach activities aimed at sharing information and raising awareness. By leveraging the advanced scientific knowledge of its researchers and their teaching skills, MER delivers educational content and field trips tailored to groups interested in deepening their understanding of marine ecosystems and human influences on them. 2. **The economic system:** Human activities increasingly impact areas where land and sea intersect, particularly as a significant portion of the global population resides along coastlines. Consequently, the planning of coastal areas has become increasingly crucial in environmental management efforts. Such planning must be executed in a manner that promotes ongoing economic, social, and environmental well-being in these regions. The EU has issued recommendations for the implementation of Integrated Coastal Zone Management (ICZM) to its member states, aiming to ensure coordinated action in managing coastal areas at the European level. However, the implementation of these recommendations varies among countries, with some nations yet to initiate the process, leading to an imbalance in approach. MER offers a variety of services aimed at identifying and promoting sustainable practices in coastal management and planning. These services cater to various development interests, including ports, harbours, marinas, power stations, desalination plants, hatchery units, and property developers. 3. **The political system:** MER acts as governmental consultant for various subjects concerning the blue economy of the island. 4. **The media-based and culture-based public:** The MER Institute initiatives and actions are highlighted through public promotion via social media channels, so that the public is aware of such actions to promote these further and take part when feasible. One example is the centre's announcement in January 2024 of the five-year initiative for monitoring marine debris in the Republic of Cyprus. This endeavour signifies a notable stride in their mission

	to safeguard marine environments and enhance scientific comprehension of the effects of marine litter. Through the utilisation of cutting-edge methodologies and partnerships with local communities and public awareness, they aim to furnish comprehensive data that can guide and shape local environmental policies. 5. **The natural environment:** In contrast to the relatively accessible and monitored terrestrial environment, conducting research in the marine realm can be daunting and fraught with high risks. Researchers worldwide are only beginning to grasp the intricacies and pivotal roles of marine ecosystems. Recently, developed coastal nations have shown increased interest in this field of study. Despite Cyprus being an island with an extensive coastline, research into marine ecology remains limited. Ecology stands as one of the primary areas of expertise within MER. Their team consists of marine ecologists and biodiversity specialists that have conducted numerous ecological studies in the past, predominantly focusing on the marine environment. Data are integrated from surveys and analyses using advanced software to deliver quantitative, high-quality marine data. Furthermore, two of the most pressing concerns for ecologists and conservationists today revolve around the ongoing loss of crucial habitats and the loss of biodiversity, both of which are inevitable outcomes of expanding human pressures. Consequently, the governments of most developed nations have adopted strict environmental legislation to assist in decision-making processes. Environmental assessment actions through studies aim to ensure that the environmental implications of decisions are considered prior to their implementation. Coastal developers are obligated to submit an Environmental Impact Assessment (EIA) study to the Department of Environment in Cyprus before undertaking any development. The EIA serves as an environmental planning tool, facilitating the anticipation and mitigation of potential environmental impacts caused by any project. Recognising the paramount importance of EIA, it is now deemed essential for all project approvals to undergo this assessment. EIA study implementation has been a crucial component of the initiatives MER is undertaking. Specialised researchers have executed numerous marine sections of EIAs and completed comprehensive EIAs along the coasts of Cyprus. MER's EIA services encompass a broad spectrum of coastal activities, including ports and harbours, breakwaters, fish farms and hatcheries, desalination plants, power plants, and other man-made structures.
Trends & Benefits from	Due to the numerous services that MER offers, including the implementation of marine research programs, the assessment of the area's environmental impact, the monitoring of the sea ecosystems, the promotion of marine ecology and

this Best Practice	biodiversity and other important actions, MER can be considered as one of the most important research centres of Cyprus aiming at boosting the country's blue economy.
Short SWOT analysis	***Strengths:*** The strong bonds of MER with the government and the local stakeholders makes it a reliable centre that can influence the implementation of local strategies and the promotion of good practices in regard to blue economy. ***Weaknesses:*** Possible weaknesses interfering with the smooth operation of MER could be the constraints of funding through national and non-national sources. Furthermore, the sometimes much needed collaboration with external agencies and organisations can prove problematic, compromising the MER's autonomy, leading to conflicts of interest or restricted research opportunities. ***Opportunities:*** One of the many opportunities that can be offered to MER employees, the public and the local authorities through the centre's actions is the development of strong collaborations and relationships of the above-mentioned groups. These relationships will establish long term monitoring programs to provide valuable data on ecosystem health, biodiversity trends, and the impacts of climate change and human activities. Moreover, further engaging the public through outreach activities, citizen science projects, and educational programs can raise awareness about marine conservation issues and inspire stewardship behaviours. ***Threats:*** Marine research institutes such as MER may face competition from other research institutions, industry stakeholders, or commercial interests for access to funding, talent, and research opportunities. Limited resources, expertise, or infrastructure may constrain the institute's ability to attract top researchers, secure collaborative partnerships, or maintain cutting-edge research programs.
How could this Best Practice be used/transferred in other contexts?	The actions and experiences of the MER institute can serve as valuable models, sources of inspiration, and catalysts for collaboration, capacity-building, and innovation in marine research and conservation efforts worldwide.
Link:	https://www.merresearch.com/
Contact:	info@merresearch.com

Field research results: Interview with experts

In the process of collecting successful Quintuple Helix practices and models in the blue and green economy in Greece and Cyprus (and the broader EU context), a total of 15 semi-structured interviews

were conducted by the EU partners (AR, UAEGEAN, UCY, CSI, Symplexis) with experts in the blue economy, including experts from academia, research centres and aquaculture. Indicatively, out of the 15 interviewees, 9 were academics/researchers, 2 were employed in port funds, and the rest 4 held managerial positions in various blue economy companies and enterprises. All participants were briefed regarding the project and its objectives prior to their interview and asked to sign a consent form for their participation. All interviews were carried out online, through teleconferencing, during which participants either consented to the recording of the conversation or to a screenshot of the interview taking place. Following the interviews' completion, the recordings were transcribed, and the main points of interest were documented. In this section, the results of these interviews will be presented and discussed.

Firstly, most interviewees maintained being **aware of the Quintuple Helix Innovation Model**, which encompasses education, economy, the political system, the public, and the natural environment. Most participants have come across it through their research activities, and understand what the term means and how it is being used. It became evident that, for interviewees, it is an important model that can help, not only with the blue economy, but also with the green economy, which relates to the energy sector as well, aiming to foster innovation in different areas of the economy, as well as in R&D. Employing this approach when designing new activities and practices is deemed crucial for bringing balance in their development and implementation, since various and diverse stakeholders are being engaged, which can act as a mechanism to encourage a holistic approach to the activities undertaken, thus ensuring optimum impact.

As such, many of the participants claimed that they did take the **Quintuple Helix into consideration when designing and implementing projects and initiatives**, deeming it crucial to consider the added value of knowledge and the most up-to-date scientific information, along with the natural, societal, and business environments. This holistic approach ensures the development of innovative and productive practices that further generates synergies between businesses and government entities. In recent years, the implementation of such practices has become a must for businesses to be successful. Some interviewees responded that they have been using this approach in their projects, even though they name it systemic approach or integrated management. Many participants went on to describe in detail the application of the five sub-systems of the Helix into their daily operations. For example, a representative of a Port Fund in Greece highlighted the collaboration with different universities and the organisation of various trainings and seminars (educational system), as well as the involvement of port authorities in seeking sponsorships and generating and managing revenues, operations, services, and logistics expenses (economic system). Moreover, the port's operations and activities follow the national

and European legislation and policies (political system), whereas valuable insights related to the port, the island services, and the environment are also collected from both residents and visitors in the form of surveys (civil society). Last but not least, since the port's establishment, efforts have been made to preserve the natural environment, with the attainment of the "Blue Marina Flag" for six consecutive years (2018 to 2023), the implementation of water conservation activities, and the organisation of environmental training programmes in collaboration with the partner universities (natural environment).

Another interviewee from Spain referred to multi-sectorial and multi-disciplinary initiatives that aim to address problems related to fishing and aquaculture in their area. In this fisheries network, representatives from the government, the academia, research institutes, different enterprises, and the local fisheries and marine organisation come together at least twice a year to talk about the problems at hand, strategise, find solutions, and hatch new courses of action. They highlighted the value of this way to approaching problems, as it provides everyone with the opportunity to express their views on the matter (e.g., the development of Aeolic parks and their effects on their natural environment) and find multifaceted solutions that take everyone's needs and perspectives into consideration. The Spanish participants also referred to Universities' initiatives to create "càtedras de cambio climatico", independent bodies for climate change, where all possible parties that might be affected by it are invited to participate (researchers, government officials, academics, citizens, media representatives, etc.) and weigh in on the various matters/problems that arise (e.g., the port activities). Involving the government in such initiatives has also been found by the interviewees to increase their continued support and funding possibilities, which are essential for the initiatives' success.

Many interviewees commented on the importance of government involvement, despite its challenging influence, and the integration of Sustainable Development Goals (SDGs) into their initiatives. They are, however, aware of certain limitations when designing new projects, such as difficulties replicating certain practices from one location to another or getting all the different stakeholders involved and on board.

When enquired about **blue (and green) economy initiatives** they are aware of in their national or EU contexts, all participants provided a variety of different examples, such as fishing, aquaculture, tourism, shipping and shipping decarbonisation, renewable energy, oil and gas extraction, desalination, marine/coastal ecosystem protection, fish farming, maritime transport, offshore wind energy, Green Economy projects which focus on renewable energy sources, green infrastructure, water, waste and land management, as well as carbon footprint reduction. Horizon2020 projects were also mentioned; specifically the project "SEALIVE" (Strategies of circular Economy and Advanced bio-based solutions to

keep our Lands and seas alive from plastics contamination), that will bring advanced bio-based plastic solutions to the market, providing viable alternatives to single-use plastics, reducing plastic waste and contamination on land and in seas, by boosting the use of biomaterials and contributing to the circular economy with cohesive bio-plastic strategies. One participant insightfully commented that blue and green economies are interrelated (for instance, algae can be used to generate energy or biofuels), and that there is a major drive at a European level in terms of getting the Mediterranean countries to work together towards a blue/green economy transition. Other notable initiatives included Blue Green, BlueInvest, and Mission Restore our Oceans and Waters, SciDrones, CLIMEFISH, and PERFORMFISH all of which were recognized for their alignment with the Quintuple Helix framework. In Cyprus, experts mentioned initiatives such as the EU-CONEXUS (https://www.eu-conexus.eu/en/), a partnership between nine universities developing science and innovation into a hub of excellence on Smart Urban Coastal Sustainability (SmUCS), and CyFoS (The Cyprus Foundation of the Sea, https://www.cyfos.blue), a non-profit cluster organisation to bring together the Blue Economy Ecosystem of Cyprus. Further, the Blue Limassol forum is an annual event, jointly organized by Limassol Municipality and Frederick University's Department of Maritime Transport and Commerce, with the aim to air key issues and initiatives directly linked to the Blue Economy and promote maritime and environmental awareness amongst local citizens. Finally, there are number of EU research programs related to the development of blue economy, while they also aim at protecting the environment and improving quality of life.

Within the blue economy, the primary objective is to minimise the adverse environmental effects, although achieving zero environmental impact is impossible. Furthermore, there is an excessive emphasis on promoting technological and recreational requirements, while the protection of the environment is disproportionately promoted. The recommended approach for most such projects is to incorporate innovative knowledge models such as the Quintuple Helix. This will ensure that the projects are productive and sustainable, while also benefiting the environment, society, and the economy. Currently, most practices are unsustainable, putting a big pressure on the planet and ecosystems. Therefore, it is crucial to shift focus towards collective interaction and knowledge exchange through the five subsystems of the Quintuple Helix; to successfully implement this approach, cooperation, coordination, and a strong emphasis on education are necessary to overcome obstacles during both the design and implementation stages.

Some levels of the helix might have a bigger bearing compared to others, depending on where they are being applied. For instance, when thinking about economy, and specifically tourism, there are certain aspects which are more important than others; for example, it could be the publicity, the sustainable food that is being served, lower carbon footprint or the transport. Thus, the Quintuple Helix framework

has to be adapted according to the various needs and the blue economy, nevertheless, it offers fertile ground to be applied and then adapted accordingly, in order to come up with the right mix in terms of education, economy, the political system, public in general, because there are different cultures, different approaches, and different government rules and policies.

When it comes to **suggestions and recommendations to strengthen the adoption of the Quintuple Helix** in the blue/green economy initiatives, education arose as a fundamental precondition, encompassing both formal institutional education and the lifelong education of local communities and other groups, making it possible to grasp the essential coexistence and co-operation among the five subsystems. Another suggestion related to the provision of relevant incentives and guidance by the funding organisations, whereas someone suggested the use of media to present matters of the blue economy and raise public awareness. However, the involvement of citizens in the decision-making process might be problematic, therefore, one suggestion would be to find ways to get the politicians to decide based on an integrated approach. It was also expressed that all operations should be done in a sustainable way, and this is something that must be taught from a young age to incorporate this mindset for future generations. A potential obstacle for successful implementation is not enough knowledge on this matter, therefore, education is -once again- the key. Promoting collaborative activities like those within the UN ocean decade was also suggested.

An expert highlighted the importance of examining all developments from a long-term perspective, as far as their impact on the economy and society. Blue economy has a direct relationship with the sea, and it is worth mentioning that, by 2050, it is expected that approximately 50% of the worldwide population will reside at the coast. Therefore, it is important to protect the coastal environment effectively. Any developments should be looked at in a holistic manner, meaning an industry cannot develop against another, and all development should always be aligned with the quality of citizens' life. Collaboration among all stakeholders -Quintuple Helix- is therefore necessary.

Nonetheless, as already mentioned, there are many **obstacles** for the successful, complete adoption of the Quintuple Helix model, one of which is resistance to change. The government and other decision makers very often face difficulties understanding some aspects of the blue economy. That could be an area where better education might help the public appreciate the benefits of investing in the blue economy. Moreover, participants have found that, for the government to support blue economy initiatives, the problems have to be on the public agenda, which will incentivise the elected parties to act upon them for their public image. This means that the wider public and society needs to be made aware often and clearly about these issues, not only to get involved in them themselves, but to affect change on higher levels. Obstacles could also relate to interest among stakeholders, which can

sometimes lean on one side, and profits among the organizations engaged in the initiatives of the blue economy. However, ultimately, this is the purpose of the Quintuple Helix; to balance any such issues between all stakeholders. The execution of any blue economy initiative needs to be approached in a holistic and collaborative way, and the priority should be the long-term quality of life of citizens and the community.

Considering **the transferability potential** of such practices, as identified above, to other national contexts, like Malaysia and Indonesia, participants highlighted the importance of adapting paradigms with local participation and understanding, emphasising the need for people from other countries to witness and understand the benefits of such paradigms. Two interviewees mentioned that for a successful adaptation of such practices, the first step would be the identification of their priorities (e.g., education and initial participation in such projects) and the aspects that affect the development of blue economy in the Asian contexts. Few participants maintained that most of the identified successful practices and initiatives can be adapted and replicated in different contexts. For example, in Cyprus, there is a successful tourist model related to the blue economy, which perhaps exists in a similar model in Malaysia and Indonesia, but the goal would be to make it more sustainable without interfering so much with the environment. Other ideas included shipping, since Greece and Cyprus are world leaders in terms of marine transportation, and this could trigger development in these two Asian countries, so maybe this model can be investigated. Other practices that could be transferred in the Asian context included the sectors of blue economy and their connection with innovation, the role of the Blue Economy in the fight against pollution and the potential advantages that can be gained from the emerging opportunities resulting from these efforts, as well as available tools and key priorities for implementing blue practices to promote the growth of the blue economy. Lastly, the creation of Centres of Excellence based on the model of CMMI could also support many other nations in bringing together all sectors of the blue economy under one roof and ensure interdisciplinary research and innovation, bridging the gap between industry and research community.

However, participants also expressed their **concerns** with regards to adapting and replicating such practices in other contexts, as there may be certain challenges that could hinder this transfer, such as legal frameworks, infrastructure, civic engagement, lack of funding, and insufficient education. The different culture(s) could also present an obstacle, as well as different ways of approaching things. The engagement of women in various practices could also potentially be an issue, especially in countries where the relevant professions are predominantly male-dominated. Another potential obstacle could be the small percentage of specialists and experts in this field, as well as the lack of sufficient data pertaining to local contexts. Obstacles could also relate to some policies not being in place, which means

having to start from scratch, and policy makers will have to understand the importance of blue economy. Education is therefore highly important; proper educational tools will have to be in place (or developed) so that people become aware of the benefits of blue economy initiatives. The educational system should also be in collaboration with the government for transferring such blue economy practices in the national context of the country. It is also important to instil a research spirit on the involved stakeholders, which is a prerequisite for the development of blue economy initiatives that will benefit them.

Next, interviewees were also asked about their **understanding of the term "blue economy"** and to contemplate on its role in the fight against pollution and the potential advantages that can be gained from the emerging opportunities resulting from these efforts. For the respondents, blue economy encompasses everything that is related to the sea; it is the economic term used to describe the economic activities associated with the oceans and seas. Blue Economy encompasses all sectoral and cross-sectoral economic activities based on or related to the oceans, seas and coasts: Marine-based activities - includes the activities undertaken in the ocean, sea and coastal areas, such as Marine living resources (capture fisheries and aquaculture), Marine minerals, Marine renewable energy, Desalination, Maritime transport and Coastal tourism; Marine-related activities: activities which use products and/or produce products and services from the ocean or marine-based activities like seafood processing, biotechnology, Shipbuilding and repair, Port activities, technology and equipment, digital services, etc.

The sea plays a great role in the economy of any country that has a coastline, territorial sea, and Exclusive Economic Zone, and is especially critical to the economies of island States. The blue economy is highly significant at national and EU levels, since the Greek and Cypriot economies overall depend on it, given that more than 5 million of people are employed in related sectors. Moreover, around 35% of world tourists are visiting the Mediterranean every year. Therefore, the blue economy is an EU and a "global major employer" with multiple benefits to countries' economies.

All actions developed under the blue economy should be sustainable, therefore they should be one with the environment. In this way, **the blue economy plays a big role in the fight against pollution**. Pollution can take a lot of different forms in the marine environment, stemming from oil spills, the introduction of alien species, plastics, and so on. Additionally, it is estimated that, by 2050, there are going to be more plastics in the sea than fish. Pollution originating from the coastline enters the sea, activities such as aquaculture generate waste, there are emissions from ships, and recently rare metals are being harvested from the sea. Therefore, there is this interplay between the blue economy and marine activities, that can play a role in mitigating pollution, given that companies are given the right incentives to take care of these matters in a more effective way.

The **blue economy's role against pollution** lies in the prevention of plastics pollution from ships, decarbonisation, reducing biofouling on ships, stopping harmful effluents from ships (ballast water, Exhaust Gas Cleaning Systems), and reducing hull biofouling. Blue Economy, by definition, promotes sustainable economic activities related to oceans and seas and has the potential to mitigate pollution through eco-friendly practices and innovative technologies, while also fostering economic growth and job creation. The inclusion of sustainability and protection of the marine and coastal environment was deemed extremely crucial for the promotion of the blue economy; without considering the environmental aspect, blue economy solely focuses on financial objectives. Technical innovations and the importance of innovation in general in processes and procedures to exploit oceans sustainably were also mentioned, along with the importance of adhering to scientific recommendations for ocean health. The fight against pollution can greatly benefit from the blue economy, provided that there are proper political regulations and safeguards in place. However, if these rules are disregarded in favour of profit, essential controls and environmental studies may be overlooked. Without a political commitment to address the issues that negatively impact the environment, there will be an ongoing environmental deterioration.

With regards to **available tools for implementing blue practices to promote the growth of the blue economy,** education was found to be one of the main and most important tools. By providing knowledge on sustainability across all education levels, ranging from elementary to higher education, we ensure that the individuals joining the blue economy workforce are well-prepared, regardless of their specific area of expertise. By adopting this approach, the necessity for enforcement measures is eliminated. A participant also stressed the need for a connection between academia, the industry, and the public, and for a mission-oriented approach, with an emphasis on stakeholder cooperation and mutual understanding of needs. Other promising strategies that emerged are to invest in research, especially in cross-border research programmes that allow for the sharing of knowledge and information, provide easier funding opportunities and financial incentives, utilise data with the help of new technology tools.

Key priorities for "blue" practices should include investments in new technologies and facilities, in marine spatial planning, sustainable fisheries management, and international collaboration, alongside fundamental skills and knowledge in engineering, oceanography, and environmental science. While the theoretical groundwork for the blue economy exists, it lacks specific guidelines, standards, and principles. Enforcing European legislation is crucial for its practical implementation, accompanied by Environmental, Social, and Governance (ESG) requirements and SDGs.

As was mentioned previously, **the "Blue Economy" can foster the creation of new job prospects and business ventures.** The Blue Economy sectors play a significant role in national economies by

generating a substantial amount of income and job opportunities. As these sectors continue to grow, new businesses and employment opportunities are emerging, demanding higher levels of expertise and specialised knowledge. There are many new careers and specialisations that arise from blue economy, such as when mechanics and engineers have to research new material to replace artificial structures in ports, whereas ocean-based activities can also provide productive employment opportunities for youth for upper and lower-skilled backgrounds. There are indeed many opportunities, especially if an integrated, cross-sector approach is adopted. People with experience in the sea, like mariners, captains, and so on are in high demand globally, because they have the expertise, and they understand marine transport related activities. Another area would be cultivating fish or marine renewable energy, for example wind or wave energy, where there is a lot of room for improvement, which could be achieved in the areas of laying pipelines and submarine cables in the sea. Other job prospects could include lawyers active in shipping activities, technicians, engineers, scientists (e.g., marine biologists), etc. However, an interviewee noted that there is some reluctance for people to get engaged with the sea and relative professions, despite the many opportunities and possibilities.

Countries bordering the sea possess the opportunity and the ability to foster new sectors or enhance existing ones, generating novel employment opportunities and competitive businesses. Such policies should be carried out while upholding the welfare of communities and the natural environment, ultimately benefiting society as a whole. Additionally, these endeavours can serve as benchmarks for the implementation of central policies and national legislation.

The promotion of a sustainable Blue Economy has become a key focus in Europe and globally, leading to increased investments in these sectors. Consequently, the **demand for specific skills**, acquisition of new knowledge, adoption of innovative technologies, and development of new methodologies are on the rise. Depending on the Blue Economy sectors there are several skills that may be required ranging from technical skills to soft skills but also specific personal attitudes. Some fundamental skills include marine science and biology, oceanography, management, environmental law and policy, navigation and maritime skills, engineering, communication, collaboration, and teamwork. These skills are essential for success in blue economy professions. For instance, a solid understanding of marine ecosystems, biodiversity, and the impact of human activities on oceans, requires a strong background in marine science and biology. Knowledge of oceanography is crucial for comprehending ocean currents, temperature patterns, and other physical ocean characteristics, which are vital for various industries. Skills related to sustainable fisheries management and expertise in fish breeding, disease control, and sustainable aquaculture practices are essential for the primary sector. Necessary skills for a career in aquaculture, for example, would be to understand the biology of every fish species and know which is

most suitable for each area, sea, or river. Marine biology, marine engineering, naval architecture, seafaring, digitalisation, and automation were also among the skills requirements mentioned for working in the sector. Digital skills are also deemed important scientific skills. For a marine biologist, for example, this includes all experimental skills in terms of having the knowledge and using equipment; for electrical engineers, it means that they need expertise in terms of building systems and equipment. Specialised knowledge is also required regarding submarine cables, electricity transfer, and so on.

These skills will prepare individuals for a variety of careers in the blue economy, promoting the sustainable and responsible use of marine resources. It is very important to develop such multidisciplinary skills in a constantly changing environment with many challenges. There is a strong need to create an environmental culture, so that - especially young people - can understand the common benefit of a sustainable blue economy and communicate and act accordingly in a multinational coastal environment, with the density of population constantly increasing.

Lastly, interviewees were asked to reflect on **new products** that could arise **through the adaptation of blue economy principles** within the existing industries in Malaysia and Indonesia, and ways such adaptations could help **economic growth in the area.** Most believe that all above mentioned sectors of the blue economy will have the same potential in Malaysia and Indonesia, as in the EU. In case some of these sectors are not yet developed, then they will have the chance to be further developed through the adaptation of blue economy principles. Further, certain sectors, such as biotechnology, which require specialized skills, can arise through specialization. Examples of new products include ship building, ship repair, ship recycling, sea tourism products and promotion, fish farming for domestic and export fishing. Another suggestion pertained to new products connected to biotechnology, since there is a lot of potential that has not yet been realised. These products could be cosmetics, or more sustainable food, biofuels that can originate from the sea, generation of more renewable energy, etc. In the context of aquaculture, new products could arise by working with the fish species from the local seas or rivers. Other opportunities that were foreseen relate to sustainable aquaculture monitoring systems and eco-friendly marine tourism experiences, as well as recycling and repurposing of waste. New policies, such as sustainable fisheries, as well as developing the biodiversity aspect in these countries were also recommended, although many policies are usually not directed towards the relevant people and are carried out at “higher” levels.

However, the success of such initiatives largely depends on the availability of financial resources and the level of education. Nevertheless, all interviewees agreed that such policies and adapted EU practices will help and contribute to the economic growth, diversification, and resilience in the area, underscoring the potential of the blue economy to foster innovation, create employment opportunities, and promote

environmental sustainability on a global scale. Implementing and supporting initiatives that adhere to the principles of the sustainable Blue Economy not only promotes sustainability but also creates opportunities for innovation, added value and access to global markets that prioritize environmental consciousness. It is imperative for governments, businesses, and communities to collaborate in order to successfully adapt and foster such endeavours.

The Blue Economy holds **significance at both European and national level** by providing opportunities for economic development, employment, innovation, and sustainable resource management while promoting environmental conservation and international collaboration. The Blue Economy is a key driver of economic growth for the European Union (EU). With vast maritime territories, Europe can harness the potential of its seas and oceans to stimulate economic activities.

Conclusions and Recommendations

To sum up, there are several successful initiatives and projects that follow the Quintuple Helix framework, both at a local, national, as well as at an EU and international level. The main obstacle mentioned by most experts is the inconsistency in applying a holistic, integrated approach and the lack of political support and determination to implement "blue" initiatives while keeping the goal of sustainability.

To replicate this framework in an Asian context, its basic principles will have to be adapted to the cultural, economic, and institutional frameworks of these countries. The engagement of all relevant stakeholders is crucial, keeping in mind that the role of certain stakeholders in Asian countries could differ compared to the EU. The government structure could also differ significantly, and different decision-making processes and levels of government involvement could be in place. Therefore, an important step would be the training and resources provided to all stakeholders in order to enhance their capacity and foster collaboration among them. Strengthening the collaboration between academia and industry is a vital step in innovation, and this involves also securing the necessary funds to support innovation activities. The knowledge transfer between Asian countries and other regions such as Europe, through the participation in international networks and joint research initiatives will facilitate the exchange of expertise and technology and facilitate the access to new initiatives.

All in all, the successful integration of the Quintuple Helix model in blue economy initiatives requires a new model that will involve educational institutions, businesses, government bodies and civil society. The new model will be founded on a holistic approach, driven by political determination and supported

by effective policies to strengthen blue economy initiatives while promoting sustainability and addressing key challenges.

Based on the EU objectives a comprehensive action plan could include the following pillars:

I. Integration of the Quintuple Helix Model in decision making

Collaboration with educational institutions to incorporate the Quintuple Helix model into curriculum frameworks, emphasizing the interconnectedness of economic, environmental, societal, and governance aspects of the blue economy.

II. International Collaboration

a. Establishment of international platforms and forums for sharing best practices, lessons learned and technological innovations in sustainable blue economy development.
b. Harmonization of environmental regulations and standards across regions to promote consistency and effectiveness in marine conservation efforts.
c. Joint research projects and technology transfer initiatives to accelerate the adoption of sustainable practices in maritime industries worldwide.
d. Efficient management of space at sea generates the need for extensive consultation between offshore operators, stakeholders and scientists engaged in fisheries, aquaculture, shipping, tourism, renewable energy and other activities to agree on sustainable use of marine environment.

III. Policy Advocacy

a. Implementation of policies that prioritize sustainability, including regulations to mitigate marine pollution, promote renewable energy deployment, and protect marine biodiversity.
b. Engagement with policymakers at the local, national, and international levels to raise awareness of the economic and environmental benefits of sustainable blue economy practices.
c. Collaboration with industry associations and advocacy groups to develop policy recommendations and support legislative efforts aimed at shaping new production practices.

IV. Research and Innovation

a. Investment in research and development initiatives to boost renewable energy technologies, improving waste management systems and enhancing ecosystem resilience in coastal areas.
b. Promotion of circular economy practices to address pollution in line with new production standards (fishing gear etc.).

V. Promoting Environmental Education

a. Development of educational programs and skills tailored to various stakeholders, including students, professionals, policymakers, and local communities, to enhance understanding of marine ecosystems and sustainable resource management.
b. Establishment of environmental academies and training centers focused on blue economy practices, offering courses on topics such as marine conservation, sustainable fishing techniques, and renewable energy development.
c. Partnerships between educational institutions, research organizations, and industry stakeholders to facilitate knowledge exchange and capacity building in environmental stewardship.

VI. Coastal Resilience

Adaptation of measures to incentivize green infrastructure in coastal regions, to combat erosion and flooding risks. These actions not only protect biodiversity and landscapes but also bolster tourism and the coastal economy.

VII. Sustainable Food Production

Sustainable food production strategies are crucial for preserving Europe's seas as well as new marketing standards for seafood, harnessing resources like algae and seagrass, implementing stricter fisheries control measures, and investing in research and innovation.

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