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Oceans of Tomorrow: The Sustainability Transition

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Chapter 13
Conclusions and Recommendations

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Abstract

This chapter summarizes the concluding remarks and recommendations based on the analysis presented in the previous chapters. The chapters[4] of this book capture a wide spectrum of sustainable (e.g. economic, societal and environmental) challenges related to the Seas presenting critical outcomes of marine and maritime research. The analysis in chapters 2 to 5 showed that MUOPs can potentially benefit from each other in terms of infrastructure, maintenance etc. It is clear that the main sources of uncertainty about the viability of the projects are coming from the lack of precise knowledge on the operational conditions of the technology. In this context, MERMAID's assessment tool provided researchers with an intuitive way to evaluate multiple scenarios that would be hard and time-consuming to assess manually. Chapter 6 presents novel IT applications, which can facilitate producers to engage in the technology race and chapter 7 sheds light to the source-to-sea concept, which bridges the chasm for a better integration, cooperation and coordination of activities from the rural area until the ocean aiming at a harmonized and sustainable land-sea are. Chapter 8 focuses on Marine research supporting that CES valuation can become an extremely useful tool that can bring to the surface the benefits derived from the cultural aspects of MPAs, while chapter 9 depicts the key challenges of plastic marine litter. From the analysis carried out in Chapters 10 and 11, it is clear that the maritime transport sector including ports not only are driving up global temperature but are essential part of the global economies. Ports role will be crucial in the law enforcement through reward schemes and priority entrance to ships complying with International and European regulation. Chapter 12 presents the circular economy approach, which can solve most of the challenges analysed in the previous chapters, and the synergies with the Smart Specialisation Strategies. All chapters underline the need for explicit targets and financial plans to be designed aiming at the implementation of ambitious climate and ocean related targets.

Key words: socio-economic methodology, participatory approaches, financial analysis, web-based tool, marine, maritime, sustainable development, marine litter, policy recommendations, sustainable oceans

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13.1 Introduction

The European Commission has initiated a program called Blue Growth, which is the EU's long-term strategy to support sustainable growth in the marine and maritime sectors. Within this context, several European funded projects have been developed aiming to identify key components and useful answers to support the implementation of the European policies. This chapter summarizes the main findings of the analysis conducted in the previous chapters and highlights the directions and opportunities for future research under the auspices of the European Commission.

European FP7 projects called MERMAID (2015) and TROPOS (2012) have examined offshore platforms for multi-use of ocean space for energy extraction and aquaculture, along with their advantages in a floating platform and a multi-purpose system. In chapter 2 a socio-economic methodology for studying the social acceptance and the impacts of multi-use offshore developments is being analyzed. This methodology is really important for developers and decision-makers to understand the views of local people, and to learn about any potential concerns by assessing the social acceptance of the offshore developments. Chapter 3 reviews and discusses the participatory approaches employed in the MERMAID and TROPOS projects. The discussion draws on the methods employed in each case, the objectives and obstacles encountered resulting in useful conclusions for participatory design. A common financial framework that permits to obtain comparable results of the financial performance of the different design concepts proposed in the Oceans of Tomorrow projects and demonstrated in the book "Oceans of Tomorrow" by Koundouri (2017) is defined in chapter 4. The description of a decision support tool that was designed and developed for project MERMAID is the main objective of chapter 5.

Chapter 6 explains several possible conceptual frameworks for the Cultural Ecosystem Services (CES) classification along with the monetary and non-monetary methods for their valuation in the context of Marine Protected Areas (MPAs) with application on AMAre (Interreg) and RECONNECT (Interreg). Chapter 7 presents the final outcomes of BlueBRIDGE (H2020) project drawing attention on the IT tools used (e.g. Cloud Computing Infrastructure, Virtual Research Environments) for the development of integrated production models. Rural and coastal sustainable growth and land-sea synergies are discussed thoroughly in Chapter 8, where COASTAL (H2020) project is presented. Chapter 9 covers marine plastic litter challenge and provides policy recommendations based on two EIT Climate-KIC projects: BL.EU. Climate and MEDFreeSUP. Chapter 10 provides an overview of the marine transport industry, its role and relevance in sustainable development and the needed changes to be sustainable. Chapter 11 presents major challenges and opportunities related to ports and maritime transport presenting the EIT Climate-KIC project, Deep Demonstration in Maritime Hubs.

13.2 Main findings and policy recommendations

13.2.1 MERMAID and TROPOS projects

The approach used chapter 2 is comprised a face-to-face survey with local people and tourists on Liuqiu island as well as in-depth interviews with particular stakeholders who are or will be potentially affected by offshore developments. Two methods are used, the first method in the mixed-method framework, applied to reach a wide range of participants by a multiple-choice questionnaire survey. A large-scale survey was intended to give an indicative overview of how the offshore platform is perceived. The second method focused on the ability to explore in depth the range of perceptions of the platform and the potential impacts, that's why a qualitative study was designed. Interviews were

used to obtain first-hand information on social realities as they are constructed and presented by different actors.

The methodologies used for assessing social acceptance in chapter 2 are the following: i) The Total Economic Value (TEV) is a standard theoretical approach used for capturing and describing the benefits derived from the different ecosystem services. The TEV is elicited from preferences of individuals using stated preference methods and revealed preference methods; the choice experiment (CE) method is included in this category. ii) The Social Cost Benefit Analysis (SCBA) is a technique that assesses the monetary social costs and benefits of an investment project over a time period in comparison to a well-defined baseline alternative. Due to the project's expected long-run impacts on the local economy and ecology, its sustainability is to be tested using a long-run SCBA, and the net present value (NPV) of the project is to be estimated using different discount rate schemes. The NPV results reveal whether the net social benefits generated by the investment project of MUOPs are positive and significant well into the future.

The study in chapter 2 found a general lack of awareness about the offshore platform project in Liuqiu Island. The results highlight the concerns on environmental effects of the platform and the unknown effects on existing industries, such as fishing and fishing processing. Moreover, there exist concerns from the respondents about who will be responsible for the platform construction and operation, and from the residents about the possibility of the destruction of the platform by a storm wave. The findings also suggest that current public relation activities of the project are not proactive, and point to the need to improve the involvement of local people and existing industries before the project can be carried out. The findings further show that cost and environment related alternatives were factors that influenced to a high degree the stated preferences. The presence of energy and leisure facilities affected moderately the preference, and GDP effects and job creation were not deemed very important factors when the preference was stated. Local residents preferred not to install a platform and would rather focus on their traditional fishing ground, while tourists prefer the status quo the most, they would support the installation of the platform only if renewable energy and leisure facilities are provided.

Chapter 3 compares the participatory approaches employed at the TROPOS and the MERMAID projects that studied the development of multi-use platforms. The chapter describes the approaches and relates them to the objectives of participation with the aim to assess if participation was valuable. In this chapter there are useful conclusions of participatory design, based on the findings of the two projects with the aim to inform future design processes.

In the TROPOS study, the concepts of Leisure Island Concept off Gran Canaria and the Green-blue Concept off Liuqiu Island Taiwan were used as examples. The results from Gran Canaria showed that there are concerns besides a general high acceptance of the Leisure Island among tourists as well as residents. Benefits for the tourist sector which are predicted to result in an increase of income and generation of jobs become confronted with various potential environmental impacts, in particular the disruption of marine species and habitats. The results from Liuqiu Island Taiwan also demonstrated a generally high acceptance of the Green & Blue platform among residents and tourists, although most participants had been unaware of the project. Despite the general acceptance of such a project, people also raised a number of specific concerns. These concerns are predominantly related to environmental impacts and unclear effects on local fishing and fish processing industries. Other issues that challenged the acceptance of the project include uncertain environmental impacts and adverse effects

caused by the operation and construction of the platform. Perceptions of negative impacts were balanced against potential benefits for tourism, which is a crucial economic driver for Liuqiu Island.

The MERMAID project focused on four case study sites (North Sea, Mediterranean, Atlantic, Baltic) representative for European waters, each with local challenges. The results of the North Sea showed that the biggest challenge was to find solutions that could be profitable for all stakeholders, including risks and extra insurance costs. The results of the Mediterranean showed that a number of stakeholders initially opposed to the idea of including aquaculture farms in the multi-use platforms, because they were afraid of competition with the already existing coastal aquaculture. Despite this fear of competition, the design team decided not to limit the design by this argument, as this essentially was a plea for keeping a monopoly of the coastal aquaculture. In the Atlantic case, the final design included a combination of floating offshore wind turbines and wave energy generators. Stakeholders argued for the importance to select a site where conflicts with other interests are minimal. Multi-use platforms were considered to be able to provide revenues to both the local fishing community and local businesses. In the Baltic case the eventual design combined wind turbines and off-shore aquaculture by floating fish-cages with trout/salmon production. This combination was interesting given the large-scale development of offshore wind and a technical risk assessment of the multi-use platforms appeared to be important. The stakeholders pointed out that there should be no negative effects on ecological conditions, and that the artificial reefs on the wind turbines foundations should be protected as they have positive ecological effects.

From chapter 3, it clear that in the future other projects should provide the necessary resources for creating an understanding of the locality as it is crucial for identifying the relevant stakeholders, their roles, objectives and resources. When eliciting stakeholders' view, selection bias should be avoided during both the preparation and interview stages. Thus, it is recommended to involve the relevant set of stakeholders for specific decisions. For example, in a technical scoping phase, it makes sense to only involve a small group of relevant experts and in later project phases, stakeholders should be asked to pronounce themselves on few and reasonably well-defined design options that are possible for the specific offshore multi-use platform. Finally, in this chapter demonstrated that shared knowledge and experience can contribute to more efficient and sustainable designs of offshore multi-use platforms. Acknowledging the stakeholders' perspectives enables surpassing potential obstacles and adjust the design process is necessary. On the contrary, no dialogue or not considering stakeholders´ point of view, leads to risk of inefficient processes, the need to repeat procedures or even implement sub-optimal solutions.

Chapter 4 presents the results of a comparative financial analysis performed to the three Oceans of Tomorrow projects. A homogeneous financial analysis of the Ocean of Tomorrow projects is developed, with the objective to test financial performance for all projects under the same assumptions and hypothesis, obtaining indicators that allow comparing the results between projects and comparing them themselves. In the same direction a sensitivity analysis that enables the identification of the 'critical' variables of the project is carried out. Such variables are those whose variations, positive or negative, have the largest impact on the project's financial and/or economic performance. Moreover, a risk assessment of the projects is being calculated in this chapter.

This chapter has presented a transversal analysis of the outputs generated through different projects, trying to clarify the comparison among the existing alternatives and testing them from a standard economic and financial point of view. The results based on the comparison of different projects summarized in this chapter show a homogeneous ranking on the viability of the different alternatives

and their business possibilities. The leadership in offshore activities is clearly located in renewable energy and therefore the most promising combination proposals should be those where this industry appears. The results presented by aquaculture, seabed, logistics and leisure show more optimistic view in the related projects, but this optimistic analysis do not match with the real investments developed in those sectors in offshore areas. According to the results, the main sources of uncertainty about the viability of the projects are coming from the lack of precise knowledge on the operational conditions of the technology under untested conditions and from the intrinsic volatility of revenues to be obtained in the future with uncertainty in market conditions, environmental pressures and policy regulating measures. Finally, it is assumed that the initially recognized lack of maturity is still heavily restricting for further developments in offshore activities and for now it is unclear whether the shared approach creates expectations that will lead to a successful strategy.

In chapter 5 an interdisciplinary web-based tool for applying socio-economic assessment in MERMAID project was described. This tool was part of the framework for assessing the socio-economic impact of MUOPs, and as such, utilized web and data analytics state of the art technologies in order to provide researchers with a framework for evaluating feasibility and potential of each MUOP's proposed design and location. The assessment tool extends the standard process of financial analysis into an assessment that incorporates socio-economic, legal, and technological environmental parameters. The tool provides the user with questionnaires for Technical and Legal feasibility assessment, as well as Environmental Impact Assessment. It also materializes a streamlined robust methodology for the researchers and potential decision makers.

The main results of the chapter are the following: a) a data versioning system could be added into the tool, so as a researcher to be able to reproduce the analysis and compare the results, b) the tool could potentially give the user the ability to preprocess raw climate data (wind, wave, currents etc.) from existing repositories, and shape them in the appropriate input format for the tool using graphical tools. That would allow for a more sophisticated model, and the expansion of the tool in other domains such as spatial analysis, c) The enhanced tool could include a spatial data planning component that would use relevant project data (climate, engineering, ecological, socio-economic) to present the spatial alternatives, creating a suitability map, also d) the enhanced tool could visualize the outputs of sensitivity analysis and finally e) the described tool could perform manually cross validation to refine parameter selection for the simulation. From a general point of view, MERMAID’s assessment tool provided researchers with an intuitive way to evaluate multiple scenarios that would be hard and time-consuming to assess manually. It managed to successfully capture a lot of information carefully chosen after multiple interactions with the stakeholders of the project MERMAID. This is a unique challenge given the multidisciplinary nature of the project, as well as the complexity introduced by the concurrent evaluation of different geographical sites.

13.2.2 Blue Growth and Source-to-Sea Sustainable Integration

Blue Growth, the long-term European strategy, aims to support sustainable growth in the marine and maritime sectors as a whole. Seas and oceans are drivers for the European economy and have great potential for innovation and growth. The strategy consists of three components: The development of sectors that have a high potential for sustainable jobs and growth, such as aquaculture, coastal tourism, marine biotechnology, ocean energy and seabed mining; The provision of knowledge, legal certainty and security in the blue economy; and Sea basin strategies to ensure tailor-made measures and to foster cooperation between countries (including the Mediterranean Sea) (European

Commission, 2012). The following x chapters discuss blue growth under the spectrum of Ecosystem Services valuation, aquaculture and virtual research environments.

Chapter 6 presents BlueBRIDGE (H2020) project, which aimed at the enlargement of the spectrum of growth opportunities in distinctive Blue Growth areas, and specifically it provides a brief overview of the Virtual Research Environments (VREs) developed within the BlueBRIDGE project with focus on aquaculture (BlueBRIDGE, 2020). Aquaculture can be core to Blue Growth targets with benefits exceeding the private benefits. The efficient and sustainable management of aquaculture production, at micro- but also at macro- level, requires the use of cutting-edge technology, novel IT applications and integrated socio-economic tools. The tools and the methodology developed within the scope of the BlueBRIDGE project allow for the use of advanced IT applications and facilities and the introduction of the wider socio-economic and environmental effects of aquaculture into the production management. This can support well informed management and decision making. Developing and proposing tools and methods enables the estimation of an integrated value of production that looks beyond output maximization. Easy to use tools facilitate all producers and the sector overall to engage in the technology race and use it at their own benefit. From a policy perspective the outputs of the project enable the well-informed and forward-looking decision making and target setting.

In chapter 7, COASTAL (H2020) framework is demonstrated, which aims to increase land-sea synergies via an innovative dual approach using systems dynamics coupled with participatory methods by involving local stakeholders from representative EU coastal regions to co-design business roads map and policy alternatives (COASTAL, 2020). The source-to-sea continuum considers the land and the sea as a single component (e.g. from land to freshwater, delta, estuarine, coastline, near shore and ocean, connected through flows of waters, including sediment, pollutants, materials, biota and related ecosystem services). Coastal areas and marine water are inevitably impacted by land-based activities (agriculture, forestry, heavy industry and urbanization) due to unsustainable land use, soil degradation, pollution of inland freshwater.

Initial work of the COASTAL project has yielded preliminary findings which indicate that new, innovative practices such as combined activities, alternative forms of tourism and development of renewable energies offshore or coastal risk management strategies can play a role in co-creating a common vision for the development of an interconnected rural-coastal-sea region. The project aims at identifying main issues and business opportunities from representative case studies and the development of an inventory of best practice, successes and lessons learned regarding land-sea synergies and coastal-rural collaborations. Policies are still fragmented but international initiatives (political and scientific) work towards unified, multi-sectoral framework and a better integration of the land and sea ecosystems. The source-to-sea concept highlights the gaps and needs for a better integration, cooperation and coordination of activities from the rural area until the ocean in order to achieve a harmonized, sustainable development of a land-sea area.

13.2.3 Marine Protected Areas

Chapter 8 presents possible conceptual frameworks for the Cultural Ecosystem Services (CES) classification along with the monetary and non-monetary (revealed and stated preference) methods for their valuation. The methodology used to operationally define CES in socioeconomic models, in a way that they can be useful in policy agenda and in decision-making as well classify is a literature

review approach. Besides the lack of well-established and readily applicable definition, literature seems to agree that CES are *non-material* and *contribute benefit to people in terms of well-being, mental and physical health*. An efficient context to achieve an improved management of Ecosystem Services (ES) are the Marine Protected Areas (MPAs), which are directly aligned with ES taking under considering that in most marine areas, human activities are not spatially managed and monitored, while human impacts on ecosystems services are not taken into account when management initiatives are considered.

The study supports that CES valuation can become an extremely advantageous tool that can shed light to the benefits derived from the cultural aspects of MPAs, guiding policymakers and management authorities. Integrated and adaptive management will support MPA managers to identify and adopt policies and best practices that involve both cultural and natural resources at the ecosystem and landscape levels. So far, the variety of conceptual frameworks around the CES categorization has undermined this opportunity. This chapter justifies that stated preferences methods have the lion's share in this debate and there seems to be a consensus that the more CES will become important, the more these methods will need to be developed to accommodate the specificities associated with these services. Recent projects that apply the combination of monetary and non-monetary valuation methods in MPA management are AMARE (Interreg) and RECONNECT (Interreg).

13.2.4 Marine plastic litter

Chapter 9 discusses the marine litter issue in the Mediterranean Sea through two EIT Climate-KIC funded projects BL.EU. Climate (Climate Innovation in Southern Waters), which is implemented in 2019 and MEDFreeSUP (tacking single-use-plastic item uses in the Easter Mediterranean Sea), which is the follow-up project and it will be implemented in the period 2020-2021. The methodology used by BL.EU. Climate project was conducting an extensive stakeholder mapping in all case studies in Greece, Portugal and Croatia; validating it through interviews and surveys targeting key challenge owners (e.g. fishermen and tourists); presenting the outcomes at different workshops conducted in each country seeking to trigger discussions among the participants on potential solutions to prevent, reduce and collect marine litter, focusing mostly on plastics; and designing a strategic roadmap by all three countries, identifying measures to reduce the negative effects caused by plastic waste in the future, supporting policy makers, industries, consumers and civil society to improve systems design, replacement, refuse, recycling and reuse of plastic.

The BL.EU. Climate study found that one of the greatest barriers in Greece is the knowledge gap across stakeholders. Most of the respondents understand that the natural environment is at crisis and this is caused mainly by anthropogenic factors. However, the most affected by marine litter actors (e.g. fishermen and tourists) seem to lack a basic understanding of the marine plastic pollution and its detrimental effects on the marine ecosystems, as well as the existence of European Directives on plastics. Fishermen specifically, seem to know about the marine litter problem, but they ignore the impacts on their professional and personal life, especially about the microplastics and how they end up in the food change. Another contradictory outcome of the study was that besides the environmental responsibility was perceived as significant by the majority of tourists, their WTP for environmentally friendly services were comparatively lower to their WTP for a renting better facility. However, when the cost factor was removed from the decision-making choice, the respondents were willing to adapt their needs.

Finally, the project produced a 10-year roadmap identifying the actions that are needed to be taken by policymakers, the private sector and the society in the future in different time spots to tackle the plastics issue. Top priorities appear to be education and private initiatives in combination with regulation and policy implementation (e.g. Circular Economy Strategy). Education is key to comprehend the damages of plastic and how it affects public health, while the awareness raise could bridge the knowledge gap of adults, who have completed their secondary education. A pioneer in driving change can be the private sector by implementing circular economy models and creating opportunities supported by complementary laws and strategies.

13.2.5 Sustainable Shipping and Ports

Natural challenges related to maritime transport are twofold, to be specific the impacts of maritime transport on the environment (e.g. contamination, CO2 emanations) and on the other hand the natural effect on maritime transport (e.g. climate change, extreme weather events). Thus, maritime transport and ports play a critical role in addressing the sustainability challenges in international trade, providing market access and linking communities. European Union has put into force a number of Directives and Regulations aiming to incentivize port and shipping companies to comply with environmental standards. The new regulatory challenge posed by the sulfur cap in 2020 has generated substantial uncertainty in the shipping industry (IMO, 2020). While the shipping industry is focusing on the sulfur cap the greatest challenge it has likely ever faced is the need to find the effective means of decarbonizing in line with global commitments. The speed of the required transition along with the relative difficulty of technological options vis-a-vis other sectors of the economy make this a particularly demanding endeavor.

Market based mechanisms (e.g. emissions cap, emissions trading system) could potentially enact the decarbonizing commitments though they are still far from the center of the debate. They can motivate the low carbon transition, triggering innovation across CO_2 emissions options and providing needed funding both for innovation and supporting developing economies address the burdens of the transition. They are likely however to be one of many measures, regulations and initiatives needed for the task. Accelerating financial resources and investments will also be an important enabler. This is a role that can be undertaken by regional and national development banks (e.g., the European Investment Bank). Another potential instrument for infrastructural investments is the green bonds.

Chapter 10 provides a brief overview of the marine transport industry, its role and relevance in sustainable development and the kinds of changes that are needed for shipping to be sustainable. It focuses primarily on some of the environmental dimensions of sustainable shipping, although it acknowledges that the effort of sustainable shipping needs to consider several additional aspects to achieve the Sustainable Development Goals. Sustainability is a very broad and sometimes ambiguous concept, but it captures societal values and shapes our vision. Enhancing the sustainability of the maritime transport will require a multi-sector approach involving governments, transport industry, financial institutions, academia and civil society. The inherently international nature of maritime transport seems to make it ideal for global challenges, but it is also a potential weakness given that most governance institutions and their means of enforcing law and regulation are national in nature. A number of government-led initiatives indicate a growing awareness of the shipping challenge while initiatives at the level of industry and companies suggests a new reckoning of corporate responsibility.

Chapter 11 focuses on the role of ports in implementing CO_2 regulations in international and European waters. The IMO (2020) regulation, bringing the sulfur cap in fuel oil for ships down from 3.50 per

cent to 0.50 per cent, is anticipated to bring critical benefits for human wellbeing and the environment, whereas the European Green Deal, the foremost yearning action plan of European Union, points at expanding the EU's GHG emissions reduction target for 2030 to at slightest 50% compared with 1990 levels, making the foremost driven bundle of measures, accompanied by a starting guide of key policies in cutting-edge investigate and development, in green innovations and sustainable solutions. Among them, Deep Demonstrations by EIT Climate-KIC using systems innovation approach seek the decarbonisation of the European ports and the sustainable transformation of their key components. At the same time, international institutions (e.g. IAPH, ESPO) have launched programs pointing at bringing together key partners related to ports to discuss on the most important challenges confronted nowadays, to engage port proactively take the duty of giving reward schemes or green certificates to complied ships, and to recognize key markers in measuring GHG outflows.

The study finds out that most of the EU ports are effectively working to secure the environment with the goal of complying with sustainable development standards. Most of the environmental indicators reflect a positive evolution since 2013. In principle, EU ports continue to improve their environmental performance and to maintain or even enhance the declared policies of compliance, environmental protection and sustainable development. Whereas it is troublesome to distinguish and actualize at once 'best practices' for all the environmental impacts that ports exercises create, positive steps towards sustainable development and administration are progressively taking place.

13.2.6 Circular Economy

A simple approach to tackle many of the challenges addressed above is integrating circular thinking in the majority (if not all) of the economic activity. The United Nations (UN) Sustainable Development Goals (SDGs) and the EU Circular Economy Action Plan constitute the most prominent efforts promoting the circular economy (CE) influencing/supporting policy agendas in all their members (UN, 2020; European Commission, 2020c). CE is bringing together the values of Sustainability, while having an impact on the economy, the environment and the society.

Chapter 12 aims at shed light at the opportunities, which can arise by combing smart specialisation (SSS) with circular economy in pilot areas in a European Country, which is underperforming in CE implementation, Greece. The methodology used is a policy mapping followed by validation participatory workshops and meeting targeting key stakeholders in the country. The study finds that both CE and SSS need to be revised in order to be more implementation oriented and efficient in financial terms. CE implementation is Greece and other EU countries will be further studied by two more EIT Climate-KIC projects, namely, CL Hub and CE Beacons, which aim at identifying the key drivers of decision making related to the uncertainty around climate changes and how circular thinking could resolve these doubts, and at implementing and teaching circular approaches to entrepreneurs and investors.

13.3 Directions for future research

The Commission develops efforts that create, share and communicate scientific knowledge supporting the aims of the 7th Framework Programme (FP7) Environment and the Horizon 2020 (European Commission, 2014; 2020a). Efforts will be undertaken to disseminate and promote the use of relevant knowledge accumulated under recent research and programs, as well as promoting new research in line with priority setting that takes place regularly under the auspices of the Commission. A number

of the priority areas identified in the 7th Framework Program for Research and Development and Horizon 2020 could benefit the objectives of Horizon Europe, the next research and innovation framework programme for the period 2021-2027 with € 100 billion budget. Besides theme-oriented international actions carried in H2020, including inter alia projects in the areas of Health, Food, Agriculture and Forestry, Biotechnology, Production Technologies, Energy, Environment (including Climate Change) and Transport, Horizon Europe will also target Culture, Civil security, Bioeconomy and Natural resources highlighting the importance of Innovation in this strategic planning (2020b).

The 2018-2020 Work Program focused efforts on fewer topics with bigger budgets, directly supporting the Commission's political priorities. Four Focus Areas represent a combined budget of € 7 billion: (i) Building a low-carbon, climate resilient future, (ii) Connecting economic and environmental gains – the Circular Economy, (iii) Digitizing and transforming European industry and services, and (iv) Boosting the effectiveness of the Security Union. The Focus Areas cut across thematic boundaries and bring together contributions from various program parts to pursue a common objective and create sustained impact. They are endowed with a substantial budget to allow for work of sufficient scale, depth and breadth.

From the analysis performed in chapters 2 to 5 of this book it is clear that MUOPs can potentially benefit from each other in terms of infrastructure, maintenance etc. Knowledge developed over the past years in the projects MERMAID and TROPOS can contribute to a careful integral implementation of MUOPs in Europe, including all relevant stakeholders; in order to overcome obstacles to enhance MUOPs for energy production and aquaculture in the future. The research projects MERMAID and TROPOS have encouraged cooperation among stakeholders and brought together marine sectors such as aquaculture, wind energy, wave energy, mooring and offshore engineering, and other blue economy activities to learn and discuss MUOPs. In both the Mediterranean and the Atlantic cases, the efforts made through research projects are the most important, in which the sectors actively have been involved. Through dialogues, increased attention and credibility of MUOPs have developed, and is now seen to be relevant to future governance strategies. The research projects also allowed learning among participants, which can be useful to future innovation. Still, the challenges are not to overcome, there is a need to be creative and perform sufficient research on this topic. In future an improved understanding of how self-governance, network governance and knowledge governance arrangements can be implemented in a strategic and responsible manner will be critical to future MUOPs developments.

Chapter 6 presents novel IT applications developed by BlueBRIDGE (H2020) project, which can facilitate producers to engage in the technology race and use it at their own benefit and policymakers to make well-informed and forward-looking decisions. In future, these platforms, tools and techniques could be replicated and developed by other sectors as well. The preliminary findings yielded in COASTAL (H2020) project, which is presented in Chapter 7, indicate that new, innovative practices such as cooperative activities, alternative forms of tourism, offshore renewable energy and coastal risk management strategies can play a critical role in co-creating a common vision for the development of an interconnected rural-coastal-sea region. The source-to-sea concept bridges the chasm for better integration, cooperation and coordination of activities from the rural area until the ocean aiming at a harmonized and sustainable land-sea area.

Chapter 8 discusses the Cultural Ecosystem Services (CES) frameworks along with the monetary and non- methods for their valuation, supporting that CES valuation can become an extremely useful tool that can bring to the surface the benefits derived from the cultural aspects of MPAs. Integrated and

adaptive management will support the MPA administration to adopt best practices, as this opportunity has been undermined so far. Chapter 9 depicts the key challenges of plastic marine litter as identified in the EIT Climate-KIC project, BL.EU. Climate. Tourists and Fishermen seem to lack understanding on both the impact of plastic pollution of the Seas and European and national regulation. Essential for the understanding of the damages of plastic and the associated effects on public health, is the education in all levels of society. The highly needed change can be driven by the private sector through circular economy models and job creation supported by complementary laws and strategies.

From the analysis carried out in Chapters 10 and 11, it is clear that the maritime transport sector including ports not only are driving up the global temperature (causing 3% of global GHG emissions) and but are an essential part of the global economies (80% of global trade is transported through the oceans). Ports role will be crucial in law enforcement through reward schemes and priority entrance to ships complying with International and European regulation. IMO 2020 regulation in alignment with Agenda 2030 and the SDGs, the European Green Deal and the upcoming European Climate Law are only some of the driving policies towards the decarbonisation of the maritime sector. However, they need to put explicit targets and financial plans on the table so that their ambitious objectives to be implemented, as well as revise market-based mechanisms (e.g. EU ETS) including all key drivers of environmental sustainability.

Marine and maritime research for Blue Growth will be implemented through a strategic and coordinated approach across all challenges and priorities of Horizon 2020 and Horizon Europe taking into consideration pivotal concepts, such as the circular economy and the systems innovation approaches. Further research will aim at unlocking the potential of resources from seas, oceans and inland waters for different uses and across the range of marine and maritime industries while protecting the environment and adapting to climate change. Blue Growth will support sustainable growth in the marine and maritime sectors, through sustainable exploitation of marine resources for healthy, productive, safe, secure and resilient seas and oceans. The highly needed Sustainability is a well-defined concept, combining economic, environmental and societal values, while it shapes our vision conforming with ethical behaviour that has driven change throughout human history.

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