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Report on European policy and activities in biotechnology

Work Package 3

Interactions with industry

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EXECUTIVE SUMMARY

Europe is setting course for a resource-efficient and sustainable economy. The goal is a more innovative and low-emissions economy, reconciling demands for sustainable agriculture and fisheries, food security, and the sustainable use of renewable biological resources for industrial purposes, while ensuring biodiversity and environmental protection.

To achieve this, the European Commission has set a Bioeconomy Strategy and action plan which focuses on three key aspects:

- developing new technologies and processes for the bioeconomy;
- developing markets and competitiveness in bioeconomy sectors;
- pushing policymakers and stakeholders to work more closely together.

The Blue bioeconomy, or Blue Growth, is the long-term strategy 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. It is the maritime contribution to achieving the goals of the Europe 2020 strategy for smart, sustainable and inclusive growth.

Marine biotechnology is an enabler for realising the blue bioeconomy (the Blue Growth). The Blue Growth sectors are; production and processing of marine biomass for societal value, aquaculture, renewable energy, coastal & maritime tourism and mineral resources. Marine biotechnology is considered to the most important enabling technology contributing to blue growth.

Industry development based on marine biotechnology is relatively young, dominated by academic and start-ups and small companies. There is an indication that this sector is becoming more mature as demonstrated by increased publication and citation activities. However, larger industries within diverse sectors such as pharma, food, etc. are utilizing marine resources and biotechnology for their products and markets.

Only 4 countries have dedicated policy programme with a focus on marine biotechnology, but most of the countries with a strong marine base have marine biotechnology activities in one or more areas without dedicated marine biotechnology science and technology programmes.

This brief report highligts the main EU initiatives and platforms relevant to the development of a strong marine biotechnology research and industry development.

TABLE OF CONTENTS

Contents

INTRODUCTION

Description of D3.6 from the DoW:

> *"Analyse European policy documents and documents from relevant activities (JPIs, ETPs, ERA-NETs, KICKs, etc…) to identify policy expectations expressed for industrial developments from marine biotechnology. This will inform ERA-MBT and relevant activities on the concrete areas of common interest where collaborations can address the political aims and concretely cooperate to reach them (D3.6)."*

In the European Commission's Blue Growth Strategy, a marine and maritime strategy towards more sustainable growth and increased employment in the European blue bio-economy, five sectors where identified with high potential to meet these strategic goals. The Strategy was endorsed by European Ministers for Maritime policy and the European commission through the Limassol Declaration in 2012.

These identified sectors include aquaculture and marine biotechnology, as industry areas of increased bio-product valorization and high economic potential within the EU.

A number of EU initiatives and platforms have been formed to analyse gaps and needs, prepare roadmaps and strategic agendas and enhance collaboration within and between academia and industry. This report is based on a desk-top study of several initivatives and platforms, that have been identified as relevant to industrial development using marine biotechnology, and are important tools for policy making within the EU.

MARINE BIOTECHNOLOGY POLICY AND STRATEGIC ACTIVITIES

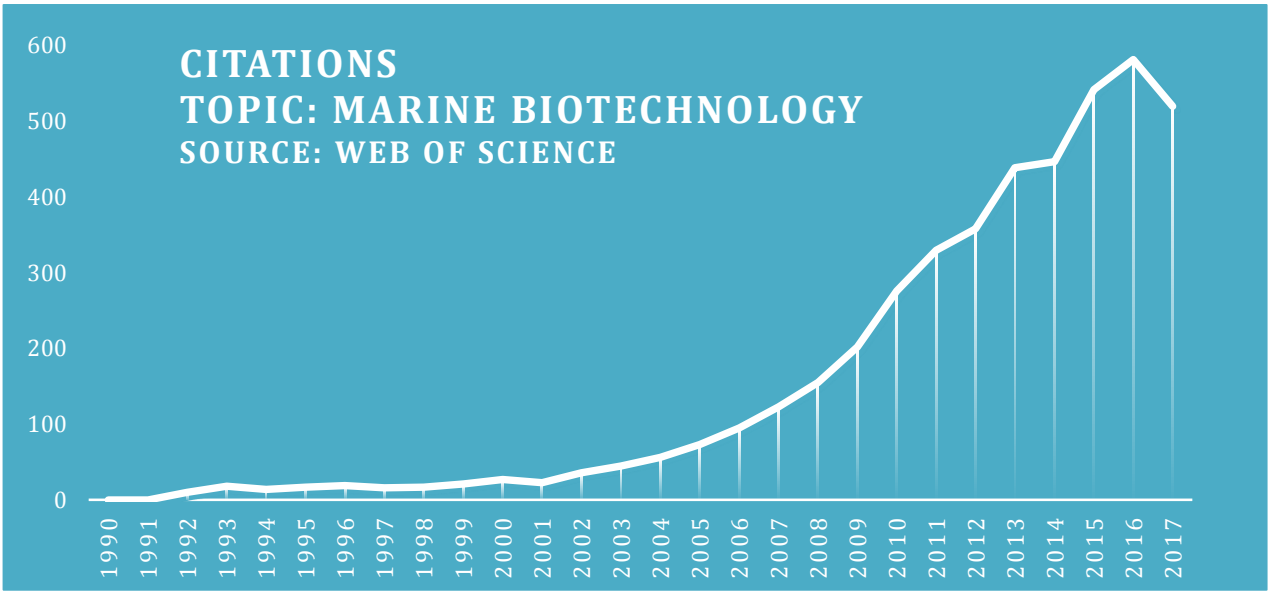
Mapping of the marine biotechnology environment in Europe, both by the ERA-MBT and DGMare, has indicated that it is very diverse in terms of stakeholders, resources and applications (ERA-MBT Deliverable D3.1.). Marine resources processed by biotechnology range from both macro- and micro-organisms and result in product development and manufacturing serving different industry sectors, ranging from food, feed, health products and materials and chemical industries' products. Environmental applications, such as monitoring, also have high level of relevance. It may then not be surprising that there is also a large variety of stakeholder categories, not only counting industries, but industry clusters, associations, networks, consultants, TTOs, funding agencies and a range of organisations at national, regional and European level.

Industries based on or utilizing blue biotechnology is thus a very diverse group of players and relatively young. Most of the companies are SMEs although several large industrial companies are very much involved in the utilisation of marine biomass. As such, co-operation and new initiatives are very research driven and require public support, the EU is involved in and has started several programs and initiative to facilitate cooperation of government, policy makers, funders, researchers, industry and NGOs.

Marine biotechnology is relatively recently taken up by industries and is characterised by:

- An active group of universities and public research institutes all over Europe supporting the development,
- Numerous start-up and small companies that concentrate their development on niche markets: E.g. marine cosmetics, enzymes development, new bioplastics, biorefining of marine biomass, ...,
- Very few medium-size companies (more than 50 employees) dedicated to marine biotechnology development, and
- Some large companies that have internally developed competencies in marine biotechnology or have acquired promising small blue biotechnological companies to reinforce their activities.

In recent years the research activity in the Marine biotechnology sector has increased considerably, as can be seen in the citation graph based on 766 publications. Only a few publications on marine biotechnology occurred before 1990 and until 2001. It is reasonable to assume that the strategy report from the European Science Foundation's Marine Board in 2001 helped define and increase the awareness and focus on buiotechnology as an enabler in the marine sciences. The growth rate is taking off in beginning of the this century and has increased considerablyin the last 10 years. If selecting Blue biotechnology as topic the trend is similar. It is only fair to assume that this is an indication of increased interest in the Blue bioeconomy.



ERA AND FP 7 POLICY MAKING

A number of ERA networks that are directly related to blue growth were established under FP7. The forerunners of both ERA-MBT and COFASP are MariFish and Seas-Era. JPI-Ocean was also established under FP7. These networks have made considerable input into the policy making of the current Blue Growth strategy;

JPI-Ocean is a joint programming initiative for healthy and productive oceans. JPI Oceans have published their strategic research and innovatin agenda 2015-2020.

The main objectives of COFASP were to strengthen cooperation and synergies between European research programmes, focusing on the sustainable exploitation of marine resources in seafood production. The three main focus areas are fisheries, aquaculture and seafood processing. COFASP initiated three calls for proposals, all calls included to some extent relevance to the use of biotechnology as an enabling technology within the projects. COFASP has recently published its strategic research agenda.

The vision of ERA-MBT is to support Europe's marine biotechnology community that adds value to sustainable use of marine biological resources. ERA-MBT published its strategic research and innovation Roadmap in September 2016.

These research reports on research and innovation priorities, together with similar reports from Seas-Era and SCARFish, form a framework for future policy making in Blue bioeconomy.

As a logical consequence the two networks, COFASP and ERA-MBT launced a joint call for proposals in 2016. The thematic area of the joint call was on the challenges within the COFASP scope with focus on the development of the biotechnology toolbox. These projects are still in progress.

Industrial biotechnology incorporates all areas utilizing biomass for value creation, and to broaden the impact, a strategic partnership was formed to include marine biotechnology as a topic in ERA-NET IB2's 7th call for innovative and precompetitive projects with industry relevance.

In FP7 a number of projects on marine biotechnology have been funded, such as:

- PharmaSea (finished 2016)
- SeaBioTech (finished 2016)
- MaCuMBA (finished 2016)
- MicroB3 (finished 2015)

HORIZON 2020

The Blue Growth Call within H2020 aims at sustainably harvesting the potential of resources from seas, oceans and inland waters for different uses and across the range of marine and maritime industries, while protecting biodiversity and enhancing climate resilience. It supports sustainable growth in the marine and maritime sectors through a responsible management of marine resources for healthy, productive, safe, secure and resilient seas and oceans, which are essential for thriving ecosystems, climate regulation, global food security, human health, livelihoods and economies.

The Blue Growth Call is intended to deliver on a series of EU policies and international commitments such as the UN Sustainable Development Goals.

The current work programme 2018-2020 on food and bioeconomy has a specific chapter on blue growth, including marine biotechnology, such as:

- BG-02-2018: Blue Bioeconomy Public-Public Partnership
- LC-BG-03-2018: Sustainable harvesting of marine biological resources
- DT-BG-04-2018-2019: Sustainable European aquaculture 4.0: nutrition and breeding
- CE-BG-06-2019: Sustainable solutions for bio-based plastics on land and sea
- BG-07-2019-2020: The Future of Seas and Oceans Flagship Initiative

The European Marine Biological Research Infrastructure Cluster (EMBRIC)

EMBRIC is a H2020 funded project (under H2020-EU.1.4.1.1. – Developing new world-class research infrastructures) running from 2015-2019. It promotes research and innovation from marine bio-resources by facilitating connection between science, industry and policy. It connects 6 existing European research infrastructure facilities and 27 public and private partners.

Blue bioeconomy cofund action

Both ERA-MBT and COFASP ended in 2017. The networks have expressed willingness to join efforts in a new cofund action, Blue bioeconomy, and are preparing a cofund proposal.

In collaboration with ERA-Nets COFASP and MarineBiotech, 29 partners from 17 member countries, have expressed interest in a cooperation effort with the European Commission's Horizon 2020 programme BG-02-2018 to fund research and innovation that will support a sustainable blue bioeconomy, targeting zero waste and innovative exploitation of aquatic biomass for use in food and other bio-based value chains

Marine biotechnology projects under Horizon 2020 that have been funded include:

- INMARE, Industrial applications of marine enzymes, that brings together research-excellent academic institutions and industrial partners with leading position on the market
- SME project VIOPSA2.0 - Omega 3 and Astaxanthin products from SeaAlgae
- SME project Blue Iodine II – an innovative seaweed bioextract for IODINE fortification

EUROPEAN TECHNOLOGY PLATFORMS

European Technology Platforms (ETPs) is a collection of industry-led fora that act as drivers in european technology development, innovation and knowledge transfer and supports EU high technology and market impact goals. ETPs are independent and self-financing entities but the EU commission engages in the ETPs and are recognised as valuable contributors and help to create synergies to EU initiatives such as, ERA-NETS, 185 initiatives and JPIs.

Several bio-based fora have medium or high relevance to marine biotechnology issues:

- European Aquaculture Technology and Innovation Platform (EATIP)
- European Biofuels Technology Platform (EBTP)
- European Technology Platform for Global Animal Health (ETPGAH)
- European Technology Platform for Sustainable Chemistry (SusChem)
- European technology Platform on Nanomedicine
- Food for Life
- Sustainable Farm Animal Breeding and Reproduction Technology Platform (FABRE-TP)
- Technology Research Platform for organic food and farming (TP Organics)

The core ETP activities is strategic research and innovation agenda development (SRIA) and implementation plans, mobilisation and encouragement of industry participation in EU networks and co-operation in research, development and innovation programs.

The most relevant platforms that rely on using the biotechnology toolbox for successful application of their strategic marine goals:

Food for life is focused on both terrestrial and marine food resources. The food for life SRIA identifies similar common themes of focus for marine biotechnology as is found in agendas and roadmaps from ERA-MBT and COFASP.

EATIP has identified eight thematic areas of interest within aquaculture focused on improved culture technology, biological lifecycle control and optimisation, feed production, aquatic animal health and welfare. This is very much in-line with the thematic area actions identified in the ERA-MBT roadmap for biomass production and processing and for product innovation and differentiation where biotechnology will have a key role.

JPI OCEANS

JPI Oceans is a EU member states strategic platform to pool national research efforts and provides policy makers with scientific and strategic input. The JPI Oceans has defined strategic areas in its SRIA related to marine challenges. Ten specific strategic areas and three cross-cutting areas. These defined strategic areas has been a valuable contribution to other European initiatives such as H2020 and European Research Area (ERA). To achive the objectives an implementation and a dynamic operational plan with 43 actions and 12 cross-cutting initiatives to execute the strategic goals.

Many of the identified strategic areas have relevance to marine biotechnology and one of the areas has direct relevance "Use of marine biological resources through development and application of biotechnology" with four main activities:

- ***Support actions towards the exploitation of genetic resources****, including bioprospecting, identification, and the valuation of biological resources. Activities will establish a maximum sustainable yield (MSY) for the use of marine bio-resources to avoid overexploitation and assess the impact and risks from exploiting marine biodiversity.*
- ***Research to enhance knowledge of taxonomy and genomics*** *to provide policy advice for Blue Growth and GES. This action will include genome bioinformatics and computational biology, sequence and structure analysis, molecular evolution and omics technologies.*
- ***Develop new organism models to understand basic biological, ecological and evolutionary processes*** *which underpin the discovery of biotechnology and application of biomimetics.*
- ***Support coordinated efforts along the value chain*** *from marine biomass to markets to reduce the EUs dependency on imports of biomass. This implies increased supply of marine bioresources through sustainable cultivation of biomass like micro and macro algae and integrated multitrophic aquaculture.*

EUROPEAN MARINE BOARD

The European Marine Board (EMB) provides an independent platform for organizations involved in supporting, delivering and using marine research and technology to promote common positions on research priorities and strategies in Europe.

EMB is a unique marine science forum which develops scientific foresight by initiating state-of-the-art analysis and studies and translating them into clear policy recommendations to national agencies and governments as well as to European institutions.

Where the EMB identifies a topic of strategic interest as the basis for a new activity, it applies one of a range of instruments to deliver a tailored impact. Targeted at European and national research programme managers, strategy developers, policymakers and the marine research community, EMB outputs drive future European and national marine research agendas, programmes and supporting strategies and policies.

EMB published a policy brief on marine biotechnology „Marine Biotechnology: Advancing Innovation in Europe´s Bioeconomy“ and another of interest „Delving Deeper“ on the deep-sea ecosystems and connectivity. Also a number of postion papers touching on the subject of marine biotechnology and the effect of climate change.

EUROPEAN INSTITUTE OF INNOVATION & TECHNOLOGY

European Institute of Innovation & Technology (EIT) is a EU initiative to boost innovation and entrepreneurship across Europe. The main objective is to create jobs and support sustainable economic growth Europe is seeking. By such they have created a Knowledge and Innovation community (KICs) that bring together buisnesses, research institutes and universities. Six KICs have been launched with focus on different social challenges. None of them deals directly with marine challenges. EIT Food accommodates mainly agrifood challenges. Marine biotechnology therefore has minimal focus within EIT.

ATLANTIC OCEAN RESEARCH ALLIANCE COORDINATION AND SUPPORT ACTION (AORA-CSA)

Atlantic Ocean Research Alliance Coordination and Support Action (AORA-CSA) is a Horizon 2020 BG-14 project that will provide the European Commission with support to scientific, technical and logistical trans-Atlantic Marine Research Cooperation. This CSA supports the implementation of the Atlantic Ocean Research Alliance in the Galway Statement on Atlantic Ocean Cooperation (from 2013) where the EU, USA and Canada agreed to join forces on Atlantic Ocean Research. An excerpt from the Galway statement: “Intend to advance our shared vision of an Atlantic Ocean that is healthy, resilient, safe, productive, understood and treasured so as to promote the well-being, prosperity, and security of present and future generations.“

One of the tasks within AORA is to provide the EU-USA-Canadian Atlantic Ocean Research Alliance with relevant and responsive information on the status of Marine Biotechnology in Europe relevant to scientific and industry needs in the North Atlantic. The CSA focus on the marine bioeconomy is very relevant to the EU marine biotechnology community.

BIO-BASED INDUSTRIES (A JOINT TECHNOLOGY INITIATIVE)

The Bio-Based Industries (BBI) is joint public-private partnership between the EU and the Bio-based Industries Consortium. It is based on the Vision and Strategic Innovation and Research Agenda (SIRA) developed by the bio-based industry in 2013 and updated in 2017. BBI is a major public and private effort (investing €3.7 billion in bio-based innovation projects from 2014-2020 of which €975 millions comes from Horizon 2020 EU funds).

The updated strategic vision of the SIRA is composed of four pillars that need to be addressed to unlock the potential of the industry and increase Europe´s competitiveness:

- foster supply of sustainable biomass feedstock to feed both existing and new value chains;
- optimise efficient processing for integrated biorefineries through research, development and innovation (R&D&I);
- develop innovative bio-based products for identified market applications; and
- create and accelerate the market-uptake of bio-based products and applications.

As part of the updated SIRA from 2017, BBI activities now include emphasis on the use of and valorization of added-value products from marine (and freshwater) biomass. The marine strategic objectives for 2020 and 2030 identifed in the SIRA are in-line with and supports the strategic vision of other EU marine initiatives e.g. ERA-MBT and COFASP.

Strategic objectives for 2020 and 2030 with relevance to marine biotechnology:

- BBI activities will help guarantee a secure and sustainable supply of biomass feedstock for European biorefineries. They will do this through the development of integrated and sustainable value chains using agri-based, forestry-based, aquatic feedstock and their residues and side streams; and bio-waste and CO2.
- BBI activities will aim to utilise and valorise as much available biomass as possible, pursuing solutions towards ‘zero-waste’ bio-based operations with subsequent closure of the cycles. Integrated biorefineries will apply the cascading principle where feasible to maximise conversion of the biomass feedstock and its by-products, side streams and residual streams into higher added-value products .
- BBI activities will contribute to isolating and valorising protein through additional biomass processing, bringing down imports of protein (e.g. soy) for feed in Europe by 15 % by 2020 (and halving imports by 2030).
- BBI activities will include valorising high added-value products from un- or underexploited sources of sustainable biomass, such as bio-waste and marine biomass.

NATIONAL PROGRAMMES IN BLUE BIOECONOMY

European countries can be roughly subdivided in the following four main categories:

1. Countries with a clearly identifiable marine biotechnology focus as developed in dedicated marine biotechnology RTDI plans, strategies and/or funding programmes nationally and/or regionally.
2. Countries with strong marine biotechnology activities in one or more areas, but without dedicated marine biotechnology science and technology plan(s), strategies and/or programmes
3. Countries with some interest and activities in certain marine biotechnology application areas, but without dedicated marine biotechnology science and technology plan(s), strategies and/or programmes
4. Countries without dedicated marine biotechnology science and technology plan(s), strategies and/or programmes and where there is only limited marine biotech focus and activities

As of now only three countries, Ireland, Denmark and Norway, have published their dedicated national policy programme in marine biotechnology with Iceland expected to publish its programme soon. Portugal, France and Germany have strong regional strategies and focus. Other countries with considerable interest in the sector (2nd category) are Belgium, Italy and Spain.