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Update global priority list of relevant international initiatives

Work Package 4

Outreach to external activities

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EXECUTIVE SUMMARY

As a result of the desk study in the inventory of the CSA MarineBiotech seven countries (USA, Brazil, Canada, China, Japan, Republic of Korea and Australia) were identified which have to be regarded as highly interesting for collaboration with the ERA-MBT.

The information from the CSA report "A global perspective: High-level analysis of key trends and developments in global marine biotechnology RTDI" was summarized in a table for a comparison of the potentially most active countries concerning their MBT related strategies/plans/programmes, infrastructure and private investment and was assessed.

COUNTRIES	NAT. SPECIFIC STRATEGY/PLAN	NAT. SPECIFIC STRATEGY, PLAN	INFRASTRUCTURE	PRIVATE INVESTMENT
USA				
Brazil				
Canada				
China				
Japan				
Rep. of Korea				
Australia				

GREEN	YELLOW	RED
= advantageous for cooperation	= maybe advantegeous	= adverse for cooperation

All seven compared countries should be taken into account for collaboration efforts in form of further desk research, contacting of responsible persons in the respective countries and a fact finding mission.

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SCOPE OF WORK PACKAGE 4 - TASK 4.2: INTERNATIONAL MBT LANDSCAPE

The general aim of work package 4 in context of this report is to link the ERA-NET Marine Biotech with **international activities and to reduce fragmentation of research efforts in the area** of Marine Biotechnology via better coordination and cooperation between relevant players within and from outside Europe. This should be achieved by:

- Involving upcoming activities at the earliest possible point of time
- Making contact with global initiatives
- Developing and conducting common activities together with these initiatives in close cooperation with the other WPs

The activities within this work package will build on the achievements made in the CSA-MBT and contribute to the development of a strategic roadmap (T2.2) and of a sustainable MBT Net (T2.3). This WP should provide the measures to explore the possibilities of launching a call together with other research coordination initiatives (T5.5).

The aim of task 4.2 within this work package is to identify and preferably realise potential collaborations with institutions/initiatives in non-European countries where ERA-MBT can benefit from. The results of task 4.2 should be a deeper insight into e.g. international research areas and themes, best practices for research management, capturing industry participation etc., as a decision basis for collaboration activities. ERA-MBT should benefit from these insights concerning the development of a long-term strategy for ERA-MBT (WP2, recruiting members for the IAG), joint actions with other initiatives (WP5) and initiations of collaboration with industry (WP3). Collaboration opportunities could be e.g. joint workshops, exchange programs, surveys, conferences or training activities.

As a first step a desk study in the inventory from CSA-MBT should identify the most promising international MBT-related initiatives, with a special focus on areas where ERA-MBT can profit from already made international experiences. In a second step promising contacts should be intensified by a fact finding mission to the respective countries. This should identify or verify a more concrete potential for joint actions with the international partners and should initiate these actions (Milestone 22).

This report will be updated at month 40 to summarise realised international collaborations that were developed during the ongoing ERA-MBT activities and to make a selection of potential partners for future collaborations. One can expect that within the duration of the ERA-NET- project new potential partners will have to be taken into account based on the developments in the different countries and their willingness and ability to cooperate. Other partners could have to be excluded for future outreach activities for the same reasons.

ACTIVITIES IN REPORTING PERIOD UNTIL MONTH 12

INTRODUCTION

In the first year of the ERA-MBT initiative the first question that grew up in connection with the international outreach was “which criteria can be defined to identify potentially interesting countries for collaborations”. It became obvious that not a single criterion, like the existence of a more or less specific national strategy, plan or programme on MBT/biotechnology/marine RTDI, an extensive MBT infrastructure or a high private investment can be adduced to identify a country as potentially interesting for collaborations. More or less all these criteria have to be taken into account to make a first selection of countries which can be regarded as highly relevant for MBT collaborations.

Based on this understanding a desk study in the inventory of the CSA-MBT was started. The CSA-MBT report «A global perspective: High-level analysis of key trends and developments in global marine biotechnology RTDI» by Meredith Lloyd-Evans (BioBridge Ltd) was identified and analysed, as a central document for this purpose. This extensive report gives an overview about international and regional activities and infrastructure with specific national profiles. It was published in February 2013 and raises no claim to completeness. The source of the country specific and region specific profile data were contacts from the CSA-MBT consortium or extracted from the World Wide Web. The report already defines countries “that are relatively highly active, such as USA, Brazil, Canada, China, Japan, Republic of Korea and Australia, as well as others where activities are growing from a smaller base (Thailand, India, Chile, Argentina, Mexico, South Africa) and where there are signs that marine biotechnology is increasing in importance as a research priority.” The assessment of the activity grade of these countries bases on the amount of available data about MBT in connection with the preparation of this report.

Because, as already mentioned before, there were no other single criteria determinable for a collaboration potential of a country within MBT, the activity grade were regarded as a summarizing criteria for a country selection. Based on the conclusion of the report, that the mentioned seven countries are the most active ones, only these countries were regarded closer for a comparison. The information about these countries was extracted and juxtaposed in the following chart

RESULTS

Countries	Nat. specific strategy, plan or programme on **MBT**	Nat. specific strategy, plan or programme on **biotechnology** and/or on **marine RTDI** including MBT	Infrastructure	Private investment	Remarks
USA	NO nat. strategy, **Nat. Oceanic and Atmospheric Administration (NOAA)** coordinates most of the applied MBT research -> Nat. Sea Grant College Program ->32 univerty based network programms incl. Costal, oceanic and undersea works; Ocean explorer programm-> research boat and data for/from bioresource exploration; nat. Undersea Program -> biodiscovery and bioactives; (Sea Grant Program -> cutting-edge technologies, but not specific MBT), Dept. of Energy (DOE) -> supports bioenergy from algae (30 projects, $85M)	Nat. Bioeconomy Blueprint (2012)-> biol. Innovations and challanges in health, food, energy, environment-> incl. e.g. Biodiesel from algae and biosensors for marine pollution as innovation examples; "Marine Biotechnology" mentioned in National Science Council; National Science foundation has a BIO directorate ($733 M in 2013) programms incl. marine ecology, microbiology and biotechnology-> Contributer to the EC-US Task force meeting in MBT topics;	**17 Research Centres** listed in context of MBT; American Type Culture Collection and Harbour Branch Institute;	Nereus Pharma, Albany Molecular and Estée Lauder -> marketing amrine-derived products for health and cosmetics; Bio Architecture Lab -> seaweed as feedstock for ehtanol, fertilizeres, proteins; Solazym-> algae biofuels; J Craig Venter Research Inst. -> marine biodiversity mapping, metagenomics, synthetic biology, Sapphire Energy-algae biofuels plant	Reelection of Obama saves the continuance of the microalgae biofuel research policy
Brazil	NO nat. strategy, but on ferderal level: **BIOMAR** programm (since 2005) - Study & Evalualtion to the biotech potencial of marine biodiversity (Ministry for STI; 6 Ministries , 4 Organisations, 1 com. Org.)	**Nat. Biotech Developm. Strategy** (recently formulated in 2007)	**15 Centres of marine Biotech Research** listed; networking activities are strongly supported by government (3 established networks: macroalgae, biodiesel, biodiversity)	algae technology pilot plant in collaboration with an Austrian company ($10M) -> biorefinery concept on algae	>500 groups in closer or wider research context; recognised as an International Cooperation Partner Country (EU); already existing marine specific bilateral cooperations with Germany and France;
Canada	NO nat. strategy, but some provinces have strategies and action plans for MBT **e.g. Québec** (->ACCORD project with clusters in MBT, aquaculture, seafood processing, marine technologies);	**Nat. Biotech strategy** (1983, renewed in 1998, Topics: Biosafety and regulations, less science and economy) ; **Marine strategy** (2002) and **Healthy Oceans** Initiative (2007, canad. $ 60M canad. $) with elements of marine biosciences/biology/bioresources; **Fisheries & Oceans Canada** (R&D prog. In Auqatic Biotechnology,...); **Nat. Research Council Council** (Bioproduct Programm incl. algae biofuels; **Genome Canada/Brit. Columbia/Atlanitc** (International Salmon genome project,...)	**Marine Biotechnology Research Centre Rimouski, Québec;** Bedford Institute of Oceanography; Dalhouse University; McGill University; The Ocean Scientific Centre, University of Prince Edward Island; ArcticNet, DAMAMNet, Ocean networks Canada, CCCM, NSERC's Canadian Healthy Ocean Network,	Some important **companys**: Ocean Nutrition Canada Ltd. (world leading supplier Omega-3-fatty acids); Acadian Seaplant Ltd. (Seaweed to products); Jellet Rapid Testing (Identif. of shellfish poisining); Kenny & Ross Ltd. (fish gelatine products)nautilus Biosciences Canada Inc. (marine-derived natural products for health)	**2nd place in scientific impact and publications on aquatic biotechnology** (esp. aquaculture), molecular ecology, environmental monitoring; 208 companies producing bioproducts (esp. bioethanol) 1,3B$, 5% from marine and aquaculture rescources
China	No nat. strategy, but MBT was specific topic in nat. hightech strategy ("863") since 1996 was supported from several five year plans; **Roadmap of Developm. in chinese marine S&T to 2050** -> potential of marine resources to contribute to several actual topics; One nat. strategic goal is "to exploite the Sea Unsing S&T"	Biotechnology is part of the chinese "**Five Year Plans**" since 1986 (last in 2010) incl. MBT: one of China´s strategic industrial sectors (govern. subsidies, pos. tax treatment, preferential policies); **New Nat. Hightech Strategy** ("863 program")->20% biotech.; **Nat. Basic Research Program** ("972" program)-> 30% agriculture biotech., **Nat. Key Technology Program**; Nat. Nature Science Foundation of China (NSFC)-> Capacity buildung and basic research ability; MOST (Innovation fund for Technolgy-based firms) Four main region for marine biodiscovery and bioactive developm.	At leat 10 chinese Inst. are specialized in marine biopharmaceuticals + state key laboratories at universities + 5 specific freshwater and marien or germplasm collections	Shanghai Zeyuan Marine biotechnology Ltd.->R&D in microalgae culturing technology by novel sequential technique and development/industrialisation of related products; Shanghai Zeyuan Bio -> algae cultivation (open pond and photobioreactor)-> biodiesel and bioactives ->new biorefinery technology; Xunshan Group-> global biggest producer of brown seewead.	Trend: **"New marine biological product industry technoloy innovation strategic alliance" (PPP?) ->covers the whole range of activities**
Rep. of Korea	YES: **BLUE-BIO 2016** (Nat. specific plan for MBT)-> Korean Institute of Marine Science and Technolgy inculdes the MBT Supporting centre; Aim: Establish a marine Bio-resource Research Institute in 2013 ($145M) including culture collection international collaborations for tropical, South Pole and North Pole explorations and construction of special research vessels; MasterPlan for MBT based on Biotechnology Pro	National biotechnology development plan "**Bio-Vision 2016**" until 2016-> Aim: to accelerate South Korea's economic development using biosciences and biotechnology so that it could join the ranks of the G-7 nations by 2010->Five key biotechnology areas are defined, including life sciences; healthcare and medicine; food, agriculture and livestock; industrial processes/environment and maritime industry; and a bioconvergence industry) In addition, there will be actions to help gain broader public support and participation such as strengthening research ethics and life ethics guidelines and stepping up awareness and information efforts. BioVision 2016 is supported by 8 government agencies, including the Ministry of Science and Technology (in chief charge) and the Ministry of Education and Human Resources Development, with an annual rolling plan. **Ocean Korea 21 (Ocean Development Plan)** for 2011- 2020 -> Aim: to form a coherent and continuous plan for all marine, coastal and Economic Exclusion Zone activities.	**Korean Institute of Ocean Science and Technology** (KIOST)-> Marine Biotechnology Research Division; **Korea Polar Research Institute (KOPRI)**; **Korea Maritime University** -> Division of Marine Environment & Bioscience; **University of Kunsan**-> College of Ocean Science and Technology; **Pukyong National University** -> Marine Bioprocess Research Center, the Marine Biochemistry Laboratory, the Ocean Life Science Research Center, the Maritime Transformation Research Center, and a Marine Disease Control and Prevention Centre; **Seoul National University's CMDD** (Center for Marine Natural Products and Drug Discovery; **Marine-bio center of Silla University** in Busan; National Research Laboratory (NRL) programme!; NIBR (the National Institute of Biological Resources; **MBRD at KIOST hosts the Marine & Extreme Bioresources Collections**;KOBIS (the Korean Ocean Biogeographic Information System) is a member of the international OBIS system and provides **marine biodiversity information to the main databases**.	**strong support shown by the Korean government to biotechnology**, the overall market for biotechnology-derived products, mainly human health and 'bio-foods', was estimated at US$6.5B in 201025. A number of companies make more specific use of marine-origin materials, including **Kittolife**, with products based on high-purity, high-quality chito-oligosaccharides and **amBio**, which is investigating marine organisms and algae as probiotics and food or feed ingredients. The **US Company Unigen** has a Korean subsidiary that uses extracts from marine organisms as ingredients in pharmaceuticals, functional foods, dietary supplements, cosmeceuticals, and animal health products . Companies working on algae for carbon capture or energy production include **SK Energy**, which began investment in marine biofuels in 2008, **Ecophyco Tech** and **Pegasus International. SAIT (Samsung Advanced Institute of Technology)** is involved in one relevant research project, developing the use of red seaweeds as biofuels, with Sungkyunkwan University, Seoul National University and the University of Illinois USA.	
Australia	NO nat. MBT strategy, butr the National Biotechnology Strategy included enhancement of access to marine bioresources as one of its goals and marine science is specifically mentioned in "Powering Ideas". **Several states include marine biotechnology in their development strategies, including Queensland, Western Australia, South Australia and Tasmania**. Life Sciences Queensland notes that marine biotechnology is part of the state's plans for sustainable economic and social growth.	Australia's first National Biotechnology Strategy spanned 2000-2008 followed by **"Powering Ideas - An innovation agenda for the 21st century"** was published by the Australian government in 2009 and included biotechnology as one of four key technologies, nothing that Australia was one of only 6 countries deemed capable of benefiting from sixteen future applications arising from biotechnology, nanotechnology, materials science and information technology. The other five were Canada, Germany, Israel, Japan, Korea and the USA32. The Government then published the National Enabling Technologies Strategy in 2012, within a Super Science – Future Industries initiative and with a budget of A$38.2 over 4 years. "Cutting-edge" biotechnology is part of this. **Super Science Initiative** ->priority areas of Australian research until 2013->"Future Industries", one of the three categories qualifying for support, includes marine biology. **National Collaborative Research Infrastructure Strategy programme**	**AIMS, the Australian Institute of Marine Science**; **WAMSI, the Western Australian Marine Sciences Institution**; **Flinders University's Centre for Marine Bioproducts Development; James Cook University's School of Tropical and Marine Biology; CMB (University of New South Wales Centre for Marine Bio-Innovation; SARDI (the South Australian Research and Development Agency ; A range of CRCs (Cooperative Research Centres;** CSIRO manages the **Australian National Algae Culture Collection;** Griffith University maintains the **Queensland Compound Library at the Eskitis Institute,** where the Natural Product Discovery Unit was established ; **The NQAIF, the North Queensland Algal Identification /Culturing Facility, houses a tropical algal culture collection;** Western Australia Museum houses the **Western Australia Marine Bioresources Library, WA Government, AIMS and the Western Australian Marine Sciences Institution.** Flinders University's CMBD has initiated an **Australia-New Zealand Marine Biotechnology Network,** with University of Waikato New Zealand and others	**AstraZeneca** provided over A$100M to Griffith University, of which A$45M went into building the Natural Product Discovery Unit and the remainder into projects, screening and culture collections. In 2008, Griffith University's discovery partnership was re- established with **Pfizer Inc**, looking at new molecules for malaria and trypanosomiasis.**Marine Biotechnology Australia Pty Ltd** is developing a potential treatment for herpes infections in humans derived from abalone haemolymph, supported by almost A$330,000 from AusIndustry; this has recently entered clinical trials, with funding from ARC. The company itself is investing over A$4.5M in the development. The enzyme company **Cassa Bio-Tec** has received over A$175,000 as a feasibility grant from a local council to remove beached seaweed and turn it into liquid fertiliser via enzymatic digestion.**Marinova Pty Ltd** develops medical, cosmetic and nutraceutical uses of fucoidans from seaweed, including anti-viral and anti-cancer applications. **AlgaeTec**, based in the USA and Western Australia, has strategic partnerships with the Manildra	The trend is towards government investment in research translation into industry. The Industrial Transformation Research Program was established in 2011, with A$236M funding to help transfer innovation into industry, specifically focusing on strategic technologies with future economic impact, including engineering, materials science and nanotechnology, communications, chemical engineering and biotechnology. Up to 20 Industrial Transformation Research Hubs will be funded, initially for up to five years, allowing shorter- and longer-term projects with industry and economy focus. The ARC will put A$1M per year into each ITRH, to be matched by the industry partners. In addition, up to 50 Industrial Transformation Training Centres will be nominated over the next 5 years, giving up to 600 doctoral and postdoctoral researchers the opportunity to work with industry partners on research for specific industry needs. Each ITTC will receive up to $1 million per year for up to three years.

Color code:

green = advantageous for cooperation	yellow = maybe advantegeous	red = adverse for cooperation

The color code in this table follows a subjective assessment, in how far a single indicator for MBT activity can be advantageous for a possible cooperation with the ERA-MBT. No indicator was assessed as adverse for cooperation for all seven countries.

The table shows that in all seven countries there are national strategies, plans or programmes that cover the topic of marine biotechnology at least in an indirect way. Only the republic of Korea has an MBT specific strategy (BLUE-BIO2016). But only the existence of such a strategy still doesn´t allow a conclusion on how much it is implemented in the respective country. Hence, it is still possible that MBT is covered in other countries in a better way by a wider strategy e.g. for biotechnology. An evaluation or comparison of the single national strategies related to MBT is not content of this report, here. But the existence of these strategies/plans/programmes is evaluated as an indicator for systematic MBT efforts in all listed countries. All seven countries have an extensive research infrastructure for MBT in form of research centers, university institutes, networks, databases and/or type culture collections. For Brazil the CSA report gives not much information about private investment. But it is possible that there are MBT related companies in Brazil which weren´t identified via internet search. All other countries show a number of companies which are dealing with MBT related products or services. A general basement for the transfer of R&D results into products and services can be estimated for these countries.

CONCLUSION

Based on the juxtaposition of the information that was available from the CSA-MBT report for the most active MBT countries it is concluded that any of the listed countries should be excluded generally for further international cooperation efforts of the ERA-MBT. Furthermore any of the listed countries can be exposed as especially interesting for cooperation in comparison to the other countries. All seven countries should be taken into account for collaborations and be regarded as a pre-selection for further and deeper analysis.

PROSPECT

Building up on the results of this CSA report analysis, all seven countries should be investigated further for their collaboration potential. In a next step contact persons in these countries should be identified and contacted. After a first e-mail contact the information basement should be extended and updated by telephone interviews and/or surveys. Also more actual reports e.g. from conferences should be consulted to decrease the selection of the most potentially interesting countries for collaborations. In a further step a fact finding mission in one or two of these countries should be organized for the ERA-MBT partners to confirm the previously collected information by their own impression and to initiate or concrete collaboration negotiations. Divergent to the milestone planning (originally month 16) of the ERA-MBT description of work the realization of a fact finding mission is now estimated for 2016.