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Report on
ERA-MBT Open Stakeholder Consultation

between 25 June and 15 August 2014

Work Package 3

Interactions with industry

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EXECUTIVE SUMMARY

This report summarises the results of a survey made by ERA-MBT June-August 2014. The updated mapping of the marine biotechnology environment, concludes that the complete area of marine biotechnology is very complex, on the industry side comprising mostly SMEs, but otherwise include a large variety of stakeholder categories such as industry clusters, associations, networks, consultants, TTOs, funding agencies, academic institutes and a range of organisations at national, regional and European level.

Raw material being processed contains all different biomass categories, counting both macro- and micro-organisms. Similarly the products coming out of marine biotechnology processing include a large variety of product categories, ranging from food and feed over health products to the materials and chemical industries' products. Further to that, environmental applications have a high priority.

Concerning the industry needs for new legislation for IPR/IPP a careful conclusion could be drawn that if there are specific IPR/IPP issues for marine biotechnology they relate to the jurisdiction connected to the ABS of raw material. For the remaining part of the marine biotechnology area the technical issues related to IPR/IPP can be considered similar to other biotechnology production. New legislation is under way in Europe that might make it easier to protect knowledge and particularly file patents.

Lack of public funding to bridge the gap between academia and industry, and insufficient co-operation between academia and industry are the most important reasons identified as a problem for successful technology transfer. The focus of the verbal answers in the ERA-MBT survey was more on lack of funding in general than on funding to bridge the gap between academia and industry in particular.

Overall it is estimated that modern infrastructures and tools are essential for the successful development of marine biotechnology, but it is realised that good equipment is very expensive and difficult to get funding for. The quality of existing infrastructure is in general estimated as good, but there is a need for continuous updating if level of research and innovation is to be continued at the present level. Availability is fairly good, but due to lack of collaboration between academia and industry, the two sides are not utilising existing infrastructure and tools optimally. It is also considered that infrastructures are scattered in Europe.

The answers given in the ERA-MBT survey did not allow further analysis of what opinion the different stakeholder categories had on technology transfer because the number of responses for each category was not sufficient to make a more detailed quantitative analysis.

The answers on funding sources and funding portfolio in the questionnaire presented a quite varied picture where the majority of marine biotechnology stakeholders pool resources to fund their RTDI from many different funding sources. Domestic public funding was otherwise the source that most stakeholders relied on. The bottlenecks for funding were similarly varied, but again access to public funding was registered as the main bottleneck.

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INTRODUCTION

Between 25 June and 15 August 2014, the Marine Biotechnology ERA-NET has consulted its stakeholders to get a better overview of the existing interactions between the industry and academia in the area of marine biotechnology. In particular, the aim of this open consultation was to identify the needs and gaps in such interactions.

The questionnaire for this consultation had 3 sections related to following themes:

- General questions
- Technical Transfer Practice and Policy
- Funding schemes and marine biotechnology specific funding issues

An outline of the questionnaire is presented in Appendix 1 to this report. The questionnaire was presented on the ERA-MBT webpage and sent by direct mail to more than 900 stakeholders.

In total, 126 answers from our marine researchers, industrial stakeholders and policy makers have been received. The answers have been analysed and the results presented in this report, which will be used to explore and identify challenges on the road to develop marine biotechnology into a sustainable and strong driver supporting industrial development of marine biotechnology in Europe.

The aggregated results will further be used for the purpose of increasing awareness in industrial development environments about the potentials within marine biotechnology. ERA-MBT will strive to develop mechanisms and tools to reduce or eliminate identified bottlenecks and barriers for a successful development within the area.

It must be emphasised that the survey is a *quantitative* analysis where a picture of the category of respondents have been mapped, and respondents marketing products have been asked what kind of raw material they use and what kind of products they deliver. The respondents wanting feedback on the results of the survey were asked to provide contact information, but the survey is per se anonymous and shall not, and must not be coupled to the responses given.

MAPPING OF THE ERA-MBT ENVIRONMENT

The mapping as performed here is restricted to the respondents having answered the questions presented in the survey. As stated in the introduction the questionnaire used was published on the ERA-MBT website and sent by direct mail to a range of stakeholders as given in the ERA-MBT contact mailing list.

A Stakeholder Group was earlier categorised in the CSA MarineBiotech preparatory action as research, industries, policy makers, outreach professionals, infrastructures and networks, of which most were research, industries and networks. Further to these stakeholders a range of new stakeholders have been identified. The MBT environments has thus been continuously updated, but a picture of their activities and opinions to relevant questions such as collaboration within the area, access to infrastructure and the funding situation have not been obtained. The present survey is thus an attempt to get an updated mapping of activities and opinions of the MBT environment.

STAKEHOLDER DISTRIBUTION

127 responses were received from 24 countries (Figure 1). 94% of these responses originate from European entities (including entities from French Polynesia). Only seven responses are from non-European entities. Five responses came from America and one from Africa and Asia (Figure 2).

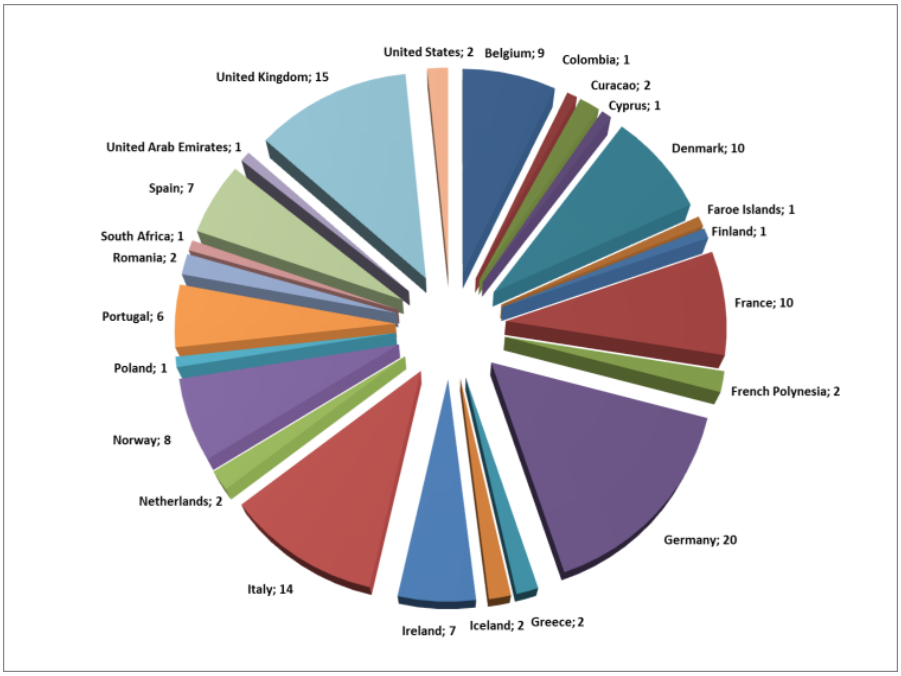

Figure 1. Responses by country

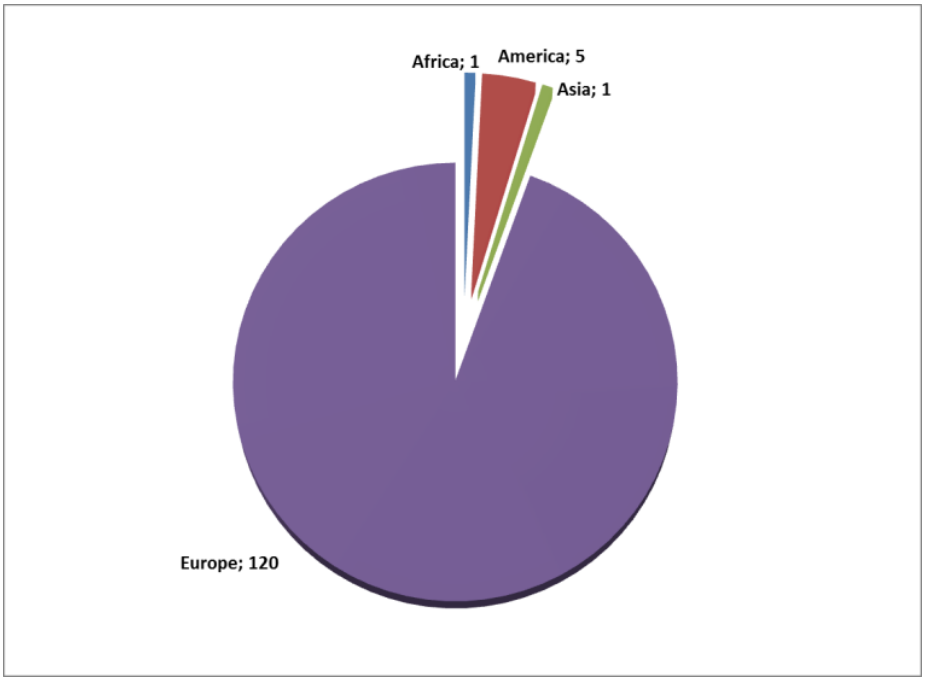

Figure 2. Responses by continent

STAKEHOLDER CATEGORIES

The respondents were given the opportunity to identify themselves within a list of stakeholder type. The private sector is about one third of the responses and the public sector about two thirds (Table 1). 28% of the respondents classify themselves as large industrial company or as a SME. Some identified themselves as overlapping type of stakeholder (chose more than one option) and this was much more common for government bodies than the private sector entities. Almost all those who responded as 'other' to 'What type of stakeholder are you?' are from governmental agencies, research institutes and universities. Of the 35 who identified themselves as large industrial companies or SMEs three did not answer the specific company questions and seven replied the specific company questions but are not marked as large industrial company or SME in the list of stakeholders. With careful filtration of answers probably eight of the responses to the question 'Are you a company?' are not responses from large companies or SMEs with active marine biotechnology R&D projects. However, the statistics below is based on total unmodified pool of responses.

Table 1. Stakeholder response

Stakeholder type	Response Percent	Response Count
Larger industrial company (international)	4,7%	6
SME	22,8%	29
Industry cluster	3,1%	4
Industry association	1,6%	2
Industry network	1,6%	2
Consultant	4,7%	6
Technology transfer organisation	8,7%	11
Regional organisation	3,9%	5
European organisation	3,1%	4
National organisation	28,3%	36
Funding agency/venture capital provider	3,9%	5
Other (please specify, max. 2000 characters)	38,6%	49
	Answered question	127
	Skipped question	5

MARINE BIOTECHNOLOGY ACTIVITY OF COMPANIES

There is no apparent trend in what kind of activities the companies are engaged in (Table 2). Many companies indicated multiple activities, e.g. about half of those using raw material are using marine related bio information for development of products or services.

Table 2. Marine biotechnology activity of the companies

Marine biotechnology activity	Count
We use raw material from marine biomass	22
We use marine related bio information for development of products/services	19
We develop product/services for use in marine bio environment	17
We do not have any marine biotech activity	4
Blank (did not mark any of the above)	1

No specific type of biomass used by the companies is dominant in the R&D or production of the companies (Table 3). Filtering for those who use biomass as a raw material does not change that scenario. The source of material is diverse, fish, invertebrates, micro- and macroalgae, bacteria, sponges and fungi. If looking only at the large industrial companies their market is either food/feed (4) or pharmaceuticals (2) and four out of the six are using macroalgae, three as food/feed and one is a pharmaceutical company.

Table 3. Marine biomass used for R&D or production

Marine biomass used for R&D or production activity	Count
Fish	15
Molluscs	11
Microalgae	14
Macroalgae	14
Bacteria	12
My company does not use raw material from marine sources.	2
Other	7
Blank (did not mark any of the above)	5

The respondents identified their main target market(s) and again the responses are evenly divided among the categories given (Table 4), with the exception of energy. The target market(s) for the companies are diverse but at least two market clusters can be identified. One is food and feed. 70% of those who marked food as the main market also selected feed. Out of 13 that selected feed 11 are also in food. The other market cluster is cosmeceuticals, health and pharmaceuticals. Most of those who selected one of these three markets marked the other two as well. Presumably, the companies have bioactive material with potential opportunities in all these three markets. The third strong target market area is environment and monitoring.

Table 4. The companies' main target market(s)

What is the main target market for your marine related products?	Count
Food	16
Feed	13
Energy	7
Materials	12
Cosmeceuticals (e.g. skincare)	13
Health (e.g. food supplements)	13
Pharmaceuticals	12
Environment and monitoring (e.g. biosensors, anti-fouling technology, bioremediation....)	14
Production of commodities or services other than above	4
Blank (did not mark any of the above)	5

CONCLUSION TO MAPPING OF THE ERA-MBT ENVIRONMENT

- This is a European survey, less than 5% of responses are outside Europe
- The marine biotechnology industry is a relatively young industry, most of the companies are SMEs although several large industrial companies are very much involved in the utilisation of marine biomass (four out of six large industrial respondents are using macroalgae).
- The MBT environment having answered the questionnaire is dominated by public national and research institutions
- More than half of the SMEs that answered the specific company questions use raw material directly from marine biomass, others are in marine related services
- The market for the Large industrial companies is:
    - Food and Feed, and
    - Pharmaceuticals.
- The main market focus for the SMEs can be categorised in three pillars, two of them as market clusters:
    - Cluster of food and feed, and
    - Cluster of cosmeceuticals, health and pharmaceuticals, and
    - Environment and monitoring

INDUSTRY NEEDS FOR NEW LEGISLATION FOR IPR/IPP

Protection of knowledge is an issue that comes up immediately as soon as research results are suggested for commercial exploitation, or good ideas are proposed for economic benefits. This is a general condition, so the question is if there are special circumstances connected to marine biotechnology that need attention. The ERA-MBT questionnaire was considered a good opportunity to ask the stakeholders if this could be the case.

MAIN FINDINGS FROM THE ERA-MBT QUESTIONNAIRE

The question was asked in the survey: ***Are there specific technical IPR/IPP issues for marine biotechnology?*** The result was 42 counts for YES (44.7 %) and 52 counts for NO (55.3 %).

Many respondents (20) who were giving a YES also gave a verbal comment. These were very general, quoting 'uncertainty in IPR/IPP questions', 'unclear legal aspects', 'fuzzy rules concerning the property of the bioresources', etc.

Some respondents mentioned the specific problems related to the Access and Benefit Sharing (ABS), which was 'not very applicable'. Such comments were thus concerned with the raw material and not the wider consideration of marine biotechnology per se.

As the answers given by the total population of the survey only gave an indication that there would not be any specific IPR/IPP issues for marine biotechnology (55.3 vs. 44.7%), it could be tempting to have a look at what producing companies answered to the question. Of the 27 respondents being from companies providing specific products being marketed, 16 voted NO to the question, 9 voted yes, and 2 did not answer the question. This gives a score of 64% saying NO and 36% saying YES among the respondents having answered the question. This strengthens the assumption that there are no specific technical IPR/IPP issues for marine biotechnology, but as the numbers are very low no firm conclusion can be drawn.

Among the respondents having said YES to the question, 7 have given a verbal expression of what they consider the specific IPR/IPP issues to be. Of these expressions, 5 are concerning the Access and Benefit Sharing (ABS) question and ownership to strains as the main issues, thus conditions related to bioprospecting.

CONCLUSION ON THE IPR/IPP ISSUES

A careful conclusion could be drawn that if there are specific IPR/IPP issues for marine biotechnology they relate to the jurisdiction connected to the ABS of raw material. For the remaining part of the marine biotechnology area the technical issues related to IPR/IPP can be considered similar to other biotechnology production. New legislation is under way in Europe that might make it easier to protect knowledge and particularly file patents.

MAPPING OF TECHNOLOGY TRANSFER PRACTICE

In the Document of Work (DoW) for ERA-MBT it is specified that 'Technology transfer best practice across Europe needs to be identified and understood to match industry and academy needs and inform calls'. As a first step to identify how technology transfer is practiced in Europe the ERA-MBT questionnaire included questions as outlined below.

In the ERA-MBT questionnaire we wanted to focus on present difficulties specifically related to technology transfer within marine biotechnology and to see if it would be possibly to get closer to the reasons for the observed difficulties. We consider this very important for further suggestions to how the challenges may be approached and successful solutions found.

MAIN FINDINGS FROM ERA-MBT QUESTIONNAIRE

A question asked in the survey was: ***What do you consider the main technological transfer problem(s) in marine biotechnology?*** The respondents were asked to only choose three out of seven answer options given and list them in order of importance. If none of the propose answers were found right, a possibility for 'other' issues was also provided. The results are shown in table 5 below.

Table 5 Technology transfer problems in marine biotechnology

Main Issues	Priority 1	Priority 2	Priority 3	Priority 4
Level of public funding to bridge the gap between academia and industry	28	21	8	57
Insufficient co-operation between academia and industry	28	17	8	53
Lack of incentives for PP collaboration and problems associated with such partnerships	5	19	22	46
Lack of national policy and strategy for tech transfer and start-up companies	14	18	7	39
Limited access to resource material for R&D and pilot studies	9	3	19	31
IPR issues – Benefit sharing	2	9	11	22
Other	8	4	9	21

The highest number of first priority was given to the answers 'Level of public funding to bridge the gap between academia and industry' and 'insufficient cooperation between academia and industry'. It was realised that such a complex question/answer situation could be difficult to interpret, so the respondents were given the option of making verbal comments to their different priorities.

Most such comments were given to main priority 1 and 3, where virtually no comments were posted to main priority 2.

Here are listed a few examples of the comments: 'the gap between marine *biology* and *biotechnology* remains too large'. Another respondent stated that market knowledge is missing, and still another mentioned 'lack of concise and focused strategy between different politic entities/ministries' as a problem, and proposed the solution to be 'more consultations involving all important political entities'.

A comment in somewhat the same direction was 'missing of a long time strategy…a three year funding period is usually not sufficient to be successful'. It was also stated that 'culture of entrepreneurship and building business from knowledge is underdeveloped in Europe'. A suggestion to improve this was 'the possibility of researchers to be part of a spin-off company'.

CONCLUSION ON TECHNOLOGY TRANSFER MAPPING

Lack of public funding to bridge the gap between academia and industry, and insufficient co-operation between academia and industry are the most important reasons identified as a problem for successful technology transfer. The focus of the verbal answers in the ERA-MBT survey was more on lack of funding in general than on funding to bridge the gap between academia and industry in particular.

FUNDING OF MARINE BIOTECHNOLOGY RTDI

In the ERA-MBT DoW it is specified that a task is to 'Investigate public and private funding schemes for industrial development of results and technologies from MBT and identify gaps and propose ways to mitigate them.' The present presentation is the preliminary finding based on the ERA-MBT questionnaire.

MAIN FINDINGS FROM ERA-MBT QUESTIONNAIRE

Sources of funding

The percentage of answers for the different main sources of funding, and the actual number of answers given by public institutions and industry respectively are given in Table 6.

The majority of marine biotechnology stakeholders depend heavily on domestic public funding, which as a source of funding is closely followed by EU or international funding. Private funding, either in the form of risk or other types of private capital (share capital, private investments, industrial cooperation and other commercial contracts), is still a limited source of capital for marine biotechnology stakeholders. When it comes to specific stakeholders, domestic public funding is the main source of funding for national organizations, including universities and research institutes. A few SME's also depend on domestic public funding, but the majority fund their RTDI activities either thorough EU or international funding, venture or other private capital, the latter also being the main source of funding for large companies.

The five answers from industry in the category 'Other' cover financing from own revenue or own contribution in collaboration projects. Similarly the three answers in this category from public organisations cover contribution from industry. This may be considered as a very low number.

Table 6 Main sources of funding

Main funding	Percent answers	Public	Industry	**Total**
Domestic public funding	46.6	34	7	41
EU / international funding	36.4	17	15	32
Venture capital	8.0	2	5	7
Other	9.0	3	5	8
Total	100	56	32	88

Funding portfolios

In addition to asking the question of what the main source of funding was, respondents were also asked to indicate how much the share of funding was from this source. Results are given in Table 7, and an analysis of what kind of stakeholders who depended on a single source is given below.

Table 7. Funding portfolios

Share of funding from main funding source					
Answer options	0-25 %	26-50 %	51-75 %	76-100 %	**Response Count**
Between	13	34	22	19	**88**
				Answered question	**88**

The majority of marine biotechnology stakeholders pool resources to fund their RTDI from many different funding sources. Those stakeholders who depend heavily on one source of funding are privately owned entities which are funded with private capital (including 2 being funded with risk capital). Some national entities, including universities, research institutes and technology transfer companies also heavily depend on domestic public funding, but most have more diverse portfolios of funding sources, which most often include EU or international funding as another important part. The same observation can be made for other stakeholders, but other trends are hard to observe as similar stakeholders many times have very different funding portfolios.

Main findings on funding sources

Public stakeholders rely extensively on domestic public funding with EU/international funding being the second most important source of funding. The industry sector is relying more on EU/international funding, but overall the domestic public funding is the most important source. Concerning funding portfolios the majority of stakeholders pool funding from different sources, although many report as much as 26-50% to come from a main funding source.

BOTTLENECKS OF MARINE BIOTECHNOLOGY RTDI FUNDING

The question asked on the bottleneck of funding: *'What do you consider the main bottleneck for funding of marine biotechnology R&D* (please choose 1 or 2 issues from the list below in order of importance, where 1 is the most important)' is given in Table 8, where also the figures for answers are given.

Access to EU/international funds is considered the main bottleneck for most marine biotechnology stakeholders. While domestic funding is considered one of the main bottlenecks by most stakeholders who have identified domestic funding as their main source of funding, successful private public partnerships and the availability of funding for infrastructure and tools are among other most identified bottlenecks by all marine biotechnology stakeholders, with access to venture capital identified as a bottleneck to RTDI funding mostly by SME's and technology transfer companies.

Table 8 Main bottlenecks for funding

Answer options	Access to domestic public funding	Access to EU or international funding	Availability of funding for infrastructure and tools	Access to venture capital	Access to charity foundation (NGOs) funding	Successful public-private partnership funding	Other (please specify below)	Response Count
Main bottleneck (priority 1)	23	24	14	11	1	11	4	88
Main bottleneck (priority 2)	6	25	16	9	0	24	3	83
	29	49	30	20	1	35	7	

When further analysing the answers given on bottlenecks to funding, the picture given in Table 9 emerges.

It is observed that for industries the main bottleneck is more access to the same type of funding that is already their main source, i.e. EU funding and venture capital. The picture is not as clear for public organisations, although access to public funding, being the main source of funding is also the main bottleneck. The availability of both funds for infrastructure and PPP funding is also an issue. This corresponds to an extent to the low availability of infrastructure as identified the tech-transfer chapter.

Table 9 Main bottlenecks as answered by public organisations and industry respectively

Bottlenecks	Public	Industry	**Total**
Access to domestic public funding	33	8	41
Access to EU / international funding	20	18	38
Access to venture capital	11	9	20
Availability for funding for infrastructure and tools	20	10	30
Succesful public-private partnership funding	24	11	35
Access to charity foundaion (NGOs) funding	0	1	1
Other	3	4	7
Total	111	61	172

A further analysis of bottlenecks when considering the different type of respondents is given in Table 10.

The numbers of answers are in many cases very low, so the analysis should be considered with caution. The grey marked areas are thus answers interpreted as being of importance to the respondent.

Table 10 Bottlenecks for funding indicated by different respondent types

Bottlenecks	Large industry	SMEs	Industry clusters	Industry networks	Consultants	Tech transfer agencies	EU & regional organisaions	National organisations	Funding/VC providers	Others
Access to domestic public funding										
Access to EU / international funding										
Access to venture capital										
Availability for funding for infrastructure										
Succesful PPP funding										

Main findings to bottlenecks for funding

The major bottlenecks reflect the same pattern as the major sources of funding, where domestic public funding is scoring highest, but several other reasons are also given high priority.

SUPPLEMENTARY OBSERVATIONS RELATED TO FUNDING

Venture capital is the main source for companies operating on a global level. They are mostly SMEs who would want more access to EU/international funding, venture capital, public private partnership options and funding of infrastructure (in that order).

Domestic public funding is the main source of funding for national organizations, which mostly operate on a global or national level. Most organizations are universities or national research institutes. The main identified bottlenecks include access to domestic or EU/international funds, followed by infrastructure funding. Public private partnerships and venture capital are perceived as bottlenecks but not to a big extent.

Organisations that are mostly funded through EU/international funds operate mostly globally, closely followed by those operating nationally, with a substantial amount operating in the EU as well. The majority are SMEs, followed by universities and research institutes. Among the obvious bottlenecks are EU/international, and also domestic funding, public private partnerships and infrastructure funding closely follow, with venture capital perceived less of a bottleneck.

Companies funded through share capital, private investments, industrial cooperation and other commercial contracts, either large companies or SME's mostly operate on the global level and see access to EU/international funding, public private partnerships and venture capital as the main bottlenecks.

Further analyses of open-ended answers on funding questions delivered from industry and non-industry respectively are given in Appendix 2, where issues raised and solutions proposed are given for the different funding sources.

CONCLUSIONS ON QUESTIONS TO FUNDING

The answers on funding sources and funding portfolio in the questionnaire presented a quite varied picture where the majority of marine biotechnology stakeholders pool resources to fund their RTDI from many different funding sources. Domestic public funding was otherwise the source that most stakeholders relied on. The bottlenecks for funding were similarly varied, but again access to public funding was registered as the main bottleneck.

INFRASTRUCTURES AND TOOLS

Infrastructures and tools could be interpreted as anything from vessels necessary for sampling material for bioprospecting and biodiscovery, but it could also be interpreted as specific tools needed for handling sampled material or processing equipment, including pilot plant facilities. As the toolbox has also been tremendously developed, and continues to develop, analytical equipment and advanced instrumentation at lab scale is also relevant to consider.

MAIN FINDINGS OF THE ERA-MBT QUESTIONNAIRE

The question asked was divided into three parts: ***Please provide your opinion on the quality of infrastructure and tools available for Marine Biotechnology at a) the academic level, b) the industrial level and c) at the level of public organisations***.

It was possible to give written comments on each part. The answers from each respondent should be considered together, but as some only gave comments to one or two out of the three, an impression is given below for each of the categories.

For each of the parts, respondents were asked to consider both *quality* and *availability*, each of which should be graded in the levels 'low', 'good' or 'excellent'. The respondents were further asked to elaborate on the levels given. Respondents' rating is given in tables below for each part.

Academic infrastructures and tools

Some of the respondents connected quality and availability such that due to lack of sufficient infrastructure (availability), the quality was considered 'low'. Further, there seemed to be agreement that infrastructure is scattered in Europe and there is a considerable lack of collaboration and cooperation in utilising existing infrastructure and tools. Funding was mentioned as a problem; particularly as high quality equipment is very expensive and takes a lot of skills to operate. It was a bit strange to observe that the question of availability was interpreted as industry's access to infrastructure at academic institutions. Not many respondents commented on the availability for academic researchers as such (Table 11).

The main impression was otherwise that there are many differences in different countries, however, the answers for each of the nationalities were too few to draw any specific conclusions.

Table 11 Quality and availability of academic infrastructures and tools

Answer options	low	good	excellent	Response Count
Quality of academic infrastructure and tools	19	57	16	**92**
Availability of academic infrastructure and tools	39	40	13	**92**
Please elaborate				**30**
			Answered question	**92**
			Skipped questions	**40**

Industrial infrastructures and tools

Several respondents repeated their statements for academic infrastructures as also applicable to industrial infrastructures. However, there seemed to be less knowledge about industrial infrastructures. The picture emerging was that some larger industries (not involved only with marine biotechnology) are in possession of very good infrastructures, whereas SMEs have to collaborate with academic institutions to get access to infrastructures, i.e. they do not have them in their own possession. One respondent stated that 'industries/SMEs are specialised in doing the screening but these facilities are not always available for academia'. That must be interpreted as another lack of good collaboration and open-ness between academia and industry (Table 12).

Again the picture is that the situation varies a lot in different European countries. Some states that they 'don't know companies related with marine biotechnology'. Two statements are somewhat contradictory, one saying 'there are numerous companies with marine biotechnology interests in Europe', while the other says 'there are very few companies with expertise in marine biotechnology, most are at early stage in development'. So the interest may be there, but expertise is lacking.

Table 12. Quality and availability of industrial infrastructures and tools

Answer options	low	good	excellent	Response Count
Quality of industrial infrastructure and tools	32	50	8	**90**
Availability of industrial infrastructure and tools	53	34	3	**90**
Please elaborate				**27**
			Answered question	**90**
			Skipped questions	**42**

Public organisations infrastructures and tools

While quality and access are rated low, it seems that many respondents actually do not really understand what is meant by 'public organisations', which is also expressed explicitly by two respondents. One says that 'most of the infrastructure is quite new', while another says: 'I hope that EMBRC Research Infrastructure will help to solve the problem', indicating there is a problem (Table 13).

Table 13 Quality and availability of public organisations infrastructure and tools

Answer options	low	good	excellent	Response Count
Quality of public organisation infrastructures and tools **Availability** of public organisation infrastructure and tools	44 49	39 34	7 6	**90** **89**
Please elaborate				**27**
			Answered question Skipped questions	**90** **42**

A graphical overview of the results given in the tables are illustrated in Figure 3, which gives the overall impression that the quality is rather a bit higher than availability for all three categories of infrastructure and tools.

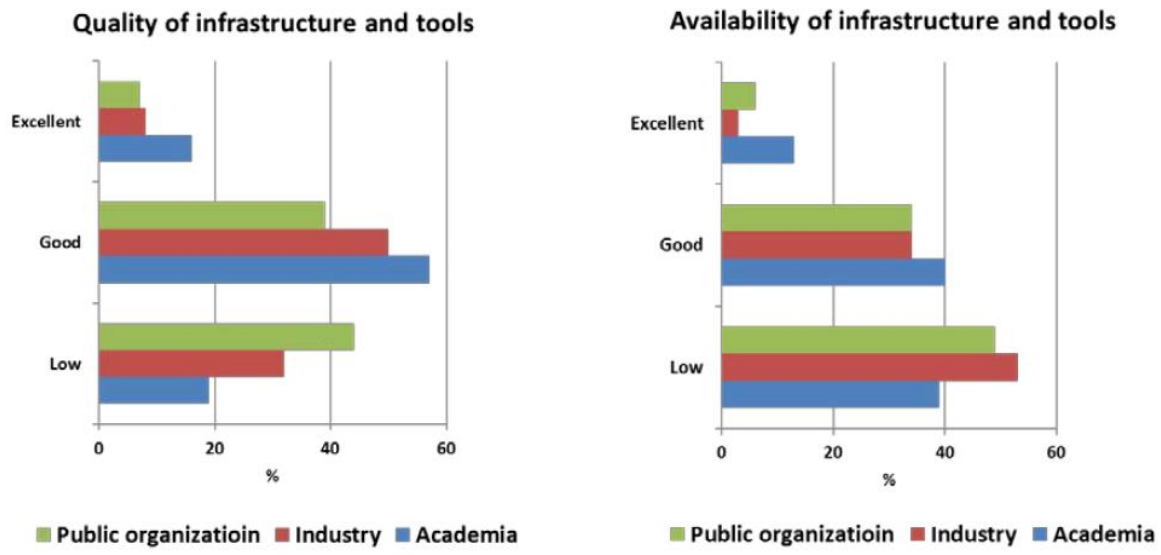

Figure 3. A graphical overview of results for quality and availability of infrastructure and tools

CONCLUSIONS TO INFRASTRUCTURES AND TOOLS

Overall it is estimated that modern infrastructures and tools are essential for the successful development of marine biotechnology, but it is realised that good equipment is very expensive and difficult to get funding for. The quality of existing infrastructure is in general estimated as good, but there is a need for continuous updating if level of research and innovation is to be continued at the present level. Availability is fairly good, but due to lack of collaboration between academia and industry, the two sides are not utilising existing infrastructure and tools optimally. It is also considered that infrastructures are scattered in Europe.

APPENDICES

APPENDIX 1: OUTLINE OF THE QUESTIONNAIRE

General

1. **Please identify the country where your headquarters are based**
   Dropdown list of all countries
2. **Please identify the country/countries in which your organisation operates. If multi-national within Europe, choose „Europe“, if global choose „International“**
   Dropdown Europe, International
3. **Please identify your category/categories** (tick boxes; multiple answers allowed)
   - Larger industrial company (international)
   - SME
   - Industry cluster
   - Industry association
   - Industry network
   - Consultant
   - Technology Transfer organisation
   - Regional organisation
   - European organisation
   - National organisation
   - Funding agency/venture capital provider
4. **If you are representing a company please answer the following, otherwise go to question 5.**
   a. **What is the main marine biotechnology[1] activity of your company?** (tick box, multiple answers allowed)
      - We use raw material from marine biomass
      - We use marine related bio-information for development of products/services
      - We develop product/services for use in marine bio-environment
      - We do not have any marine biotech activity (if ticked then go straight to Q5)
   b. **What type of marine biomass does you company use for R&D or for production?** (tick box, multiple answers allowed)
      - Fish

[1] *Marine biotechnology companies apply biological knowledge and relevant technology to generate knowledge, goods or services either a) by using marine biomass as source material or b) by using non-marine material for use in marine biotic environment (e.g. bioremediation, biosensors….). Add web ref if available.*

- Molluscs
- Microalgae
- Macroalgae
- Bacteria
- Other, explain *Textbox*
- The company does not use raw material from marine source

c. **What is the main target market for your marine related products?** (tick box, multiple answers allowed)

- Food
- Energy
- Materials
- Cosmeceuticals (e.g. skincare)
- Health (e.g. food supplements)
- Pharmaceuticals
- Environment and monitoring (e.g. biosensors, anti-fouling technology, bioremediation....)
- Production of commodities or services other than above, explain

Textbox

Technical Transfer Practise and Policy

5. **What do you consider the <u>main</u> technical transfer problem(s) in marine biotechnology (please only choose 3 issues from the list below in order of importance, where 1 is the most important) (Three dropdown lists):**

3x,

i.e. after each tick the textbox appears

- Insufficient co-operation between academia and industry
- Level of public funding to bridge the gap between academia and industry
- Lack of national policy and strategy for tech transfer and start-up companies
- Lack of incentives for public-private collaboration and problems associated with such partnerships
- IPR issues – Benefit sharing
- Limited access to resource material for R&D and pilot studies
- Other

Please elaborate.... *Textbox*

Suggested solutions or comments:

Textbox

6. **Are there specific technical IPR/IPP issues for marine biotechnology? (Text box text length is max 2000 characters)**

Textbox

7. **Infrastructure and tools**

Please provide your opinion on the quality of infrastructure and tools available for Marine Biotechnology at the different levels listed below:

- Quality of academic infrastructure and tools (dropdown - low, good, excellent)
- Availability of academic infrastructure and tools (dropdown - low, good, excellent)

  Please elaborate

  Textbox
- Quality of industry infrastructure and tools (dropdown - low, good, excellent)
- Availability of industry infrastructure and tools (dropdown - low, good, excellent)

  Please elaborate

  Textbox
- Quality of public organisation infrastructure and tools (dropdown - low, good, excellent)
- Availability of public organisation infrastructure and tools (dropdown - low, good, excellent)

  Please elaborate

  Textbox

Funding schemes and Marine biotechnology specific funding issues

8. Sources of funding.

- What is your main source of funding? (dropdown with following options, choose one and choose also share of funding 0-25%, 26-50%, 51-75%, 76-100%))
    - domestic public funding
    - EU or international funding
    - venture capital
    - other

  Please elaborate.... *Textbox*

- Are there additional sources of funding? (choose one from dropdown list)
    - domestic public funding
    - EU or international funding
    - venture capital
    - Charity foundations (NGOs)
    - other

  Please elaborate.... *Textbox*

9. What do you consider the <u>main</u> bottleneck for funding of marine biotechnology R&D (please only choose 1 or 2 issues) (Dropdown list):

2x,

i.e. after each tick the textbox appears

- Access to domestic public funding
- Access to EU or international funding
- Availability of funding for infrastructure and tools
- Access to venture capital
- Access to charity foundation (NGOs) funding
- Successful public-private partnerships
- Other

Please elaborate.... *Textbox*

Suggested solutions or comments:

Textbox

APPENDIX 2: FURTHER ANSWERS TO FUNDING QUESTIONS

ANALYSIS OF OPEN-ENDED ANSWERS: additional issues raised and proposed solutions

INDUSTRY

1. Domestic public funding

Issues

- Cofounding rates for SMEs are too high and a lot of warranties are needed to receive pre-financing
- Blue biotechnology is not on the radar of national research policies
- Lack of market-input in much of the research
- The prospect of small seafood SMEs being able to exploit opportunities for e.g. nutraceutical products, is low

Solutions

- Opportunity for domestic funding to guide research community towards relevant larger end-users capable of exploiting outputs

2. EU / international funding

Issues:

- National legislation hinders the effective use of funds, slowing down and limiting access and the use of EU funds (due to a huge administration apparatus, many times a grant is not even used in its totality)
- EU / international funding: SME's are at the short end of EU/international funding as they do not have employees who are dedicated to facilitating complex procedures (lack of experience and competence to handle highly complex calls)
- Need for a progression from basic research to pilot-scale phase
- EU is funding marine biotechnology but commercialization is not, in practice, a priority
- In general not enough funding is directed towards technology transfer in marine biotechnology
- Lack of market-input in much of the research internationally (E.g. WEFTA-Bio marine research)
- EU funding is very competitive and most SMEs, small start-ups and spin offs with potentially interesting products and services cannot reach such programs due to lack of experience, lack of competencies or complexity of calls.

Solutions:

- Greater funding programs for technology transfer are needed to produce more significant impact
- More technology transfer funding programs in marine biotechnology are necessary to direct funding towards industrial/academic research cooperation
- More calls for pilot and testing stages, including innovation experimental testing, should be made available

3. Public private partnerships

Issues

- SME's do not have human/financial resources to dedicate to public private partnerships

- Difficulties in sharing academic knowledge with industry hinders successful public private partnerships
- There is little mutual trust between sectors due to scarcity of funds, high bureaucratic burdens and poor innovation mentality from industry (on a national level)
- There is a need to identify relevant research for public private partnerships
- Public private partnerships need local incentives, which there is a lack of
- The focus of researchers on basic research still prevails as does their unwillingness to share their knowledge with the industry
- the market/business case for 3-4 year projects is sometimes weak

Solutions

- Making a market business case for shorter duration projects through linking larger players with smaller (directing funding to guide the research community towards relevant larger end-users capable of exploiting results)
- Research should not necessarily be dictated by industry but should link closely with industrial partners to ensure outputs can create employment and financial return at some stage
- Need for strengthened data on potential returns to further attract industry and keep them interested during 3-4 year projects
- Administrative documents needed to obtain funding need to be reduced
- Companies should have increased control over practical results, especially in projects related to the market
- Co-funding between EU and private industry is a viable option, but IPR should go to industrial partners only.

4. Infrastructure

Solutions:

- Creation of regional centers with “open-source” infrastructure and tools required by early stage spin-out companies
- In addition to open-source, instruments to help companies, especially SMEs to mitigate risk when equipping themselves to launch new products and/or services

5. Venture capital – how to incentivize venture capital investment in the field?

Issues:

- Venture capital is more and more directed towards easy making deals, such as IT and similar industries in detriment of more complex and risky fields such as biotechnology.
- Venture capitalists shine away from complex and risky businesses like biotechnology in general, but marine biotechnology poses additional problems (infancy and only a few examples of success available, most companies are still at the proof of concept stage that requires further validation before venture capitalists become interested, problem of the search for a miracle compound venture capital wants to find)
- If venture capital does invest the demand in time of IR and levels of risk-taking are inappropriate for biotechnology development.

Solutions:

- Biotechnology as a high risk domain needs support to cover the accompanied extra risk by public funding to stimulate venture capitals to step in
- Creation of a marine biotechnology venture capital fund, creation of government co-investment funds, creation of marine biotechnology incubators with investment funds and business support.
- Specific marine biotechnology instrument similar to the SME instrument: pooling international venture capitals with prior investment in marine biotechnology or in sectors that can benefit from technologies derived from MB activities to participate in coaching, providing a strategy plan and means to move forward and more easily attract investment.
- Further programs that could bridge the gap between R&D funding/seed capital and venture capital investments, where the later ones can participate at a reduced level risk or in a matching funding scheme, might incentive more venture capital investment in this field.

6. Additional bottlenecks

Issues:

- A lack of a suitable platform to meet similar research groups
- Lack of political awareness – how to increase it?

Solutions:

- ERA-MBT could pull together relevant experts, synergizing them with the industry in forming relevant research proposals.
- Organization of a standalone International conference showcasing research projects and relevant outputs in targeting the (e.g. seafood) industry and (e.g. ingredients, nutraceutical) experts (the conference could also be linked to another relevant annual conference
- Setting up a business development facility to communicate outputs and IP to a global audience
- Research groups in SMEs need to link with larger seafood companies in conjunction with e.g. ingredients players to fully exploit potential through e.g. industry workshops (pre, during, post research) to discuss research aims and potential outputs and create new opportunities to link seafood operators with e.g. nutraceutical/ingredients representatives.

NON-INDUSTRY

1. Domestic funding

Issues:

- In some countries, no national funding programs with the aim to foster marine biotechnology exist (e.g. Italy) or the availability of such funds is limited (e.g. UK, where despite this, research performs well)
- In other countries funding for science is generally decreasing and funding for projects on marine biotechnology (as in other areas) is attributed based on the evaluation of proposals following criteria that is not always clear. National funding programs of the BMBF in Germany could help initiate more innovation in this promising applied research field. Even if excellent infrastructure of academic research institutes working in the field of marine (micro)biology exist, outstanding fundamental research expertise is insufficiently linked to applied research activities.

- With the overall reduction in public funding, long-term projects, which is what marine biotechnology is, are put aside in favor of rapid results rather than fundamental studies (i.e. in the US, where long-term funding system analogous to the EU 5 year plus plans needs to be established).

Solutions:

- National financial support of university groups (and SMEs), which specifically focus on biotechnological applications, would facilitate their collaboration with research groups from Max-Planck-, Helmholtz- or Leibnitz-Institutes and could help support more innovation in marine biotechnology in Germany.
- In addition to general funding for projects in all scientific areas, additional funding should be directed to some key areas, such as marine topics, which are claimed by politicians as being among the top priorities in the country (i.e. Portugal).

2. EU/international funding

Issues:

- Funding overburdened with administration and bureaucracy, making applications very difficult and sometimes uninteresting.
- Too many guidelines and rules to read in order to apply for EU/international funding
- Depending on your country or residence and your institute too much bureaucracy to handle as a researcher
- In some fields (e.g. field of chemicals for bioplastics) it is not easy to access funds for marine biotechnology research (i.e. most of EU funds is directed to research related to biochemicals or pharmaceuticals, underestimating the importance of the marine factory as a valuable alternative to the use of crops for the production of bioplastics).
- In general EU projects are hard to gain, even if nationally relevant research exist (e.g. in France and Spain)
- The EU system with large multipartner consortia makes this funding source less attractive when pursuing good ideas.
- EU projects have a higher probability percentage of being funded and thus should have a greater focus in academia. However, these projects are very time-consuming with all the administrative work and reports. In addition, the way of running these projects give less freedom to pursue scientific data as the project is running.

Solutions:

- The whole procedure needs streamlining and a return to scientific needs, also with regard to biotechnology.
- A better consideration in the calls to the underfunded issues would be very beneficial for the advancement of interest of companies in those areas (i.e. specific calls on marine biotechnology applied to plastic production or chemical for plastics would be a good solution. It is questionable that EU has supported with a huge amount of money the research on artificial brain, which has caused a big protest in the scientific community, and has not enforced the area of not-oil production of chemicals).
- EU and international funding may be an incentive to focus research on marine biotech, indirectly targeting bottom up R&D programs towards marine biotech - once a project is written

and people are working on it, it will also be taken further in the national applications for bottom up funding.

3. Public private partnerships

Issues:

- There is little industry for marine biotechnology, most are SMEs who don't have money for external R&D
- National differences in industrial funding input exist (e.g. UK: Industry, unlike the USA and Germany, spends only a small proportion of its profits in research, and developing and exploiting links in the marine area is far less well developed (in the UK) than elsewhere due to culture and lack of government incentive).
- Very often the SMEs declare that the project proposal is very promising, but it is too early for them to join the project(s).
- Public private partnerships could be helpful for sustaining partnerships and long term development, however, the skills and frames for establishing them are not widely distributed;
- Cooperation between public and private institutions is still young. There are very few successful examples and many projects correspond to a sum of contributions (when all entities contribute even contribute...) and not to true team work.

Solutions:

- Finding the right collaborator as early in the process (project) as possible and thus being able to have a better chance to be financed than if applying with real basic science projects that have a much lower impact of being funded
- Need for training and support in establishing private public partnerships.
- Additional focus and funding has to be directed towards the limited company-university research interaction
- More efforts should be put on projects betting on the cooperation between companies and research centers regarding applied research and technological development.

4. Infrastructure

Issues:

- gap in developing comprehensive platforms and specific marine tools.
- need of more funding to deliver state-of-the-art infrastructure to make real progress in the area
- There is a lack of funding schemes for larger instrumentation/facilities at all levels.
- Sometimes biotechnology is not identified as the main research priority of the institution or people working on biotechnology focus only on their area of expertise and don’t have a common goal as an institute

Solutions:

- Funding infrastructure through seed money with supported development of a sustaining structure (e.g. project developer, business developer)
- Successful research outside marine biotechnology could be transferred to marine biotechnology, if access to already existing infrastructure of marine institutes is made available.

- Structural funds should be considered for funding
- Generating information on the availability of relevant tools

Venture capital

Issues:

- does not fund early stage research
- not easily accessible to academia, this leading to high dependence on public funding marine biotechnology is not in the focus of venture capitalists