ShareBiotech

Sharing life science infrastructures and skills
to benefit the Atlantic Area biotechnology sector

STRATEGIC RECOMMENDATIONS AND ACTION PLAN

TO REDUCE THE GAP BETWEEN LIFE SCIENCES AND TECHNOLOGY SUPPLY AND DEMAND

ATLANTIC AREA Transnational Programme
ESPACIO ATLÁNTICO Programa Transnacional
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European Union
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INNOVATION NETWORKS
REDES DE INNOVACIÓN
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INVESTING IN OUR COMMON FUTURE

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TECHNICAL DATA

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Activity coordinated by
CRIA, Regional Centre for the Innovation of the Algarve, Division of Entrepreneurship and Technology Transfer, University of the Algarve, Portugal.

Workshops organizers:

Bioinformatics and data analysis: the big issue? Concrete answers for concrete needs!:
Conceição Egas (Biocant, Portugal)

Access to Biological Resource Centres:
Anne-Claude Lefebvre and Jocelyne Le Seyec (CRITT Santé Bretagne, France)

Technology Facilities in Life Sciences: Towards Transnational Networks:
Paul Tomkins and Vincent Walsh (Athlone Institute of Technology, Ireland)

Bio-economy and regional development: what policies and actions should be implemented to overcome the innovation paradox?
Hugo Pinto (University of the Algarve, Portugal) and Karyn Morrissey (National University of Ireland, Galway, Ireland)

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SECTION 1: CONTEXT FOR STRATEGIC REPORT AND ACTION PLAN

ShareBiotech – *Sharing life science infrastructures and skills to benefit the Atlantic area biotechnology sector* is an INTERREG IV B Atlantic Area project that aims to promote transnational networks of innovation and entrepreneurship focusing on the development of knowledge transfer between research centres and firms. The project seeks specifically to strengthen the contribution of biotechnology in European regional economies through the establishment of a network of scientific infrastructures and competencies that may be available for the consolidation of research, development and innovation from public and private actors.

In the context of ShareBiotech Activity 3 "Action plan to reduce the gap between life science technology supply and demand" the relevance of elaborating two documents to facilitate the second phase of the implementation of the project was defined:

- A **Strategic Report**; this document is based on the lessons learnt from Activity 3 that can be shared with external Biotechnology stakeholders, especially policy-makers.
- An **Action Plan**; this suggests guidelines for ShareBiotech's ongoing activities, dedicated to project partners and internal stakeholders.

It was decided to collate these two documents in a single report as (1) concrete actions (action plan) and (2) strategic solutions were both inspired by the findings of the "Biotechnology Competencies and Techniques Regional Needs Study[1]" and the vision of relevant stakeholders. In order to obtain the opinions of stakeholders, the First ShareBiotech Transnational Event "Facilities to Speed Up R&D and Innovation"

[1] Based on a survey conducted at the end of 2010 by the ShareBiotech consortium to more than 300 research groups and companies

held in Cantanhede, Portugal, on 12th April, 2011, included an afternoon session for parallel workshops intended to collect information about relevant topics.

The ShareBiotech consortium, based in the results of the above mentioned study, defined as crucial two discussion dimensions that resulted in four different thematic workshops:

Technologies for tomorrow: it was decided to focus on specific technological demands that rose from the interviews conducted among research groups and companies for the purpose of the study. The ShareBiotech consortium decided to tackle "bioinformatics and data analysis" and "access to Biological resources centers (BRC's)", which were among the most needed resources to support R&D activities.

Structuring for the future: it appeared that both the regional and the transnational dimensions were the relevant scales to progress towards achieving the objectives of ShareBiotech as an INTERREG project. Therefore, two workshops were held: "Technology facilities in Life Sciences: Towards Transnational networks" and "Bio-economy and regional development: what policies and actions to overcome the innovation paradox?"

The four workshops are presented hereafter.

TECHNOLOGIES FOR TOMORROW

1. Bioinformatics and data analysis: the big issue? Concrete answers for concrete needs!

The workshop aimed at establishing synergies between supply and demand in bioinformatics and data analysis for life sciences R&D performers, to develop networks and stimulate technology transfer. For this purpose an informal discussion was lead by a field expert, based in the concrete needs of companies and research groups pointed out in the 2010 ShareBiotech survey. Questions such as the following were addressed: where can companies and research groups find available resources and facilities for data analysis and biostatistics? How to get guidance to find the right tool? Are bioinformatics resources sufficient and accessible? How to improve the situation? The discussion group imagined concrete actions to be held in the near future to facilitate access to bioinformatics solutions.

2. Access to Biological Resource Centers

Biological Resource Centers (BRCs) are considered to be key elements for sustainable international scientific infrastructures, which are necessary to underpin successful delivery of the benefits of biotechnology, whether within the health sector, the industrial sector or others. From the Organization for Economic Co-operation and Development (OECD) definition: "Biological Resource Centers are an essential part of the infrastructure underpinning biotechnology. They consist of service providers and repositories of living cells, organism genomes, and information relating to heredity and the functions of biological systems. BRCs contain collections of culturable organisms (e.g. micro-organisms, plant, animal and human cells), replicable parts of these

(e.g. genomes, plasmids, viruses, cDNAs), viable but not yet culturable organisms, cells and tissues, as well as databases containing molecular, physiological and structural information relevant to these collections and related bioinformatics."

BRCs must meet the high standards of quality and expertise demanded by the international community of scientists and industry for the delivery of biological information and materials. They must provide access to biological resources on which R&D in the life sciences and the advancement of biotechnology depends. During the workshop, experts, users and technology transfer organizations debated the visibility and accessibility of these biological collections, and proposed solutions to improve the current situation.

STRUCTURING FOR THE FUTURE

3. Technology Facilities in Life Sciences: Towards Transnational Networks

The overall objective of the workshop was to analyze the scale of relationship between the provision of advanced technologies and biotechnology sector development and prospective new models, by which transnational collaboration can synergize and enhance regional bioeconomy development. The workshop intended to evaluate the current impact of selected technology facilities on biotechnology research development and exploitation and determine the most valid adoptable cluster and network models that will enhance technology access, communication and relevant knowledge transfer.

4. Bio-economy and regional development: what policies and actions to overcome the innovation paradox?

The problems that affected European research and prevent it from reaching the market in the form of valuable innovations were debated paying particular attention to knowledge transfer mechanisms from research groups to companies. The goal of the workshop was to discuss the potential of bio-economies for the Atlantic regions. The workshop was oriented towards the definition of specific actions that needed stimulation by different governance levels to overcome the innovation paradox, the difficulty for Europe in linking successful high level scientific knowledge to new products and processes creation when compared with other important players like the US or Japan. Emergent fields and required policies for regional potential in Biotechnology were identified.

The seminars were oriented by the experts towards the identification of problems, strategic action and practical solutions.

Section 2: REPORT OF THE "BIOINFORMATICS AND DATA ANALYSIS" WORKSHOP

This workshop aimed at establishing synergies between supply and demand in bioinformatics and data analysis for life sciences within the Atlantic Area, to develop networks and stimulate technology transfer. Initially, a survey was made in order to assess the needs of research groups and companies, where several gaps were identified. Biostatistics, data storage/computing power, processing of biological data and bioinformatics training emerged as the most cited.

To discuss these topics five expert leaders were invited; four from Portugal and one from France. Each expert presented their work relating to one of the areas identified as gaps. At the end of the presentations there was a general discussion where the following problems were addressed:

- Hardware

  Data Storage/Computing Power
- Human Resources

  Training (Bioinformatics and Biostatistics)
- Catalogue of technological core facilities (TCF's)

  Where can companies and research groups find available TCF´s (technological core facilities) for data analysis and biostatistics?
- Generic software and applications for specific problems

In the discussion between invited specialists and members of the audience the following solutions/pathways to overcome the gaps were pointed out:

- It is necessary to establish the level of bioinformatics support that is required by the companies/research groups. There are different levels of requirements from simple informatics processing to complex data analysis, and for most of the simpler processes there is already open access or commercial solutions available.
- Bioinformatics has become a relevant area in the current years and both companies and research groups should be counseled to predict funds for software, hardware and human resources in their budgets.
- Organization of multidisciplinary teams able to respond to different request fields (it is difficult to find expertise both in bioinformatics and statistics in the same person).
- Inclusion of available bioinformatics resources in catalogues indicating location and fields of specialization.
- Promotion of training sessions in different bioinformatics/informatics fields.
- Promotion of networks of bioinformatics at regional and international level.

Notes on experts having participated in the workshop:

Carlos Fiolhais, University of Coimbra:

Carlos Fiolhais is the director of the Center for Computational Physics of the Coimbra University where he accomplished the installation of the largest supercomputer in Portugal. This supercomputer can be used by research groups in different fields.

João Paulo Cunha, University of Aveiro:

Director of a national network for processing of NMR images at the research level, integrating multimedia data generated in biology and medical applications.

José Leal, Calouste Gulbenkian Institute:

Is the leader of a research group holding an informatics cluster that is available for research groups and also development of software applications which are used for data analysis in plants.

José Luis Oliveira, University of Aveiro:

Is the Director of a research group involved in software development with user-friendly interfaces at national and European levels.

Olivier Collin, Biogenouest Bioinformatics Facility:

Is the Manager of the GenOuest Bioinformatics platform, working in the utilization of software in sequence analysis, phylogeny and metadata in Biology.

Moderator: Miguel Monsanto, Biocant

Section 3: REPORT OF THE "ACCESS TO BIOLOGICAL RESOURCE CENTRES" WORKSHOP

Biological resource Centers (BRCs) retain collections of biological material and associated information to facilitate access to *ex situ* biological resources and to ensure that they remain available for sustainable use. They are entities compliant with appropriate national law, regulations, and policies and have been constituted to fulfill many crucial roles, which include:

- Preservation and supply of biological resources for scientific, industrial, agricultural, environmental and medical R&D and biotechnological processes (e.g. extract bioactive components from those resources)
- Performance of R&D on these biological resources
- Conservation of biodiversity
- Repositories of biological resources for protection of intellectual property
- Resources for public information and policy formulation.

Biological Resource Centers are key elements in the health sector, industrial sector, etc.

During the workshop in Cantanhede on the 12th of April, three different examples of BRCs were presented. First, Jocelyne Le Seyec (CRITT Santé Bretagne – France) showed the organization of human BRCs in France, with a focus on the human biological resource centre in Rennes. Then, Ian Probert (Station Biologique de Roscoff – France) presented the European Marine Biological Resource Centre (EMBRC). Finally, Yohan Lecuona (INRA – France) talked about EMbaRC, a European consortium of microbiological resources centers and Celia Quintas (University of Algarve – Portugal) gave her experience as a BRC user.

The ShareBiotech survey pointed out needs and problems expressed both by biotech companies and academic research laboratories. As examples:

- A company developing new microbiological diagnostic equipment needed access to pathogenic microorganisms to test their equipment.
- Contract research Organizations (CROs) need wider access to human tissues or organs, or to tumor library (biopsies) to develop new models for *in vitro* tests.
- A specialized company used its own potato collection and other public collections (from INRA, French National Institute for Agricultural Research) to create new varieties. But there is a problem of alteration of some of these collections and it seems that INRA finds it difficult to manage BRCs because they are very expensive.
- A human biotech company looking for specific human cells (hepatocytes) to test their innovative products but were unaware that there was an appropriate human BRC next to them.
- A biotech company would like to develop a partnership with a BRC to get better access to « banks of tissues » to develop research on specific biomarkers.
- A biotech company pointed out the difficulty of getting access to tumor banks (confidentiality, very long delay to get an answer, etc.).
- Some companies such as CROs get some human samples (blood samples…) from clinical studies and are open for their use through R&D projects. Unfortunately, they don't have enough places and the right organization to store them properly.
- Companies and research laboratories pointed out that they have sample storage problems.

It appears that one of the main problems is the accessibility of the biological collections for companies.

The major problems identified by the ShareBiotech were:

1. BRCs exist but biotech companies or public researchers don't always know or use them. There is clearly a lack of visibility.
2. Problems of confidentiality and of intellectual property (mainly when companies want to get access to public BRCs).
3. Problems of sustainability of funding for BRCs with very high costs if they want to keep the collections on a long term basis, to maintain their expertise and to get a quality certification.

The different solutions that could be considered are:

1. For the lack of visibility; a one stop-shop to get access to the different collections could be implemented. For example, a single catalog on a web site. BRC expertise and services need to be easily accessible. This could be addressed during the lifetime of ShareBiotech.
2. The problem of confidentiality is more difficult to answer. BRCs look for too much information when companies/research centers need to access bio-samples. One solution could be the implementation of quality management in all BRCs taking into account the confidentiality problem.
3. For the problem of sustainability for the funds for BRCs, ShareBiotech could think about new models for BRCs. As an example, some partnership between BRC and company could be forged, as it is the case for the human BRC in Rennes – France, where a biotech company is preparing liver cells for the research community that needs them for their research and is selling the rest for its own business.

SECTION 4: REPORT OF THE "TECHNOLOGY FACILITIES IN LIFE SCIENCES: TOWARDS TRANSNATIONAL NETWORKS" WORKSHOP

The workshop was structured with four initial short presentations, covering overview/issues and specific models adopted in Munich (Stephanie Wehnelt) , Stockholm (Teresa Soop) and Cambridge (Derek Jones), followed by an interactive discussion.

Experts: Stephanie Wehnelt (Bio^{M}, Munich), Teresa Soop (SSC, Stockholm), Derek Jones (BBT, Babraham), Sean Daly (CeBec Group Ltd), James Walsh (EI), Patricia McAlernon (Bioimages Ltd), Denis Looby (DTL Biotechnology Ltd)

The following topics were discussed:

The workshop opened with a short presentation by Paul Tomkins outlining, (1) the nature of Technical Core Facilities and their existence within stand alone organisations and designated clusters, (2) company scale and their facilities access, (3) collaboration models, (4) promotion of technologies. The debate addressed access 'models', transnational options and future strategies.

Due to the current financial situation, the level of investment in Biotech companies has generally reduced, jobs have been shed and it is now accepted that it takes a long time for Return on Investment (ROI) in new biotechnology companies. The EU still hosts more biotech SMEs than the US, but the difference relates to traditional faster, stronger growth in the States. An impacting factor is potentially, the capital costs of necessary laboratory technologies and the provision of cheaper, fast access models. The need for relationship collaboration, the speed of technology turnover and facilitated access to new technologies was highlighted. What impact do TCFs have on

biotech research and commercialisation and how can this impact be measured? One suggestion was that this could be gauged by the amount of new customers and cash generated. The need for transnational access to TCFs and how this could be facilitated was addressed.

It is accepted that ShareBiotech is not restricted to analysing TCF implementation in formal clusters, a positive individual outcome can arise from engagement between a single company and a Higher Education Institute (HEI) or between two HEIs, but clusters do inevitably represent formal structured thinking and implemented models regarding provision of facilities and stimulation of sector development.

Valid Adoptable Clusters and Network Models that will Enhance Technology Access, Communications and Technology Transfer:

1. BioM Biotech Cluster in Munich, presented by Stephanie Wehnelt

In the last few years the Munich Biotech Cluster has experienced an exceptional rate of development. With a total of about 350 Life Science companies, Munich is home to one of the top biotechnology centers in Europe. Of particular importance in the ongoing development of commercial biotechnology is the proximity of excellent scientific research institutes, bioincubators, good infrastructure, capital investment, role-models in the form of firms that have already attained success, as well as highly qualified employees. BioM is a service and consulting company whose aim is to promote the development of the Munich Biotech Cluster as an internationally recognised centre of excellence in the field of novel biotechnology. It is the first point of contact for biotech start-up companies seeking financial support or business advice. Through the BioM network which includes all important players in the region (representatives from public offices, scientific institutions, venture capitalists and biotech companies), BioM assists Munich-based companies in finding the right contacts and partners. Part of an additional service offered by BioM is the organization of seminars and workshops on a broad range of topics relevant to the successful development of a biotech company. The young firms are also offered the possibility of participating in larger exhibitions, partnering conferences and other events.

Key factors associated with BioM**:**

- Organising clinicians to work with researchers
- Availability of expert knowledge (patient information)
- Access to BioBanks
- Personal medicine research needed on-site clinical studies
- Development of Biomedical innovations
- A common goal between researchers and clinicians
- Added value
- Shared financial benefit
- The project must deliver results for clinicians
- Amalgamation of Biobanks to provide optimal, organised access to cells/tissues
- Standardisation of Bio-sample collection between Biobanks
- Centralisation of clinical trials
- Appointment of scouts to seek out new talented researchers
- Peer mentorship of young researchers

- Mentoring award to reward teams work

2. Stockholm Science City (SSC), presented by Teresa Soop

The aim of Stockholm Science City Foundation is to attract academia and business within life science to Stockholm Life Solna-Stockholm. Stockholm Science City Foundation is commissioned by the three universities Karolinska Institutet, KTH Royal Institute of Technology and Stockholm University, the two cities Stockholm and Solna as well as the county and the business sector. As a result, the Stockholm-Uppsala region is considered one of the leading regions in Europe within research and education in life science

Key factors associated with SSC:

- Awareness of technology availibility both in-house and externally
- Streamlining of drug development
- The need for an open facility and provision of easy access
- Provision of a platform - newsletters, networking events and a series of seminars to connect SMEs to facilities
- Openess and willingness to work with SMEs
- Openess to collaboration and welcoming of new customers
- A desire to respond to industrial needs
- A common language, usually English to embrace recognition of corporate needs and timelines

3. Babraham Cluster Cambridge England, presented by Derek Jones

Babraham Bioscience Technologies Ltd (BBT) is the commercial arm of the internationally-regarded **Babraham Institute**, a biomedical research organisation renowned for its work in cellular signaling, immunology, neuroscience and epigenetics. BBT undertakes the **Knowledge Exchange and Commercialisation (KEC)** remit and business development function for the Institute, developing the infrastructure of the campus to support start-up bioventures. BBT brings together the Babraham Institute's research and facilities with industry in a geographical location at the core of the Cambridge cluster. The campus is close to the University of Cambridge and research centres such as the MRC Laboratory of Molecular Biology (LMB), the Wellcome Trust Sanger Institute, and Cancer Research UK. The Cambridge Cluster has a long history and large scale of underlying research and resultant company development and growth.

Key factors associated with BBT Babraham Cluster:

- Belief that a core facility is only sustainable within a cluster environment
- Strong reputation of biotechnology research success (the UK does 6% of the Worlds science with 1% of the Worlds population - however these figures are changing with the growth in China, India etc.)
- Babraham hosts 70 PhDs, 300 scientists and Cambridge has a recent history of 14 Nobel Prize Winners
- Getting people to work together and overcome barriers
- A long history of company generation and attraction to the region
- A belief that 'sharing what you have is more important than commercialisation' per se, because it will facilitate commercialisation
- An on site facility costing £23M that provides access to 50,000 laboratory mice
- A belief that use of technology must have a realistic and affordable change
- Government funding (Babraham received a £46M grant in early 2011 because it is perceived as a very successful and low risk research venue for investment purposes)

- Academic versus commercial metrics must be balanced - pressure to generate traditional academic papers from research may obviously have a negative influence on exploitation and cluster development
- 'Build it right versus building the right thing', is important
- Wet leasable lab space for start-ups and full bio-incubator facilities with access to a specialist centre dedicated to the provision of selected core facilities and test competence
- Research competence provided within the universities and other companies/ institutions within the cluster
- Proximity to universities and the availibility of new blood, openess to international collaborations to learn new ways of doing things
- Understanding the simple needs of start-ups e.g. glass-ware provision, basic bench work and test facilities may be as important as advanced technology

Overall Workshop Outcomes

Identification of Problems & Indicative Solutions:

- How can able, low cost core facilities be made available to technology companies, other researchers and allied collaborations?
- Is a transnational TCF model applicable and a cost-effective adjunct to introduce
- How does one generate a transnational network of TCFs and how can we ensure it is useful to companies, i.e how do we get an SME in Ireland to access a valuable TCF in France? ShareBiotech aims to set up a transnational network of TCFs, a web-book with a library of these TCFs, and the appointment of Regional Technology Translators should play an important role in addressing this problem.
- Do SMEs know how to verbalise their needs? This highlights the necessity of appointing Technology Translators which ShareBiotech can address in it's lifetime.
- The privacy issues relating to BRCs was an issue.

Further Possible Solutions:

- It is difficult to obviate the provision of accessible core facilities other than by public sector institutions and selected large companies embracing a degree of inherent subsidy.
- A key centre needs to appoint people with a businesss background to successfully run a cluster in partnership with necessary science and innovation expertise
- A buisness partner can manage investment and company operation – the recent concept of 'Cluster Manager' is considered valid.
- Mapping of TCFs and their dissemination and promotion could be handled via establishment of a complex web portal, but it's impact will demand a far deeper interface and entity – hard to detach from access to the right people
- There should be complementarity between research programs
- People issues; managers and interfacers are crucial

Summary:

The general view was that access to technology facilities needs to be logistically close. There are numerous examples of companies that manage a virtual structure or who contract out around the world to the best perceived location, but, particularly for SMEs, faster and more effective work will occur if collaborations can occur in quite close proximity. Such facilities should also provide extensive bioincubator space and the provision of services should not be at full cost. Technology facilities have to be managed very professionally and be able to deliver results on time and to a given quality. The organisation has to be able to maintain and update these technologies. The centres must also offer basic technology test services as well as perceived advanced research methodologies. Extensive communication via the right people provides a medium for accessing all other elements supporting company development, science, money, business etc. Consequently, the desire to develop transnational models suggests that this can only emerge from a linkage between current intrinsic substantive and strong regional structures or clusters and this to some extent reflects present examples such as BioValley.

SECTION 5: REPORT OF THE "BIOECONOMY AND REGIONAL DEVELOPMENT: WHAT POLICIES TO OVERCOME THE INNOVATION PARADOX?" WORKSHOP

Identified Problems

Decision-Making

- Involvement in short-term projects is the main motivation for action in the European Biotechnology sector
- Low levels of interaction between different levels of governance (European, National and Regional) in relation to biotechnology themes
- There is a limited accumulation of policy knowledge and strategy for biotech at the regional level
- There is a limited knowledge on the benefit of networking economies, i.e., difficulty to understand the benefits of cooperation and looking beyond own borders and structuring critical investments in the basis of a cooperative demand
- Due to this limited knowledge on the benefits of creating a network, there is little policy or strategy in place to develop such networks
- Limited levels of competition and cooperation make the emergence of biotechnology clusters difficult
- The peripheral Atlantic regions suffer particular difficulties in clustering as they do not benefit from physical proximity to share infrastructures and competencies
- Different approaches in clustering practices (bottom-up versus top-down) creates a diversity of situations that cannot be tackled with one size fits all policies

- This leads to a lack of effective networks
- The political cycle within EU countries demands short-term results that are not achievable in the Biotechnology domain
- There is a perception of wastage of scarce financial resources (project duplication, etc) when funding options are scarce
- Several regions do not have the capacity to achieve a minimum critical mass of actors and knowledge to stimulate biotech investments – creating ineffectiveness in several projects
- There is a high level of heterogeneity in technical competencies among Biotechnology stakeholders
- The limited level of public understanding of science impacts on the public's
- and governments understanding of biotechnology potential. This has implications in terms of funding and policy
- Poor levels of interaction between 'scientists' and industry
- The non-existence of transnational centers of excellence to articulate the needs and expertise of different biotech centers and companies in order to link the most developed bioregions with the less developed regions trying to launch their regional bio-potential

Operational

- Technology Transfer Offices (TTO) assume a pivotal role in developing the biotech sector but its competencies are often limited in terms of marketing and/or research understanding
- Technology transfer focuses on three main mechanisms (spinning-off, licensing IPR and research contracts). However for the biotech sector several other tools are crucial, especially in more grassroots biotechnology regions
- TTOs need to establish networks to guarantee a high level of expertise in different areas of knowledge regarding commercialization dynamics
- The translation of potential knowledge and capacity of the public and policy-makers to solve market needs is critical in gaining public and political confidence in the sector
- There are a lack of channels for communication between scientific researchers and company managers
- Companies depend heavily on IPR to create incentives to innovate; however unclear IPR decreases the motivation for collaboration among companies
- Tensions in the scientific world to protect and publish research creates ambiguous incentives for scientists to think in a commercial manner
- Stimuli to applied research creates dangerous and fictional barriers with more fundamental projects

Identified Solutions

STRATEGIC ALIGNMENT

- Top-down clusters should reduce political weight and capture local stakeholder's perspectives
- Bottom-up clusters need more hard and soft infrastructure to strengthen regional commitments and engagement
- A longer-term perspective in research funding is critical: politicians should participate in the creation of long run roadmaps for the European Biotech Research Agenda
- Biotechnology planning in Europe should be more participatory including national and regional levels commitments

- Working groups/Focus groups/In-house days could be set-up by researchers and companies to help politicians to understand in more depth biotechnology debates and controversies

SCIENCE COMMUNICATION

- It is crucial to look at the way science is taught, especially in the early years of schooling
- There is a need to stimulate scientific communication and activities to improve the public's understanding of biotechnology
- Create different financial instruments to aid scientific communication with different public groups i.e. children, teenagers, adults, but also companies, politicians or public bodies
- Create and disseminate information to companies and research groups regarding interaction with different groups within society
- Increase researcher's capabilities to communicate with different groups of the public
- Facilitate the improvement of management skills in companies, especially in traditional sectors and SMEs (small and medium enterprises)

KNOWLEDGE TRANSFER

- Explore connections between knowledge transfer activities and scientific communication
- Create tools to underline the benefits of knowledge in production, ensuring that companies and research centre's see these as investments and not costs
- Create and regularly apply tools to better identify companies needs that can be satisfied by current biotechnology competencies
- Improve the effectiveness of regional knowledge transfer

ENTREPRENEURIAL SKILLS IN RESEARCH

- Structure a network of experts to help develop a long term strategy that is adapted according to different periods within the biotech start-up life cycle
- Create a pool of experienced managers that can follow-up on the establishment of new ventures – a mentoring system
- Create training courses and higher education programs that are suitable to biotech needs and help bridge the gap between research and market applications

CRITICAL MASS

- Share and standardize existing online platforms about Biotech competencies and infrastructures allowing companies and research centre's to benefit from existing resources
- Develop new regional investments based on existing infrastructures and demands

SECTION 6: LIST OF STRATEGIC RECOMMENDATIONS AND ACTIONS

Based on the workshops results, the ShareBiotech consortium proposes in the following tables recommendations for strategic and operational actions.

Table 1: Bioinformatics and data analysis: operational and strategic actions proposals.

Problem dimension	Specific Actions (operational) *Possibly to be developed within the ShareBiotech project*	Strategic Actions *For policy makers*
Data storage and computing power is lacking; both for researchers and companies.	Identify facilities either internally (ShareBiotech's TCFs) or externally (external providers) Encourage TCF networking	Higher investment needed in bioinformatics (from governments, research institutes, etc.) Hosting the resources for data storage and management implies an investment in both the infrastructure and expertise of bioinformatics TCF.
Access to catalogues of available bioinformatics and statistics technological core facilities	Bioinformatics TCFs listed and presented on ShareBiotech website. Improve the way these catalogues are presented: make them more user-oriented "Translator Centre" to help find the appropriate TCF	Create awareness among technology transfer offices, innovation centers, etc.
Better establish the levels/kinds of bioinformatics support needed by research groups and companies, because they are in fact very varied	Get back to source information of the ShareBiotech interviews and specify the demand (deepen analysis of needs)	Ensure TTOs have at least one individual with a good working knowledge of the biotech industry
Need for bioinformatics (and statistics) training	Specific training offer presented on ShareBiotech website. Provide ShareBiotech mobility grants to attend specifically these training courses Organize local technology meetings on bioinformatics	Encourage the creation of short-term training sessions (e.g. summer courses) accessible to both academic researchers and companies. Ensure all university courses have compulsory statistical courses for its science undergraduates and postgraduates
Find skills to perform bioinformatics and statistics analyses	Review existing education programs in the Atlantic Area (Activity 6 of ShareBiotech) and/or in Europe.	Encourage creation of new education programs in bioinformatics and statistics, at all levels (Technicians, Masters' degrees, PhDs)
Identify the most adapted equipment/software	Offer training in project management	
Companies and Research Groups are not aware of costs related to software, hardware and human resources and don't integrate them in their projects' budgets		

Table 2: Access to Biological resources centers: operational and strategic actions proposals.

Problem dimension	Specific Actions (operational) *Possibly to be developed within the ShareBiotech project*	Strategic Actions *For policy makers*
Lack of visibility of existing Biological Resource Centers. Companies and Research Groups don't know what exists, sometimes even next-door!	Identify existing BRCs in ShareBiotech regions, and publish the list on ShareBiotech website and others. Distribute the list among ShareBiotech contacts. Identify other national and European BRCs and networks. Strengthen links with the EMBRC and EMbaRC projects. Organize a series of local technology meetings (LTM's) with publicity of foreign BRCs.	Promote National and European BRCs and networks Create a one stop-shop catalogue/online portal of all BRCs in Europe. Publicize BRCs and networks.
Confidentiality (companies don't want to detail their R&D projects, which is generally a prerequisite to access a public BRC) and intellectual property.	Organize a workshop for ShareBiotech BRCs to share good practices in confidentiality and IP protection Inform or propose a training session about quality management/ certification for BRCs Organize a colloquium on IP dedicated to BRCs: case studies and legal advice.	Develop a common confidentiality scheme at a European level (certification) Incentivize quality management systems in BRCs National/regional commercial development agencies to host seminars/workshops on IPR
Sustainability needed in BRCs funding, as material/information must be kept in the long term.	Identify models of operation among existing ShareBiotech BRCs (e.g. public-private partnerships – Activity 6 of the project). Organize a market place between ShareBiotech BRCs and users (private and public) Promote implementation of traceability procedures (including environmental data and stock assessment)	Provide more adapted funding Identify the life cycle of the raw material in BRCs

Table 3: Technology facilities in life sciences: towards transnational networks: operational and strategic actions proposals.

Problem dimension	Specific Actions (operational) *Possibly to be developed within the ShareBiotech project*	Strategic Actions *For policy makers*
Is it more efficient to have TCFs in clusters than TCFs as individual entities? Impact of TCFs on cluster development and conversely "you can't have a TCF unless it is within a cluster".	Identify a TCF within each partner region to become a model flagship for the role of a TCF (if relevant)	Have a "flagship" facility that will drive activity and funds - if it proves to be useful and efficient, public funding may be granted- : e.g. of the Babraham animal facility in Cambridge, UK, that gives access to 50,000 mice at any time)
Connecting SMEs to the facilities: important to have a common language. Do SMEs know how to verbalise their needs?	ShareBiotechTechnology Translator Centre should be developped further (Activity 6)	A platform, newsletter, networking events, series of seminars (e.g. www.toolsofscience.se) Support incentives models (like vouchers in the Fasilis project, another on-going INTERREG project)
Absence of a proven functional model for transnational facilities. How to make a transnational network of facilities and how can we make it useful to companies? E.g. how do you get a SME in Ireland to access a TCF in France?	Identify complementarily of ShareBiotech TCFs Identify which TCFs are more likely to answer companies' needs (Activity 4). Facilitate access to TCFs through the mobility plan.	Foster interfaces, bioincubators, not necessarily at full costs. Centers must offer basic biotechnology tests services as well as potential advanced research. Access to facilities needs to be logistically close. A transnational model can only emerge from a linkage between substantive and strong regional structures or clusters (such as Bio-valley) Document the benefits of TCF-industry linkages to both TCFs and industry Make commercial development agencies aware of these benefits and highlight the need for these agencies to develop links between TCFs and industry
TCFs have to be managed very professionally and be able to deliver results on time and to a given quality	Increase awareness among TCFs about accreditation; offer a specific training course for TCFs.	

Table 4: Bioeconomy and regional development: what policies to overcome the innovation paradox: operational and strategic actions proposals.

Problem dimension	Specific Actions (operational) *Possibly to be developed within the ShareBiotech project*	Strategic Actions *For policy makers*
Lack of involvement of regional authorities at transnational level to build a real long-term transnational bioregion (with a critical mass, a real technical specialization) – e.g. Alsace, Torino…	Organize workshops in each region involving more stakeholders Establish bottom-up clusters Highlight synergies between the biotech sector and traditional sectors in the economy, i.e. agriculture, etc to stimulate interest in the sector	Strategic alignment of research in biotechnology Keep the regional technology translator initiative after the project. These people should communicate regularly with regional and transnational authorities. Publish the benefit of traditional sectors within each region working with the biotech sector, i.e., functional foods, to create new/update products/services/processes
Non-existence of transnational centers of excellence to articulate the needs and expertise of different biotech centers and companies in order to link the most developed bioregions with the less developed regions trying to launch their regional bio-potential	Structure networks of different experts (virtual thematic centers of excellence) Ask for the support of the administration	Regional support (at regional and transnational levels) of the centers of excellence.
Lack of society recognition of the biotechnology potential to each region (research, economic impact, etc.)	Create working groups involving researchers, politicians and companies to better understand the value/potential of biotechnology. Communicate the benefit of biotechnology to society – particularly functional foods – in a more systematic manner	Promote science in a more attractive way in early years of schooling Communication strategies aligned with policies
Industry and TCFs have a limited knowledge on the benefit of networking economies across regions	Increase industry and TCF knowledge on the benefits of networking – resource sharing, labor pooling, capacity polling, etc – and it's economic returns	Workshops/publications on the benefits of networking and scale economies. Particularly focusing on its benefit in regional/peripheral economies
Incentivize networking practices	Develop a best practice model for creating networks for each region. Needs to be region specific	National Commercial development agencies to offer hard and soft supports to facilitate networking i.e. meeting facilities for free, coordinator in place to link companies and TCFs with similar needs/outputs together

ANNEX 1: EXPERTS AND WORKSHOP PARTICIPANTS

Bioinformatics and data analysis: The big issue? Concrete answers for concrete needs!

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Technology facilities in life sciences: towards transnational networks

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Bio-Economy and regional development: what policies and actions to overcome the innovation paradox?

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ANNEX 2: LIST OF ACRONYMS

ANAIN	Agencia Navarra de Innovación y Tecnología
BRC	Biological Resource Centre
CCMAR	Centro de Ciências do Mar
CIIMAR	Centro Interdisciplinar de Investigação Marinha e Ambiental
CRIA-UAlg	Centro Regional para a Inovação do Algarve, Universidade do Algarve
CRITT	Centre Régional d'Innovation et de Transfert de Technologie
CRO	Contract Research Orgzanization
EMBRC	European Marine Biological Resource Centre
EU	European Union
HEI	Higher Education Institute
INRA	Institut National de la Recherche Agronomique
IP	Intellectual Property
IPR	Intellectual Property Rights
KEC	Knowledge Exchange and Commercialisation
NUIG	National University of Ireland, Galway
OECD	Organization for Economic Co-operation and Development
R&D	Research and Development
ROI	Return on Investment
SME	Small and Medium Size Enterprise
SSC	Stockholm Science City
TCF	Technology Core Facility
TTO	Technology Transfer Office
UK	United Kingdom
US	United States

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Biocant - Associação de Transferência de Tecnologia (Portugal)
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Athlone Institute of Technology (Ireland)
www.ait.ie

National University of Ireland, Galway (Ireland)
www.nuigalway.ie

Gobierno de Navarra, Departamento de Innovación, Empresa y Empleo (Spain)
www.navarra.es

Universidade do Algarve, Divisão de Empreendedorismo e Transferência de Tecnologia (Portugal)
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