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Abstract	This work package examined financial models for BRCs with the goal to discover the best options to help deliver their sustainability. BRCs, to perform their activity, have three main kinds of expenses: Salaries, infrastructure costs, and bench costs. They also have three main income streams: government-institution funding, research grants either public or private, and fees for services (including strain sales). The study illustrated that in most of the BRCs, the financial equilibrium is reached by the sum of the three main sources of income. However, their respective proportion (government or institution versus fees) can drastically vary from one collection to another. Indeed, depending on the BRC, 20 to 90% of the total funding can come from fees and contracts. This means that a few of the BRCs are almost financially self-sufficient without direct public support funding. However, i) this depends upon the history of the BRC, its age and the kind of resources preserved and ii) to recover 90% of the costs does not mean the BRC is sustainable in the long-term. A successful BRC business plan depends upon meeting local market needs and the provision of unique services but also the ability to adapt to changing demands depending on the kind of resources. This study goes someway to provide some basic guidance and examples of how BRCs can become sustainable.
Validation process	Document prepared by INRA in collaboration with CABI and submitted to the Executive Committee for agreement.

Contents

Abbreviation key

BCCM	Belgian Coordinated Collections of Microorganisms
BRC	Biological Resource Centre
CABI	CAB International
CBD	Convention on Biological Diversity
CBS	Centraalbureau voor Schimmelcultures
CECT	Colección Española de Cultivos Tipo
CIP	Collection of the Institute Pasteur
CIRM	Centre international de Ressources Microbiennes
DNA	Deoxyribonucleic acid
DSMZ	Leibniz-Institut DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH
ESFRI	European Strategy Forum for Research Infrastructures
EC	European Commission
GBRCN	Global Biological Resource Centre Network
ECCO	European Culture Collections' Organisation
INRA	Institut National de la Recherche Agronomique
MIRRI	Microbial Resources Research Infrastructure
OECD	Organisation for Economic Cooperation and Development

1 Background and Objectives

"EMbaRC will establish a **self-sustainable** community of European Microbial Resource Centres representing a large bio-diversity and offering a wide-range of not only bio-resources but also expert services." This was the prime objective expressed in the desription of work for the EMbaRC project and a crucial goal towards providing key aspects of the European Community's biotechnology needs. Indeed, to build such a network of microbial BRCs, the BRCs themselves must be sustainable for the long term, or at least a plan is necessary to take them in this direction. **Despite the fact that the BRCs represent crucial bioresources, a long term vision of how BRCs and their services should or could be supported financially has never been presented at a pan-European level.** BRCs must mobilise alternative funding sources to fund their development and enable them to provide the essential services and products needed today. The preservation of microbial diversity and facilitating its exploitation is essential for the future of BRCs and of the GBRCN network (the Global Biological Resource Network – www.gbrcn.org). The EMbaRC project has highlighted many fundamental differences between BRC situations, each

demonstrating *a unique case with often, a unique national history.* The first goal of this document is to assemble arguments dealing with the sustainability of BRCs and why it is an issue for EC countries, whatever the country being considered. Background for this was provided by each partner collection answering a short questionnaire. This delivered an overview of the *state-of-the-art* regarding strategic actions and the goals of any existing business plans. As the BRC partners in EMbaRC comprise some of the largest and oldest European collections, the responses can be regarded as representative of the whole culture collection situation. Utilising these findings the general considerations concerning the financial balance of a typical BRC and varied revenue models are presented. Finally, an action plan, at an individual and collective level is proposed. The **MIRRI (Microbial Resources Research Infrastructure)**, proposed by members of the consortium during the course of EMbaRC, is one of three infrastructures **recommended for inclusion in the ESFRI roadmap in 2011:** this forms the infrastructure in which Europe's BRCs will be strengthened and further developed. MIRRI's main mission is to bring together resource holders, researchers and policy makers with the aim of delivering resources and services more efficiently to meet the needs of innovation in biotechnology. **Obviously, MIRRI will contribute in a very concrete way to the visibility of BRCs in Europe, and will address their sustainability**. Following this success in collaboration with GBRCN and ECCO – the European Culture Collections' Organisation- the two initial deliverables regarding sustainability in work package NA3 were merged into this single document. The question of sustainability is crucial, although Europe currently represents 31% of all MRCs in the world this proportion is decreasing; whereas in Asia-BRCs are developing at an exceptional rate, covering more organisms, expanding their services and are better funded. Europe needs to be able to compete better and retain its strong biotechnological leadership by securing the future of its microbial resources as a tool for biotechnology competitiveness. Sound business plans are needed to address i) the preservation of the huge numbers of samples of microbial biodiversity that are isolated and characterized each year; ii) the new services expected by today's users, iii) the technical evolution of taxonomic tools and at the same time the loss of taxonomic experts, iv) the future global society challenges regarding the environment, green and white technologies, in healthcare, food security and the environment, where microorganisms are, and will be more and more, valuable tools with almost infinite metabolic abilities to provide solutions.

2 Why BRCs have to be sustainable?

There are several areas in which BRCs have crucial responsibilities that need to be sustained:

- To conserve microbial diversity and facilitate its access and sustainable use allowing countries to meet their Convention on Biological Diversity (CBD) obligations; an international treaty (1992) to sustain the diversity of life on Earth (www.cbd.int/convention) and, on a country basis, help implement National Biodiversity plans.

- To assure long term preservation of microbial resources for science credibility, confirmation of results and enabling further research; taxonomic reference strains must never be lost as well as strains of scientific or historical interest (such as lines of Fleming's *Penicillium* (Smith D., 2012) or patented strains for safe deposit; traceability.
- To protect public funding investments in research by preserving the biological material generated. It was demonstrated in this project (D NA 3.2.1) that less than 1% of the strains described in European microbial journals were deposited in a public collection.
- To assure long term preservation for the biotechnology sector; biodiversity can have an economical value (Ten Kate and Laird, 1999), in particular microbial diversity and thus contribute to the development of the bioeconomy .
- To keep unique resources that do not exist elsewhere (rare resources, disappearing biotopes)
- To provide services and expertise not necessarily provided elsewhere, in particular to be centres of excellence for taxonomy
- To provide a sustainable model to encourage and support other collections wanting to become a BRC; indeed, more BRCs are needed as the capacity for preservation has to be dramatically increased to accommodate the huge biodiversity, new species and new strains isolated and described by scientists each year. To become a BRC following the high quality standard of the OECD best practices guidelines (OECD, 2007) has a cost that must be met.
- To control access to dangerous "dual-use" organisms implementing biosecurity controls to prevent materials getting into the wrong hands and being maliciously used
- To ensure shipment of strains meet national quarantine regulations particularly that controlled organisms are only sent to authorised permit holders
- To promulgate best practices in access, handling and use of microorganisms, including at laboratory scale by training researchers.

3 Situation amongst the partners of EMbaRC and existing business plans

3.1 Questionnaire

In order to assess the situation for each BRC in terms of strategy and business plan, a short questionnaire was designed and circulated to the members of the consortium; the eleven questions were as follows:

1. Is your BRC hosted by an institution, or independent? or independent even if hosted?
2. Do you have an independent budget? if not, are the fees and expenses controlled to a certain extent by the hosting institution?
3. Do you already have a strategic plan for sustainability of your BRC? or for your BRC within the strategic plan of the hosting institution? Or is there no strategic plan at all?
4. Do you agree that there are three main sources of funding: government-institution funding, research grant, fees (supply, consultancies and sales of services)?
5. Do you agree that BRC sustainability can be improved by diversifying sources of funding?
6. In your opinion, is the connection of your BRC with industry/bioeconomy sector sufficient?
7. If not, what should be done to increase this connection? actions from your side, from your institution? and/or from other actors?
8. Is there a Microbial Society in your country? if yes, do you have direct contact with its director? do you know him/her? did you already have exchanges about BRCs and their importance? do you think that this society has enough influence to reach national research funding bodies? (please indicate here the website of this microbial society, if any)
9. did you already try to meet government representatives (in charge of policy or funding relative to biodiversity?) if yes, what was his/her reaction/position?
10. Did you already try to meet funding agencies representatives to present BRCs? if yes, what was their reaction/position?
11. Do you think that networking (at national and international levels) e.g. MIRRI will improve your funding situation?

3.2 Main Conclusions from the questionnaire

The detailed answers of each BRC are provided in the Annexe A, the 7 members of the consortium were involved and 12 answers were obtained, because of the four sites for INRA and three for BCCM. **The main points arising from the questionnaire answers are summarised below:**

- **Five out of the seven BRCs are hosted by institutions** (university, research institutes), one is independent under an overarching host and one is fully independent under direct governmental funding.
- **Few BRCs (2 out of 7) have their own independent budget;** most of the time even if a certain independency can exist, the expenses are under the control of the host institutions; most often (but not systematically) the fees for BRC services are allocated to the BRC.
- **Regarding the question of the existence of a strategic plan for sustainability, the situation is variable from "no plan at all" (3), "no but strongly recommended to define one by funding institutions" (1) to "yes" (3).** Within these last three, the situation is again contrasted, from a strategy on a yearly basis and not strictly dedicated to sustainability, to a 5 year basis (one example is provided annexe 3) .
- **100 % of the BRCs agree that there are three main sources of funding : government-institution funding, research grant, fees (supply, consultancies and sales of services*)* – with one important restriction :** a research grant can only pay for research and cannot support the service part of the collection. Research is important for a collection but more often than not it should be focused on improving operations or services as the

BRC must have sufficient staff to do the routine basic work of the BRC (i.e. maintenance and supply of products and services).

- **The connection with industry/bioeconomy was considered insufficient by 6 out of the 7 BRCs.** One of the essential needs underlined is the engagement of the broader user group and deliver their needs more effectively and efficiently driving innovation and accelerating discovery, this means more staff and greater capacity, which are lacking in most BRCs.

  To increase this connection, it was identified that BRCs were more committed than their host institutions. Several ways forward were indicated: active engagement, participation in forums attempting to link resource holders and industry (e.g. Technology Strategy Board), communication-outreach strategies, organization of meetings, increasing the range of products provided, establishing spin-off companies providing test kits, new diagnostic tools, licensing IP rights, new formats for delivery of microbes, offering training and knowledge sharing. . An interesting idea was to mobilize senior scientists and senior curators for this specific link with industrial partners, creating expert platforms to provide expertise lacking in industry, such as taxonomic expertise or knowledge on microbial physiology and growth to gain better access to the microbes chemical potential. A much stronger mutual understanding and greater trust are essential. A key requirement from the host institution is to make this connection easier (e.g. through administrative policies and collaborative strategies).

- **The level of relationship between the Microbiological Societies and local BRCs is highly variable and is dependent on the country**: relationships vary from complete absence of linkages to strong connection in some cases, presence of a member of the Society for Microbiology on the Scientific Advisory Board of the BRC or, alternatively, the presence of BRC curators on the administrative/scientific board of the Microbiological Society**. Regarded by all as key partners in the development of the BRC concept, microbial societies are generally considered as not supportive enough.**

- **The link with government representatives is not easy and has not really led to big funding success (with a few exceptions**). Relevant Government representatives are difficult to identify and change regularly; the responsibility for management of genetic resources and therefore BRCs, is sometimes spread over several ministries and thus lack of ownership results. The link can be very positive at the conceptual level but very modest in actions. A decisive point seems to be whether there is Government policy or large national programmes on biodiversity.

- **Most of the BRCs have tried to approach funding agencies, with varied levels of success**: in the worst case**,** rejection followed because of the lack of a specific budget for BRCs or biodiversity; and generally there was only marginal interest in culture collections (exception for long term repositories for electronic datasets). In the best case, small

research grants were offered most often on a competitive basis, this presented problems as basically research money pays for “research” and to allocate money to service work (deposit, authentication, preservation, maintenance, was considered difficult.

- **Almost 100% of the BRCs of the consortium are convinced that networking at national and international level, and in particular MIRRI is a key tool to improve the BRC visibility and their sustainability,** even if the final impact for each separate BRC is still unknown.

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4 Revenue models

To perform their activities, BRCs have **three main kinds of expenses**: Salaries, infrastructure costs, and bench costs. They also have **three main income streams**: government-institutional core funding, research grants either public or private, and fees for services (including strain sales).

In annexe B, a scheme illustrates the financial balance of the EMbaRC partners BRC activities. In most of the BRCs, (situation A) the financial equilibrium is reached by the sum of the three main sources of income. However, their respective proportion (government or institution core funding versus revenues from fees for services and products) can drastically vary from one collection to another as analysed previously (deliverable 3.2.1). Indeed, depending on the BRC, 20 to 90% of the total funding can come from fees and contracts. This means that some of the BRCs are almost financially self-sufficient with little direct public support funding. However, i) this depends upon the history of the BRC, its age and the kind of resources preserved and ii) to recover 90% of the costs does not mean the BRC is sustainable in the long-term.

The different kinds of income streams that a collection can develop by its own activity are the following:

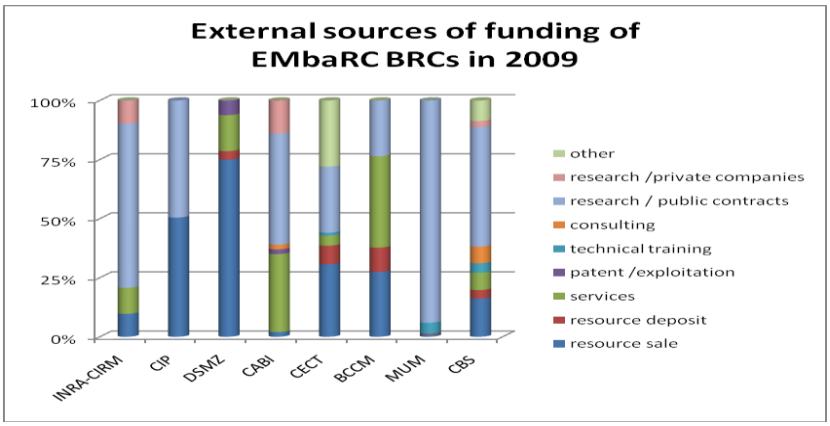
The model BRC includes considerable diversity of funding mechanisms for individual centres. However, it is to be expected that most BRCs, whether single large national centres or smaller distributed or specialized centres, will require some degree of commitment to core funding by their respective national Governments. Other kinds of funding sources include support from industry, grants from agencies that support research, cost-recovery through fees-for-service, development of databases and other tools that complement the core role of BRCs e.g. even funding from charitable sources, especially those associated with public health or sustainable development. The basic income lines for culture collections or BRCs excluding Governmental or institutional support are:

- Fees for repository service (safe deposits and patent strain maintenance)
- Provision of technical courses

- Sales of resources (strains, DNA, technical materials)
- Services (safe deposit, patent strain maintenance under the Budapest Treaty for those BRCs with International Depositary Authority status, identification and other technical consulting based on in-house expertise such as preservation, sampling and detection of contamination, challenge and proficiency testing)
- Research incomes (grants research agency, contracts)
- Technical courses / training / guidance in implementing best practice
- Adding value and exploitation of genetic resources diversity (targeted extracts, derivatives and compounds ultimately generating IP that can be protected by patents)
- Public and private foundations

It can be argued that Governmental funding is essential and appropriate but the long-term stability of such funds is always under threat. Such Government funding is usually balanced against the income received for the various services and products offered by the collection. This leaves very little for investment and to enable the collections to improve their coverage and incorporate new and advancing technologies. Collections need sound and innovative business plans to allow them to keep pace with the ever increasing demands of their users. However, the diversification of activities of a BRC could deflect a BRC away from its core activities therefore the goal must be additional sources of revenue through projects related to new technology based partnerships.

There is no one model of external resources combination as shown in this figure issued from the Deliverable 3.2.1



Mapping of the different External resources of funding (Fees + research contracts)

8 BRC = 8 different maps …

Even if some BRC are rather good in covering their costs, and even if others can adopt similar tactics, this is and will not be enough. Indeed, c**oming back to the annexe 2, the <u>situation B</u> is**

the only one which is sustainable. **BRC must be able to invest time and money to adapt to future challenges, to today user's need, to develop new services and keep with high quality standards at least part of the huge biodiversity isolated each year** (At least 5000 new strains per year minima should be saved in BRCas estimated in the WP…)**.** It is not cost effective for collections to have expertise in product development or have all modern technologies available in house. The role of BRCs is clear, that is to provide high quality and well characterised biological material so that biotechnologists and other users get materials fit for purpose, to accelerate discovery and innovation.

The long-term security of a collection depends on providing a sound financial platform which is usually a balance between governmental support, commercial and other income lines. There are several collections that are supported by governments but rarely are they fully supported. The World Data Centre for Microorganisms provides statistics on its website and as of November 2012 there were 626 collections listed, 247 supported by Governments, 236 in Universities, 58 semi-governmental, 35 privately supported and 17 Industry based collections. Overall the number of collections has decreased, over 1000 WDCM registration numbers have been issued therefore around 400 registered collections are now no longer operational. It is a fact that availability of Governmental funds is reducing resulting in limited core funding. Collections help meet obligations of Governments to the Convention on Biological Diversity and making available biological resources to underpin science, education and the economy. Collections protect public funding investments in research by preserving the biological materials generated. Perhaps they should be providing such services under contract. In any case, a combination of governmental, commercial products and services and research contract projects funding offer the best chance of long term sustainability. This means that BRC must, on the one hand, secure the core funding element, and on the other hand, develop attractive and lucrative commercial activities or research on the other.

Three kind of actors have thus to be considered in the definition of a strategic plan :

- government and police agencies in general
- scientists and scientific funding agencies
- industrial and industrial association/platforms

Of course, the question is crucial for each BRC, and the temptation to work only for its own "development" and sustainability is understandable ("individual actions"). However, to have collective actions, at a national or EC level, can be very complementary.

5 Toward Sustainability: collective versus individual actions

The traditional business of the general, national or regional collections must be extended by the provision of new products to meet the needs of today's users. Additional products may include DNA, enzymes, metabolites and other derivatives from authenticated strains. Collections can move beyond this by developing commercial products through the provision of biotechnological solutions resulting from the discovery of active compounds and funding such activities through public/private investment. The sale of products and services and the delivery of consultancies can be supplemented by research program funding for projects designed to meet donor requirements. **However, care needs to be taken in the choice of such activities so as not to divert the collection too far away from their responsibilities in delivering their public services**. As part of public investment in the running of collections the cost of deposit of strains should be supplemented by engaging research program funders to protect their investments by paying for deposits in collections and also for the supply and use of reference strains in the pursuance of their funded research. Editors can be a very active support in that field by encouraging (forcing?) authors to have a strategy of strain preservation.

[**Key assumptions on what could be the actions of each BRC** :

- **Define its own strategic plan, to increase the income streams coming from strain, services, training, expertise. This depends highly on the type of resource preserved and on a deep and accurate analysis of the economic sector related to these resources**. This means advertising the existing services to the right targets, extend contacts in particular toward private companies. Additionally, this requires the further development of existing services and the addition of new ones (e.g. databank, DNA bank; MLST, populations studies etc. to better serve the needs of clients/users; this requires time, experimental work and investment. A bottleneck is that some BRCs are too small with no capacity to extend services or create new ones; also a key factor is that most collections have limited experience in working with the commercial sector.
- **Build a stronger and more direct relationship with policy makers and public funders To maintain a secure public core funding (either institutional or government);** the public role of strain maintenance needs public support. This action can be individual (in particular at a regional scale) and collective (at a national or EC scale). From the response to the questionnaire, it was clear that supporting national biodiversity plans, or involvement in large multidisciplinary projects is an excellent way forward for BRCs. There is an economic value to biodiversity demonstrated by its current level of exploitation. The European Union and the OECD are recognising the value of and urging nations to improve their bioeconomy strategies. BRCs have a role to play. The recent OECD report The

Bioeconomy to 2030: designing a policy agenda (2009) emphasises that the biological sciences are adding value to a host of products and services, producing what some have labelled the “bioeconomy”. The report explains that from a broad economic perspective, the bioeconomy refers to the set of economic activities relating to the invention, development, production and use of biological products and processes. If it continues on course, the bioeconomy could make major socioeconomic contributions in OECD and non-OECD countries. These benefits are expected to improve health outcomes, boost the productivity of agriculture and industrial processes, and enhance environmental sustainability. The bioeconomy’s success is not, however, guaranteed: harnessing its potential will require coordinated policy action by governments to reap the benefits of the biotechnology revolution. International co-operation is the only way forward to provide:

  - enhanced worldwide accessibility to information and biological material
  - co-ordination of standards
  - linkage between scientific needs and government policies
  - frameworks for regulatory initiatives
  - linking mechanisms for countries without BRCs
  - enhanced efficiency and reduced redundancies
  - improved transparency.

- **Develop strategic partnerships with teams involved in biodiversity research** (genomic molecular based studies, ecosystem exploration, those with the technologies to characterise strains); a multidisciplinary approach to accelerate the uptake of strains into research and development.
- **Collaborate in appropriate networks such as national, regional or global initiatives:** as it is now recognised that Research Infrastructures provide the new dimension in life science research. The European Strategy Forum for Research Infrastructures (ESFRI) was established in 2002 to support a coherent and strategy-led approach to policy-making on research infrastructures in Europe, and to facilitate multilateral initiatives leading to the better use and development of research infrastructures, at the EU and international level. ESFRI are establishing pan-European structures to drive innovation to provide the resources, technologies and services as the basic tools necessary to underpin research. The ESFRI strategy aims at overcoming the limits due to fragmentation of individual policies and provides Europe with the most up-to-date Research Infrastructures (RI), responding to the rapidly evolving Science frontiers, advancing also the knowledge-based technologies and their extended use. EMbaRC and the GBRCN Secretariat leading the microbiology collection community have succeeded in placing the Microbial Resources

Research Infrastructure (MIRRI) on the ESFRI roadmap. The resultant high quality global platform will be designed to accommodate the future needs of biotechnology and biomedicine. Additionally, the emerging strategy for the EU, Europe 2020 Flagship Initiative, Innovation Union calls for coordinated effort. Innovation has been placed at the heart of the Europe 2020 strategy and is the best means of successfully tackling major societal challenges, such as climate change, energy and resource scarcity, health and ageing, which are becoming more urgent by the day. At a time of public budget constraints, major demographic changes and increasing global competition there remains too much fragmentation and costly duplication. Resources must be spent more efficiently and achieve critical mass. The Innovation Union sets out an integrated and strategic approach, exploiting and leveraging strengths in new and productive ways. The capacity to create millions of new jobs to replace those lost in the crisis depends on our ability to drive innovation in products, services, business and social processes and models. This demands reforms to get more value for money and tackle fragmentation. EU and national research and innovation systems need to be better linked up with each other and their performance improved. Researchers and innovators must be able to work and cooperate across the EU as easily as within national borders with frameworks for a truly free movement of knowledge. There is a need to get more innovation out of research. Cooperation between the worlds of science and the world of business must be enhanced, obstacles removed and incentives put in place. Europe needs to work better with our international partners. That means opening access to R&D programmes, while ensuring comparable conditions abroad. Establishing a common EU front reducing fragmentation and working together to achieve more effective and efficient advances is what the Innovation Union is all about. Networking will:

Support Governments to

- Coordinate legitimate access to high quality resources for research and development helping deliver the national bioeconomy
- Implement international conventions and legislation particularly in biosecurity and the CBD Access and benefit sharing
- Reduction of duplication providing cost effective and efficient cross network approaches

Support Innovation by

- Focussing essential services such as identification of novel organisms, targeting specific chemistry in organisms for further study and protection of public investment made in the isolation of organisms and the generation of information and knowledge by maintaining the link between the biological material and the information

– The honest broker in the conservation and utilisation of genetic resources

Table 1. A summary of key actions towards sustainability

TARGETS	Individual BRC actions	BRC Collective actions
Users - Scientists	• Identify from the publications research teams involved in biodiversity research (molecular basis,phenotypic exploration…) on the kind of microbial resources present in the considered BRC, to try to establish partnerships. • Communicate more effectively with user groups and clientele	• Change the general mind set and perception of BRCs • Encourage editors to stimulate deposit of cited strains in BRCs • Engender trust: Involve user groups in the Governance of BRC infrastructure and in the direction of microbial diversity management and use strategy • Improve characterization and information to facilitate organism uptake into research
Users - Bioindustry	• Identify local business needs and find ways to supply specific services • Join local bioindustry or Trade Associations	• Interact with EC industrial platforms (see list deliverable D3.2.2) – make contributions to their meetings • Be clear about IP and strain valorization policy • Establish frameworks for partnerships and facilitated access • Explore mechanisms to accelerate discovery and innovation
Funding agencies Research grants	• Lobbying to influence the topics	• Through research infrastructures such as MIRRI put expert clusters together to address research funder priorities • Help funders to reduce duplication of effort and to ensure better use of research outputs
Policy makers	• Work closely with department responsible for managing national genetic resources • Instead of requesting core funding negotiate fee for services provided to the nation for meeting biodiversity commitments and contributing to education and the bioeconomy	• Input to global debate on the major challenges and direct BRC community outputs to deliver appropriate solutions • Collaborate to ensure that policies are practical and enabling in the management and use of biodiversity • Agree and legal operational framework • Position the BRC role in developing the bioeconomy

6 Key assumptions of a BRC business plan

A complete business plan has been written by CABI and is fully presented as an example in Annexe 3. The key generic assumptions can be summarized below. In any case, the long-term sustainability of a BRC will require the generation of income lines that are traditionally culture sales, contracted services, contracted research and sponsorship. In addition to this the BRC should seek exploitable Intellectual Property (IP) through the characterisation and screening of its holdings to generate significant income through commercial utilisation.

- The BRC owners allow it operate commercially and that it has initial core funding and investment.
- The long-term operation and the stored biological resource collection can be financially supported by the commercial utilisation of biodiversity.
- Funding will be made available for countries to meet their Convention on Biological Diversity (CBD) obligations.
- The OECD Biological Resource Centre Initiative provides an improved environment for biological resource collections to operate and give the collections advantages over the free exchange of biological resources between scientists.
- Exploitable IP is discovered within the BRC biological resources.

7 Conclusion

A successful BRC business plan depends upon meeting local market needs and the provision of unique services but also the ability to adapt to changing demands. This study goes someway to provide some basic guidance and examples of how BRCs can become sustainable. There is no one universal plan for a BRC but there are key underpinning common themes as have been outlined above. Ultimately, the sustainability of BRCs will rely on both individual actions and BRC community collective action. No one collection can cover all resources and services needed therefore collaboration and specialisation rather than competition is recommended. This is not straight forward but MIRRI offers the platform to take this forward.

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Annexe1 Questionnaire and BRC answers

Questions

1. Is your BRC hosted by an institution, or independent ? or independent even if hosted ?!
2. Do you have an independent budget ? if not, are the fees and expenses controlled to a certain extent by the hosting institution ?
3. Do you already design a strategic plan of sustainability for your BRC itself ? or for your BRC within the strategic plan of the hosting institution ? Or is there no strategic plan at all ?
4. Do you agree that there are three main sources of funding : government-institution funding, research grant, fees (*supply, consultancies and sales of services*) ?
5. Do you agree that BRC sustainability can be improved by diversifying sources of funding ?
6. To your opinion, is the connection of *your BRC* with industry/bioeconomy sector sufficient ?
7. If not, what should be done to increase this connection ? actions from your side, from your institution ? and/or from other actors ?
8. Is there a Microbial Society in your country ? if yes, do you have direct contact with its director ? do you know him ? did you already exchange about BRC and their importance ? do you think that this society has enough influence to reach national research funding bodies ? (please indicate here the website of this microbial society, if any)
9. did you already try to meet government representatives (in charge of policy or funding relative to biodiversity ?) if yes, what was his/her reaction/position ?
10. Did you already try to meet funding agencies representatives to present BRC ? if yes, what was his/her reaction/position ?
11. Do you think that networking (at national and international levels) e.g. MIRRI will improve your funding situation?

ANSWERS

BRC name : CABI

1. The CABI BRC (considered as Bioservices) is hosted by an institution
2. Bioservices (the 'CABI BRC' = Collection, Microbial Identification Service and Industrial consultancy and testing laboratories) has a separate budget
3. Bioservices has a strategic plan which includes the future sustainability of the collection, data and resources;
4. These are the normal revenue sources for collections and the principle ones for CABI Bioservices (The CABI BRC)
5. Yes, We agree
6. It is not. There is much more we could do to engage a broader client group but we lack both the resources to engage and the capacity to deliver more. There are potential forums that attempt to link resource and industry such as the Technology Strategy Board
7. We are gradually increasing the range of products we provide, it is not enough to solely supply cultures; CABI has a spin-off company providing test kits; it has IP in biocontrol agents; it has developed new formats for delivery of microbes; more products could be developed if we had greater capacity and resources

8. There are several microbial societies in the UK and it is difficult to keep in touch with them all; we had a specialist group in the SfAM www.sfam.org.uk/ which was previously the UK Federation for Culture Collections but this has lapsed because of lack of interest; we have contacts with the SGM www.sgm.ac.uk/ who have offered assistance in lobbying (they are an associate party in MIRRI); the BMS www.britmycolsoc.org.uk/ is more elusive; there are others that UK collections maybe in contact with but with which CABI is not: e.g. The Association for Clinical Biochemistry Microbiology Group www.aclinmicrobiol.org.uk/ ; there are also the European Microbial Organisations most national and regional societies are registered with FEMS www.fems-microbiology.org/ and of course at the global level there is IUMS www.iums.org/
9. We have had numerous approaches to Governments and research Councils in the UK with varying levels of success

   History of CABI collection funding
   - ✓ Prior to 1947 CABI member country fees and publishing business supported the CABI science and its collections
   - ✓ 1947 - Department of Trade and Industry grant to operate the UK National Collection of Fungus Cultures (£500 initial grant) small amount of intermittent annual funding
   - ✓ 1977 National Environmental Research Council partial funding balancing against income
   - ✓ 1982 DTI funding restored after a commissioned report again only partial funding with revenue and CABI covering the short fall
   - ✓ 1989 UK Government funding ceased
   - ✓ Ran at a loss; Merged microbial services into Bioservices; Business plan includes member country core funding; Bioservices cost neutral to slight profit
     - Had no success in restoring funding having had approaches to DEFRA and DiFID
10. Recent approaches to Defra – resulted in participation in MIRRI

    Approaches to NERC resulted in small research grants

    Approaches to BBSRC rejected – needed a mindset change in scientists which they felt we would not get and they were not prepared to take on the responsibility of collections having done so in the past 1996-2000 UKNCC activities which they say should have kicked started self sufficiency
11. Common approaches are essential; in the present financial crisis we need to demonstrate that we can improve the bioeconomy, a single collection will not make much difference but the European collection community can; it won't just happen without effort. We need to demonstrate that working together we will accelerate innovation and discovery and impact on livelihoods and national productivity

BRC name : BCCM (a consortium of Belgian complementary culture collections)

1. All collections of BCCM are integrated in and reporting to a host institution. They are all financed by the Belgian Science Policy Office.
2. Collections of BCCM have an independent budget, in practice this budget is managed by their hosting institution. All expenses need detailed justification vis à vis the funding body (Belgian Science Policy Office).
3. The BCCM strategic plan has been designed at the level of the consortium, it covers more than sustainability only. The sustainability of the BCCM consortium is ensured through a yearly recurrent funding scheme of the Belgian Science Policy Office (at federal level, but in coordination with the Regions and Communities of Belgium which are also competent for R&D).
4. Yes, these sources are integrated in the strategic plan.

5. Yes
6. The connection is necessary, not sufficient.
7. Training in life sciences, support to basic / upstream research, societal and economic support are necessary
8. There is a Microbial Society in Belgium. BCCM directors have close contacts with the board of the society. The members of this society are important stakeholders and actors in biotechnology in Belgium but not the only one.
9. The BCCM consortium has been initiated by government. Support to biotechnology in general is considered as priority in Belgium public departments
10. Yes. Reaction is positive, action is slow.
11. Strictly speaking of the funding, networking at international level will improve marginally situation. Networking has other beneficial effects that indirectly can improve funding.

BRC name : BCCM/LMBP

1. Hosted by the Ghent University, financed mainly by the Belgian Science Policy Office.
2. Independent budget. All expenses need detailed justification vis à vis the external financer (Belgian Science Policy Office).
3. There is a strategic plan that covers various things, not only the sustainability. It is clear that the BRC cannot be self sustainable, its sustainability is assured through a contract with the Belgian Science Policy Office.
4. Yes. For a plasmid collection however, it is not obvious to obtain research grants.
5. Yes
6. We estimate our 'connection' with industry at present weak.
7. Active prospection, implementation of autonomous research in BCCM/LMBP.
8. Yes, Belgian Society for Microbiology, http://www.belsocmicrobio.be/BSM/Home.html
9. Contacts and feedback run via Paul Devos, director of the BCCM/LMG Bacteria collection, who is secretary of the society.
10. BCCM (hence BCCM/LMBP) is fully supported by the Belgian Government (Science Policy Office) and is part of its Biodiversity Programme.
11. Yes, positive reactions.
12. Probably indirectly.

BRC name : BCCM/LMG

1. Hosted by the Ghent University, financed mainly by the Belgian Science Policy Office.
2. Independent budget. All expenses need detailed justification vis à vis the external financer (Belgian Science Policy Office).
3. There is a strategic plan that covers various things, not only the sustainability. It is clear that the BRC cannot be self sustainable, its sustainability is assured through a contract with the Belgian Science Policy Office.
4. Yes
5. Yes
6. We estimate our 'connection' with industry at present moderate to weak.
7. Active prospection.
8. Yes, Belgian Society for Microbiology, http://www.belsocmicrobio.be/BSM/Home.html
   The BCCM/LMG director is secretary of the society.
9. BCCM (hence BCCM/LMG) is fully supported by the Belgian Government (Science Policy Office) and is part of its Biodiversity Programme.

10. Yes, positive reactions.
11. Probably indirectly.

BRC name : CRBIP

1. The CRBIP is hosted by Institut Pasteur
2. We don't have an independent budget. All the fees and expenses are controlled by the hosting institution.
3. We don't have any plan of sustainability
4. Yes
5. Yes
6. Not at all
7. Actions from Institut Pasteur
8. Yes. I belong to the administration committee of the French Society of Microbiology. No I don't think so.
9. Yes. There is no budget specific for the preservation of microbial diversity.
10. Yes. They listen but no positive actions were defined after the meeting.
11. Yes

BRC name : CBS-KNAW

1. CBS is a scientifically independent research institute. The overarching KNAW (Royal Netherlands Academy of Arts and Sciences) can be seen as hosting (administration, personnel, etc.), and determines a general science strategy for the institutes residing under it (22 at present).
2. Yes.
3. Yes, CBS makes a scientific strategic plan every 5 years. This plan also addresses how to increase exploitation of second and third stream funds (sustainability). Full financial independence is not a primary goal nor a necessity for CBS, as the KNAW lumpsum can be regarded as a sustainable source of funds.
4. Yes
5. Yes
6. No, but we are seeking improvement and having success.
7. Companies should be made more aware of the importance of the collections for applied research. Lately, senior scientists and curators of CBS have become more involved with industrial partners. For example, companies active in the clinical and applied fields, which are in need of taxonomic expertise and reference cultures. We have had success in setting up collaborations with companies that want to develop new diagnostic tools or improve existing tools in these fields. CBS provides the taxonomic expertise and reference cultures and the companies provide expensive analytical instruments and/or extra temporary technical staff. (Expected) benefits for CBS is scientific output (papers) and improvement of internal Quality control procedures.
8. Yes, the Netherlands Society for Microbiology (NVVM). CBS has regular contact with the director of NVVM, Prof. Han Wösten, who is also a member of the CBS Scientific Advisory Board. Yes. http://www.nvvm-online.nl/ Yes, but the interest of the research funding bodies in BRCs has been low for a long time in the Netherlands.

9. No, but the government decided to invest in Netherlands Centre of Biodiversity (NCB), a new biological collections infrastructure (plants and animal collections), through the program of FES (Fonds Economische Structuurversterking) of the Ministry of Economic Affairs; CBS is affiliated to NCB, and within the funding project, CBS has received over 1 Million Euros for DNA-barcoding the entire collection.
10. Yes. Last year I spoke (on the phone) to a representative of the main funding body in the Netherlands for scientific research, NWO, and she seemed marginally interested in (culture) collections. This conversation was in relation to the EMbaRC Letter to granting bodies (NA 3), for the purpose of increasing interest with funding bodies to stimulate grant recipients to deposit more cultures in BRCs. It seems that NWO is currently only interested in developing long-term repositories for electronic datasets generated by NWO grant recipients. Through MIRRI, we need to bring microbial collections on the agenda.
11. Yes, we sincerely hope so!

BRC name : Micoteca da Universidade do Minho (MUM)

1. MUM is hosted by University of Minho and It is not independent
2. The MUM budget is controlled by the hosting institution
3. MUM has a business plan that is discussed and approved by the Rector of UMinho
4. YES
5. YES
6. NO, it is important but never enough
7. A much more strong mutual understanding and trust… this take time and it is very vulnerable to changes of contact persons/administration policies
8. YES. The Portuguese Societies of Microbiology (SPM) and the Biotechnology (SPBT) are key elements to the development of BRCs concept. In both cases I know well the Presidents and myself work with the 2 societies (on the board). MUM has the privilege to have this strong contact with the scientific societies and the TOP grants used from the Portuguese researchers reflect this linkages (see attach files in portuguese)
9. YES. Very positive in the conceptual level but very modest in actions (mainly if the actions involve money)
10. YES. Very positive in the conceptual level but very modest in actions (mainly if the actions involve money)
11. YES: MUM was invited by the Portuguese government to submit a plan for the future of BRCs. This action is a consequence of MIRRI.

BRC name: Spanish Type Culture Collection (CECT)

1. Hosted by an institution
2. The expenses (but not the fees) are controlled by the hosting institution
3. The answer to the first two questions is YES (they are not incompatible) and it is NO for the third one
4. Yes
5. Yes
6. No

7. Multiple and coordinated actions are likely to be more successful than single-sided actions
8. The answer is YES to all questions except for the last one that would be 'it has probably a moderate influence' (web site is http://www.semicrobiologia.org/)
9. Yes, but their position was less supportive than we expected or desired
10. Yes, but their position was ambiguous
11. Yes, but the final impact for each separate BRC is still unknown

BRC name : DSMZ

1. Independent not-for-profit institution on its own, largely government funded
2. See above; our governing body has clear control on all budget; we have to pass on to them all incoming funds that exceed a certain limit
3. We are urged by our funding bodies to design such strategies
4. Yes and no: e.g. a research grant can only pay for research and cannot support the service part of the collection. Though own research is important for a collection still the problem remains to have sufficient staff to do the 'real' work
5. Yes and no – depending on staff time available; additional work needs to be carried on by someone, see above
6. Yes
7. O
8. Yes – <www.vaam.de> members of our BRC are active in that society; however, it is still difficult to reach the acknowledgement of the 'pure' scientists, the researchers, some of who think that collection work is of marginal importance; needs to be improved
9. We have two government representatives in our Governing Board but this does not help with specific problems. The problem is that the subjects of BRCs are spread over about seven ministries and there it is difficult to reach the relevant persons. They tend to point to each other and shift responsibilities to the other
10. We will have to try with the national science foundation – but as said above research money pays research; to allocate money to service work (deposit, authentication, preservation, maintenance, storage) is difficult; but there might be a future chance in MIRRI
11. May be not directly but the indirect benefit of visibility and, if MIRRI is successful, the potential placing on the national roadmap of the issue of BRCs might alert responsibles to understand the needs of well funded resource providers

BRC name : INRA-CIRM BIA

1. Hosted by an institution, INRA
2. The expenses and the fees are controlled by the hosting institution; however, basically the BRC can use freely the fees obtained from its activity
3. No strategic plan excepted to increase the participation to research public or private contracts.
4. Yes
5. Yes
6. No
7. Multiple and coordinated actions are likely to be more successful than single-sided actions
8. The answer is NO to all questions (web site is http://www.semicrobiologia.org/)

9. No, but we would like too
10. No, but we would like too
11. Yes, but the final impact for each separate BRC is still unknown

BRC name : INRA-CIRM Levures

1. Hosted by an institution
2. Not independent for general expenses, my BRC contributes to general expenses but any income specific to the BRC (grants, services…) is left to the BRC
3. Yes for my BRC (a simple one…)
4. Yes
5. Not sure of what you mean, are you talking about getting more grants ? or increasing the type of activities ? In that case, it can only be achieved if staff increases
6. Yes and no: my BRC is reasonably known, but this is not sufficient to have funding from the industry
7. Providing more biological resources and expertise from our side/ Supporting public/private initiatives from my institution / Showing interest in research project involving BRCs from the bio-economy sector
8. SGM / No to all the questions, although I would not know for sure about the last question…
9. No, it is hard enough to talk with our bosses about biological resources… Now, what about FRB ?Some BRC heads art part of the Scientific
10. No
11. No, just look at the exemple of BioBanques: unless a real policy towards genetic resources preservation is set up

BRCname : **CIRM-CF**

1. Hosted by an institution
2. We have not. They are controlled even if specific incomes are left to the BRC.
3. Not really
4. Yes
5. Yes
6. Connection of CIRM-CF with industry/bioeconomy is still in its infancy
7. From our side: by increasing our microbial resources; thanks to a better communication/From our institution: by making this connection easier
8. Yes there is (SFM). No, no, no …
9. No
10. No
11. No, but we hope that networking will improve our readability!

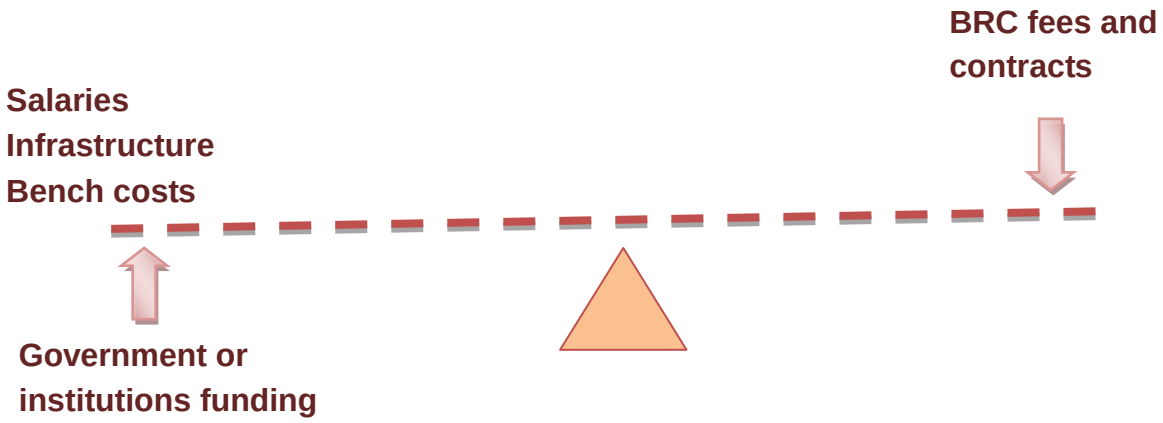
BRC name : CIRM-BP

1. hosted by an institution
2. We have our own budget which is controlled and checked by the hosting institution
3. No strategic plan
4. yes

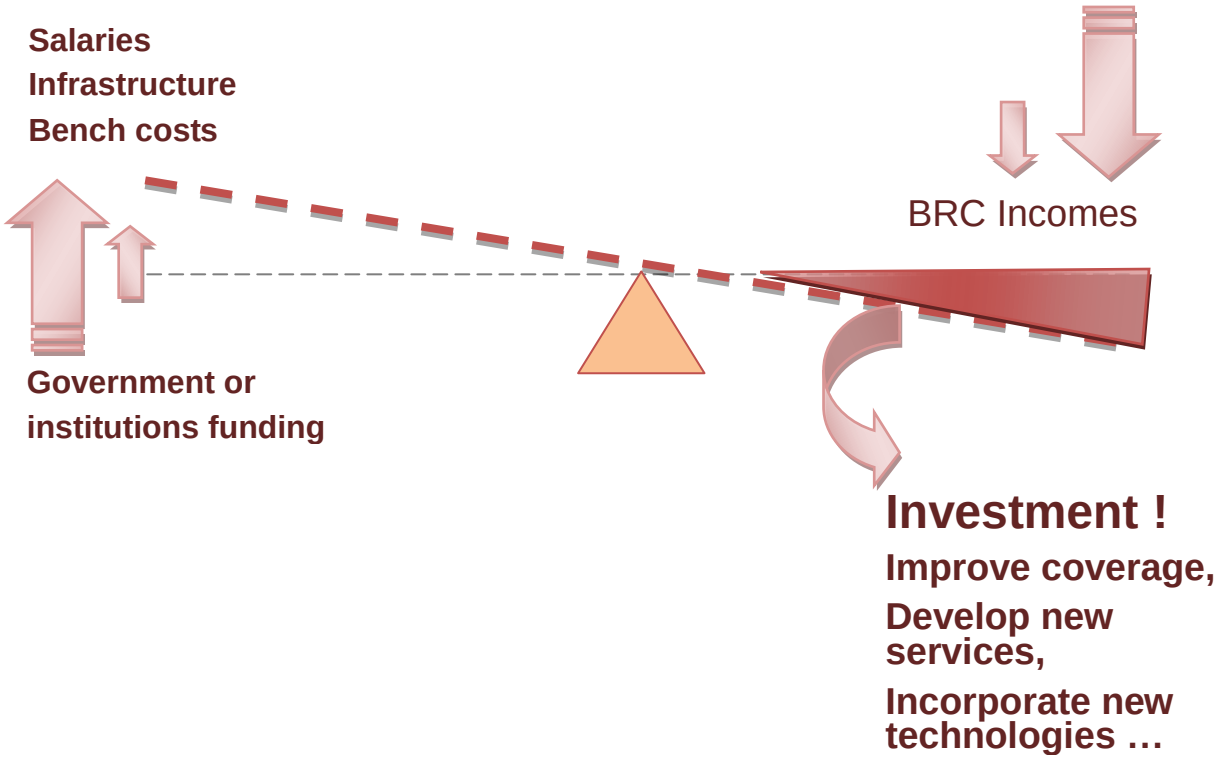
5. yes
6. Difficult to say as for increasing the connection and assume it, we should also increase our time work dedicated to industry and we would need more staff to do it
   We could perhaps increase our communication dedicated to this sector to increase their knowledge about what we are doing and what we could develop… sending some flyers and organizing some meetings to explain it
7. Yes, I do not know the director personally and never exchanged with him about BRC/not sure about that
8. No
9. No
10. I hope but in the context of international crisis, it is not sure!

Annexe 2 : schema of BRC sustainability

Situation A



Situation B : Objective to reach



Annexe 3 : **The example of CABI-BRC business plan**

Background

The long-term sustainability of a BRC will require the generation of income lines that are traditionally culture sales, contracted services, contracted research and sponsorship. In addition to this the BRC should seek exploitable Intellectual Property (IP) through the characterisation and screening of its holdings to generate significant income through commercial utilisation. Culture sales together with preservation contracts income would be insufficient to cover the BRC running and maintenance costs. Competition for culture provision is severe world-wide not only from other biological resource centres but because more organisms are exchanged between individual scientists free of charge than are obtained from collections. To support a living collection through culture sales would take a major shift in scientist behaviour, which is impossible for one collection to achieve on its own. Culture sales will remain one source of income but other mechanisms will have to be found. The BRC should have a goal to spin off biotechnology companies to become sustainable. Screening for potential properties for exploitation will require investment and time and until this can be done systematically the collection must utilise a range of income opportunities for financial self-sufficiency. To attain a level of income that will allow expansion and development in the medium term will require a portfolio of new products and services, mechanisms for funding a conservation role and increased competitiveness in securing research funding. Future financial security for the BRC will depend upon the recognition that it is a Biological Resource Centre as defined by the OECD Biological Resource Centre Initiative providing much more than the biological resource with information, expertise, facilities and its role in knowledge generation. The BRC must find a mechanism to support all its activities to enable it to maintain its collections, expertise and fundamental research. This strategy outlines the medium term mechanisms for achieving a sustainable business strategy for a BRC.

1. Key assumptions

- The BRC owners allow it operate commercially and that it has initial core funding and investment.
- The long-term operation and the stored biological resource collection can be financially supported by the commercial utilisation of biodiversity.
- Funding will be made available for countries to meet their Convention on Biological Diversity (CBD) obligations.
- The OECD Biological Resource Centre Initiative provides an improved environment for biological resource collections to operate and give the collections advantages over the free exchange of biological resources between scientists.
- Exploitable IP is discovered within the BRC biological resources.

2. Mechanisms of financial support for the BRC

Commercial

Development and ownership of spin-off biotechnology companies
Sale of products and services
Bioinformatics – production of a database to provide microbial solutions to world problems
Provision of consultancy/training services

Research Programme funding

A series of projects to meet donor requirements
Development and funding of several large projects that bring together the full range of the BRC competencies and links them to strategic partnerships to achieve national and international Biodiversity Plans
Engage Research Programme Funders to protect their investments by paying for deposits in the BRC

Government department support

Provision of services to Government's to help them achieve their conservation and utilisation of biodiversity commitments, their environmental policies and their commitment to millennium goals.

Sponsorship

Seek a single or a consortium of investors to establish a characterisation laboratory with facilities and expertise to characterise the BRC holdings and identify exploitable IP to ensure long-term sustainability.

3. The market for microbial genetic resources

Biotechnology has harnessed living organisms in bioremediation or detoxification of polluted sites, biodegradation of waste, biocontrol, production of useful chemicals, such as enzymes, biocides, drugs and dyes and in processes such as biotransformations and as food. Micro-organisms will provide even more solutions to our problems in the environment, health, agriculture and the economy. At a time when natural resources are being depleted and alternative sources of energy and food are being sought, microorganisms will provide answers. Action must be rapid because we are also in a period of exploration of microbial potential against a background of rapid species depletion.

The economic value of biodiversity

Data form ten Kate & Laird (1999) demonstrates the value of the commercial use of biological diversity. Pharmaceuticals: more than half of all prescriptions filled in the USA in 1993 contained at least one major active compound now or once derived or patterned after compounds derived from biological diversity. 42% of sales of the 25 top-selling drugs worldwide are biologicals, natural products or entities derived from natural products. The annual global sales of medical drugs are currently £200 billion a year. However, of every 5000 – 10000 products screened only one becomes an approved drug. Biotechnology may speed bioassays and the production of new drugs, explain more accurately how drugs act in the human system and may reduce the vast costs of pharmaceutical research and development. The annual market for industrial detergent enzymes is £0.5 billion. Bioremediation of soil in the EC in 2000 was considered to be worth £40 billion. There are huge revenues from fungal derived drugs e.g. cyclosporin, £0.8 billion: clarithomycin, £0.9 billion and amoxicillin £1 billion. As it is not uncommon to find that 15-30% of fungi found in the tropics or in unexplored environments are unknown to science the potential is enormous.

The Eighth Annual European Life Sciences Report 2001 produced by Ernst & Young demonstrates the importance of the biotechnology industry in economic growth and human welfare. The report covers only the entrepreneurial life science companies that use modern biological techniques to develop products or services to serve the needs of human healthcare or animal health, agricultural productivity, food processing, renewable resources or environmental affairs. Medical device and large pharmaceutical companies are excluded from the figures. In Europe 105 new companies were established in 2000 and a total income of 8.68 billion Euro (US$ 7.64 billion) realised with a growth rate over the year of 38%. Figures for the USA saw 300 new companies established with a growth rate of 10% and total revenue (again without the large Pharmaceutical companies) of US$18.9 billion. Biotechnology is providing solutions in many fields most particularly in health care.

Opportunity: To establish spin off biotech companies to harness microbes with potential in the BRC
Need: To characterise strains accessed by the BRC to realise their potential and secure IPR

This will be a long-term goal as it can take many years to take new products to the market place. This will also require significant investment. The potential should attract funders to enable the discovery of products but the BRC must maintain significant ownership in order to plough back a major part of profits into supporting its biological collections, characterisation and its biosystematic activities. The generation of data at the phenotypic and genotypic levels to help us understand and utilise biodiversity better is of great value. The BRC needs to identify a specific niche and acquire some of this funding to finance information generation.

Seeking the technology or property on which to base products of a spin-off company and creation of the bioinformatics database rely on the same basis. Facilities and manpower to characterise the holdings of the BRC. Whilst seeking the mechanisms to achieve this on the large scale the collection must identify a mid term strategy for financial security. This can be partially based on the continuation of funding agreed through the project. Utilising the mechanisms for financial support for BRC outlined above and the strengths and opportunities outlined below an action plan for sustainability can be identified.

The argument for Government support

There are several national and international initiatives that require Government action to secure the future long-term advantage and enhanced quality of life that centre on the understanding, conservation and utilisation of biodiversity. They include:

- **OECD Biological Resource Centre Initiative**

This OECD Initiative was established in 1999 to try and secure the future of microbial resource collections. Since then the definition has broadened to include a wider range of organisms. A report of the first phase was published in March *2001 Biological Resource Centres Underpinning the future of life sciences and biotechnology* and made a call for action by OECD countries and beyond. The report recommends that governments, the scientific community and the private sector work together to achieve five goals:

(i) Establish national BRCs

Selectively seek to strengthen existing *ex situ* collections of biological data and materials and, when needed, create new collections, including in non-OECD countries, and raise those collections to the quality required for accreditation as national BRCs.

(ii) Develop an accreditation system for BRCs based on international criteria

Support the development of an accreditation system for BRCs based upon scientifically acceptable objective international criteria for quality, expertise and financial stability.

(iii) Create international linkages among BRCs

Facilitate international co-ordination among national BRCs by creating an agreed system of linkage.

(iv) Co-ordinate standards, rules and regulations taking BRCs into account

Take into account the objectives and functioning of BRCs when establishing and harmonising national or international rules and regulations.

(v) Establish a global BRC network

Support the establishment of a global BRC network that would enhance access to BRCs and foster international co-operation and economic development.

The second phase has been initiated to put together an implementation plan.

- **The Convention on Biological Diversity (CBD)**

The CBD aims to encourage the conservation and sustainable utilisation of the genetic resources of the world and has a number of articles that affect biologists. These cover:

- Development of national strategies for the conservation and sustainable use of biological diversity
- Identification, sampling, maintenance of species and their habitats and the production of inventories of indigenous species
- Encouragement of *in situ* and in-country *ex situ* conservation programmes
- Adoption of economically and socially sound measures to encourage conservation and sustainable use of genetic resources
- Establishment of educational and training programmes and the encouragement of research
- Commitment to allow access to genetic resources for environmentally sound uses on mutually agreed terms and with prior informed consent
- Fair and equitable sharing of benefits and transfer of technology resulting from exploitation of genetic resources
- Exchange of information
- Promotion of technical and scientific co-operation

The CBD requires that Prior Informed Consent (PIC) be obtained in the country where organisms are to be collected before access is granted. Terms, on which any benefits will be shared, must be agreed in advance. The benefit sharing may include monetary elements but may also include information, technology transfer and training. If the organism is passed to a third party it must be under terms agreed by the country of origin. This will entail the use of material transfer agreements between supplier and recipient to ensure benefit sharing with, at least, the country of origin. Many biological resource centres or culture collections have operated benefit sharing agreements since they began, giving organisms in exchange for deposits and re-supplying the depositor with the strain if a replacement is required. However, huge rewards that may accompany the discovery of a new drug are illusory as the hit rate is often reported as less than 1 chance in 250 000. In the meantime, access legislation and the hope for substantial financial returns from isolated strains are restricting the free deposit in public service collections and the legitimate free movement of strains. An EU DG XII project, Micro-organisms Sustainable Use and Access Regulation International Code of Conduct (MOSAICC) is developing mechanisms to allow traceability and enable compliance with the spirit of the CBD and with national and international laws governing the distribution of micro-organisms, whilst not restricting scientific goals (Davison et al., 1998). The development of such common procedures is an evolutionary process and the co-ordinators of this project have placed the document on their web site and amend it as it develops (http://www.bccm.belspo.be).

The CBD places obligations on the signatory countries to conserve and sustainably utilise their biodiversity. This is a driving force for Governmental CBD Focal Points to assist *ex situ* collections meet these national obligations.

- ***Strengths, uniqueness, opportunities and weaknesses***

The BRCs capacity, power to influence in terms of expertise, facilities, location must be identified.

- **Goals (objectives) and Strategies - must be established**

Science Goals
Science Strategy
Projects/products/services Goals
Projects/products/services Strategies
Finance Goals
Finance Strategy

- **Justification for income levels**

Utilising the potential of the collection holdings to generate new products. Projects related to country obligations to implement the Convention on Biological Diversity and placing the BRC to take a lead role for Africa in the OECD Global BRC Initiative will secure project funding for the immediate future. The BRC will need to operate to recognised standard procedures putting into practice the OECD BRC Initiative recommendations. In the long-term the new products and added collection value generated income will come on line. Learning from experiences of established collections will no doubt enable the BRC to spin off new biotech companies to provide added revenues to support the Science at the BRC. Funding sources for implementing biotechnology solutions in local industries and utilising the new Biotech Funding that is available world-wide can provide the pump priming investment. A significant investment will be required to characterise the entire collection holdings but this can be done in targeted bites.

Actions to implement the BRC Business Plan

The BRC's future relies upon harnessing its full potential and unique position to achieve financial security.

BRC income

The key income lines in the short-term are:
1) Culture sales and preservation contracts
2) Development of new products

3) Project income
4) Subscription for some information services e.g. Information to accompany culture sales, etc.
5) Consultancy and training services

1) *Culture sales and preservation contracts*
(i) Establish Promotion and Marketing Strategies for collection products and services
(ii) Distribute electronic and where necessary hard copy catalogues
(iii) Develop business opportunities

2) *Development of new products*
(i) Develop new products and improved delivery and packaging systems for micro-organisms.
(ii) Initiate isolation programmes to get new and interesting strains into the BRC.

3) *Project income*
(i) Submit high quality project proposals to advance the BRC strategy.

4) *Preparatory work for future commercial exploitation of BRC holdings*
(i) Develop a plan to characterise the BRC holdings to add value and discover IP for exploitation.
(ii) Attract investment to cover the BRCs conservation role.
5) Consultacy and training services

Summary

The details of the plan can be developed when the focus of the BRC is agreed and the strengths, weaknesses, threats and opportunities are identified. Critical partnerships need to be developed to achieve:

- Trained human resources
- Expert advice
- Filling of gaps in expertise and facilities
- Financial backing
- Business partners

Some suggested initial partners or links:

GBRCN
World Federation for Culture Collections (WFCC)
Government Departments
Scientific societies
Industry
Local communities

Significance of this deliverable

This deliverable summarizes the first collective work concerning BRC business plan. The initial questionary revealed that most of the partners did not develop any strategy. The discussions within the network allowed to build a first basis of a generic approach, that could be now further developed and validated within MIRRI.