ShareBiotech

An Overview of the Irish Biotechnology Sector & its Position within the Atlantic Area

2011

Abstract

Innovation is a critical ingredient of national competitiveness, and investment in research and development (R&D) is a key component of innovation. In seeking to support the longevity of firms in high tech industries, much research effort has been directed at understanding the needs and barriers to the growth and development of these firms. One industry regarded as vitally important to most national economies is biotechnology. Utilising data from the Share Biotech project – an Atlantic Area cooperation project to promote transnational networks of innovation and entrepreneurship within the biotechnology sector – this paper presents a profile of the Irish biotechnology sector within the context of the wider Atlantic area. It was found that within the Atlantic area, Irish biotech firms perform well in terms of exports and patent activity, but less well in network participation. It was also found that Irish biotechnology have higher technical needs then their Atlantic area counterparts.

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INNOVATION NETWORKS

ATLANTIC AREA

European Union

European Regional Development Fund

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1. Introduction

Biotechnology is a broad sector and encompasses all modern biotechnology techniques and capacities, but also many traditional and borderline activities. As such, definitions of biotechnology tend to be open-ended. The OECD provides the following definition of biotechnology: "The application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services". Given the wide spectrum of activities and sectors in which biotechnology may be used, an OECD foresight exercise (OECD, 2009) acknowledges that biotechnology based innovation 'offers technological solutions for many of the health and resource-based problems facing the world. The application of biotechnology to primary production, health and industry could result in an emerging "bioeconomy" where biotechnology contributes to a significant share of economic output (…). Indeed, the sector is targeted by many regions and nations as one of the new industries with the highest potential in the twenty-first century (Zhang et al., 2011; Ireland and Hind, 2007). However, for such a bioeconomy to emerge, research is required to understand the needs and barriers to the growth and development of these firms.

With regard to needs, the OECD highlight the creation of new biotechnology companies and academic spin-offs which highly invest in R&D and Intellectual Property Rights (IPR) and the increased rates of biotechnology techniques and capacities - technology convergence - within more established industries (OECD, 2009). In terms of barriers, research has also pinpointed the financial and human capital burden for companies in engaging in the near-constant R&D process required to remain commercially viable (Batchelder and Miller, 2006). The difficulty in accessing state of the art technology couples with a lack of management knowledge, which is inherent ito all young industries, and the difficulties in overcoming the competition of more established industries, such as pharmaceuticals, agricultural and industrial chemicals, in bringing new products through the research and development (R&D) pipeline.

"ShareBiotech - Sharing life science infrastructures and skills to benefit the Atlantic area biotechnology sector" is an Atlantic Area cooperation project that aims to promote transnational networks of innovation and entrepreneurship within the biotechnology sector by focusing on the development of knowledge transfer between research centres and firms.

Specifically, the project seeks to establish a network of public and private scientific infrastructures and competencies to consolidate research, development and innovation within the biotechnology sector. It is believed that the establishment of this network will help strengthen the contribution of the biotechnology sector across the regional economies in the Atlantic Area and help overcome some of the identified needs and barriers to R&D within the sector.

The initial task of the ShareBiotech project is to assess whether the competencies and infrastructures demands of each biotechnology sector are currently being met. The demand analysis in the project will try to understand two particular kinds of actors, the research groups and the firms. ShareBiotech aims to implement two methods to reduce the demand-offer gap within the biotechnology sector. These two methods are: i) giving access to technologies by providing aggregated services in terms of infrastructures and competencies, and, ii) engaging stakeholders, firms and academic research, into collaborative projects. However, while the SBT project aims to

examine both Research Groups and companies, the aim of this particular document is to provide an overview of the companies within the Irish biotechnology sector.

2. Introduction to the Partner Regions and Methodology

2.1 Introduction to the Partner Regions

The ShareBiotech partnership included the following NUTS II level (Nomenclature of Territorial Units for Statistics) in the Atlantic Area:

1. FR52 - Bretagne (France)
2. FR51 - Pays de la Loire (France)
3. IE01 - Border, Midland and Western - BMW (Ireland)
4. IE02 - Southern and Eastern (Ireland)
5. PT16 - Centro (Portugal)
6. PT15 - Algarve (Portugal)
7. PT11 - Norte (Portugal)
8. ES22 - Comunidad Foral de Navarra (Spain)

It is important to note that, due to the geographical size of Ireland, both NUTSII regions – the Border, Midlands and Western region (BMW) and the South Eastern region (SE) were included in the project (Fig. 1). This means that for Ireland a national level representation of the biotechnology sector was achieved.

BMW Region:

Donegal, Sligo, Leitrim, Cavan, Monaghan, Louth, Galway, Mayo, Roscommon, Laois, Offaly, Longford and Westmeath.

SE Region:

Meath, Dublin, Kildare, Wicklow, Carlow, Wexford, Waterford, Kilkenny, Tipperary, Claire, Limerick, Kerry and Cork.

Figure 1: BNW & SE Regions of Ireland (BMW Assembly, 2012 & SE Regional Assembly, 2012)

Table 1 presents a set of indicators across 4 key parameters – population, economy, employment and innovation for the eight regions within the SBT project. This data is used to give a general overview of the characteristics of the NUTSII regions analysed by the ShareBiotech project. In terms of population there is a large discrepancy between regions with some having more than 3 million inhabitants (Bretagne, Pays de la Loire and Norte) and others around half a million inhabitants (Algarve and Comunidad Foral de Navarra). In relation to economic indicators both Irish and Spanish regions have stronger performances in GDP relative to the EU-27 countries compared to the Portuguese and French regions. However, it is important to note that but the World economic crisis (2008 to present) has had a dramatic impact in the Atlantic Area regions. Regarding employment, the employment rate is higher in the Centro region, Algarve and South East region of Ireland. Employment in high-technology sectors and human resources in science and technology in both French regions, Spain and the South East of Ireland are clearly higher than other ShareBiotech regions. In the area of innovation and R&D, Navarra and Bretagne have the highest R&D expenditure as a percentage of regional GDP, while Navarra Bretagne and Comunidad Foral de Navarra have the highest level of patent applications.

Table 1 Regional Indicator's – Population, Economy, Employment, Innovation

	Population 2008	GDP 2008 (EU 27 = 100)	Employment Rate 2008 (20-64)	Human resources in Science & Technology 2008	Total Expenditure on R&D	Patents 2008
	'000		%	% of overall employment	% of Regional GDP	Applications per million inhabitants
Bretagne	3.161	94.8	72.7	20.3	1.57	309.1
Pays de Loire	3.524	97.8	72	19.1	0.88	141.7
Border, Midland and West	1.189	99.2	71.6	15.8	1.29	198.8
South East	3.236	166.1	73.5	19.1	1.28	136.4
Centro	2.385	64.4	77.2	8.2	1.06	29.6
Algarve	0.428	79.6	74.2	8.4	0.37	9.5
Norte	3.745	60.3	71	9.7	1.01	22.8
Comunidad Foral de Navarra	0.61	132.2	73.7	19.4	1.88	220.8

2.2 Methodology

With the increased recognition of the potential benefit to regional and national economies of developing a bio-economy, there has been growing interest across countries in understanding the needs and barriers to developing a commercially viable biotechnology sector. However, as outlined above, given the broad range of techniques and activities undertaken by biotechnology firms and interdependencies between the biotechnology sector and other traditional economic sectors, one standard definition of what constitutes a biotechnology sector currently does not exist. This lack of definition therefore has meant that national economic datasets do not explicitly contain a biotechnology sector. Thus, to identify the needs and barriers within the biotechnology sector a five step methodology is required:

1. Define the industry segments that are part of the biotechnology sector (OECD, 2009);
2. Identify companies within the sector (Enterprise Ireland, 2010 & 2011);
3. Collect the required survey information (survey template appended for reference);
4. Record the indicators of interest (OECD, 2011);
5. Ensure consistency of data across different data and country-specific sources, compile the data and provide sectoral and cross country breakdowns of the value of the biotechnology sector.

With regard to step one, following the definition of the biotechnology sector produced by the OECD (2009), the SBT project classified the biotechnology sector into 12 domains (Tab.2)

The biotechnology companies were located (step 2) through:

1. Scrutiny of existing Irish databases (Enterprise Ireland, 2010 & 2011);
2. From other reports and surveys that reported biotechnology activities (Morrissey et al., 2010).

A survey was then administrated to the selected companies and the required information was collected across each partner region. On completion of the data collection process, all the indicators of interest were recorded.

Finally, the resulting dataset was checked for consistency and compiled to provide sectoral and cross country breakdowns of the needs and barriers to R&D within the biotechnology sector in the Atlantic area regions. In total the SBT partnership surveyed 142 biotechnology companies. These included 43 French companies, 36 Irish companies, 52 Portuguese companies and 11 Spanish companies. This paper presents the main results of the company survey, specifically in relation to Ireland, with comparative analysis on the performance of the Irish biotechnology sector in relation to the other three European partner countries.

Table 2 - Biotechnology Domains as Classified by the Share Biotechnology Project

Biotechnology Domains
Human Health
Animal Health
Agriculture
Agrifood
Nutrition
Cosmetics
Environmental
Marine Science
Industrial
Bioenergy
Bioinformatics
Other

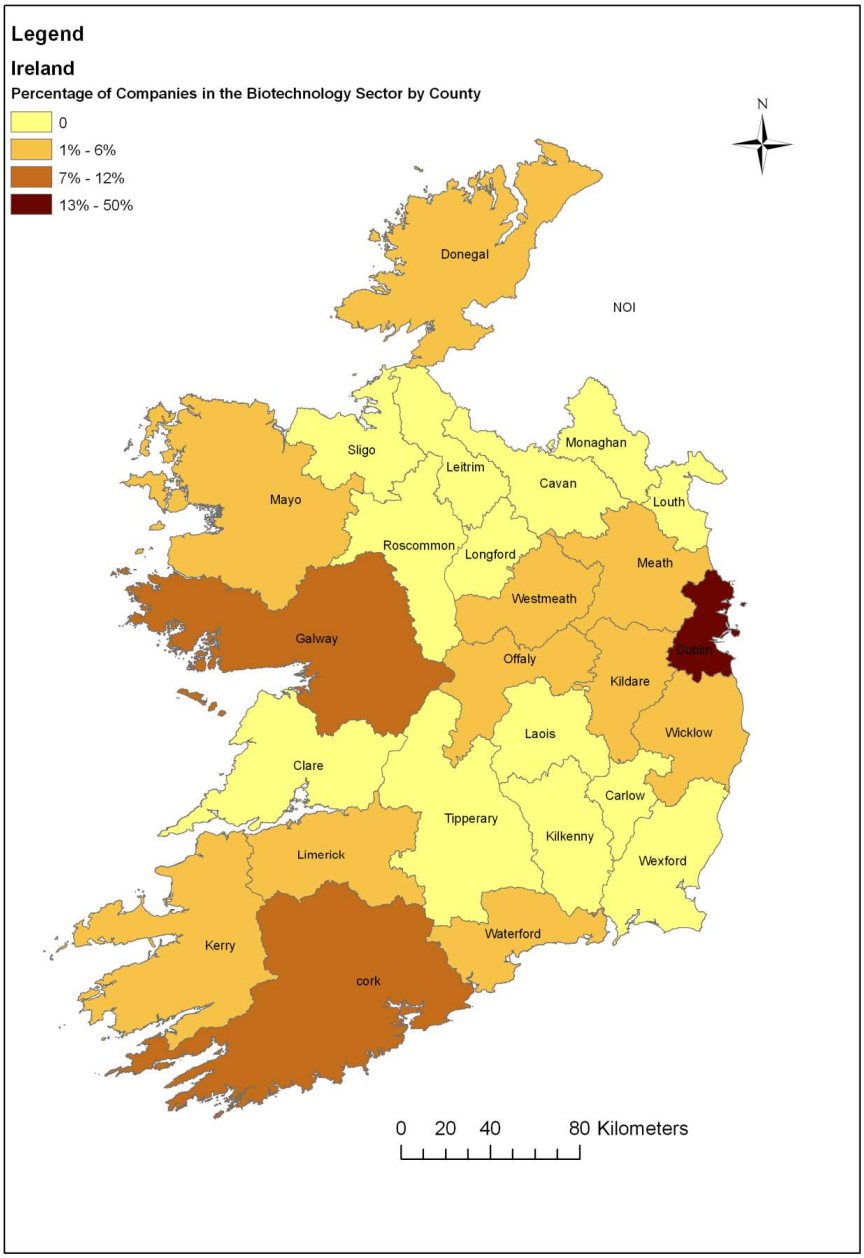
3. Results

3.1 Biotechnology Landscape in Ireland

All results pertain to the survey and data collected from interviewing the 36 Irish companies.

Figure 2 presents the percentage of biotechnology based companies by county in Ireland. From Figure 2, one can see that Dublin has the highest percentage of biotechnology companies (50%). Galway and Cork also have a high percentage share with between 7% and 13% of companies, respectively.

Figure 2 - Spatial Distribution of Biotechnology Companies at the County Level



At the National level, the main scientific domain of biotechnology companies that responded to the survey (Figure 3) was Human Health, with 84% companies partially or completely engaged in the human health sector. At the NUTSIII level, the Dublin region had the highest number of biotechnology companies and the majority of these operated within the human health sector. The West and South West had the next highest number of biotechnology companies and similar to Dublin both regions reported a high number of companies involved in the human health sector. However from Figure 4, one can see that in the West, the number of companies involved in agriculture and marine science are comparable to the human health sector. Figure 5 presents the main biotechnology domain across the four Share Biotechnology partner countries. Similar to Ireland, human health was the most common biotechnology domain in all ShareBiotech regions, with the exception of the Algarve where the most represented domains were Environment and Industrial Processing.

Figure 3 - Percentage of Irish Biotechnology Companies by Domain

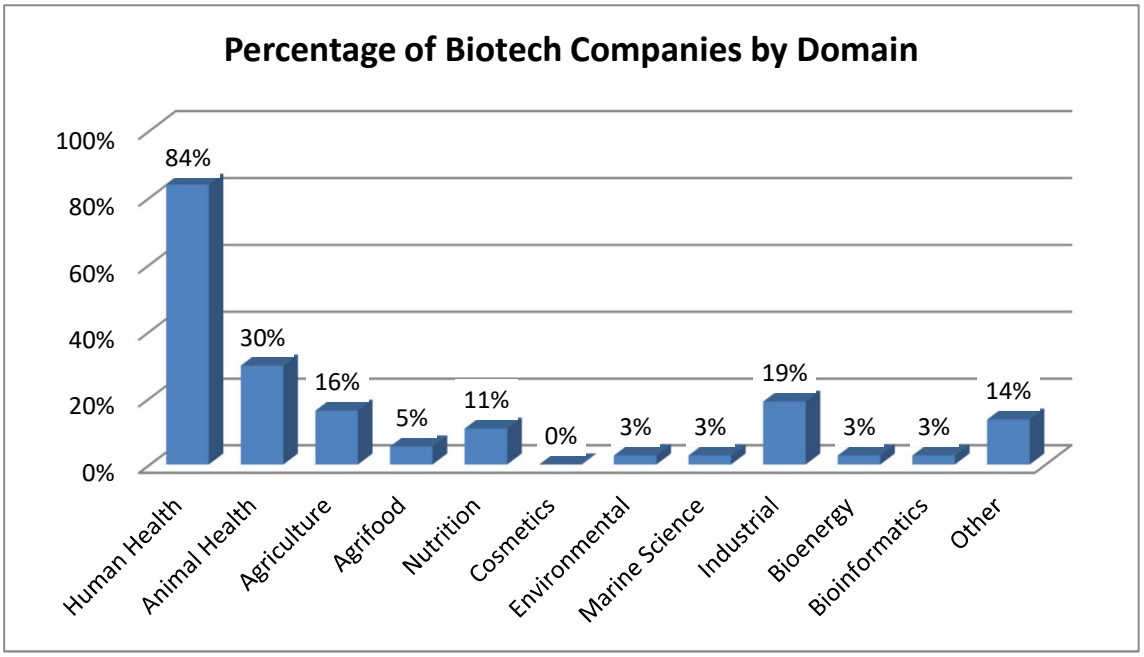


Figure 4 - Irish Biotechnology Companies by Domains at the NUTSIII Region

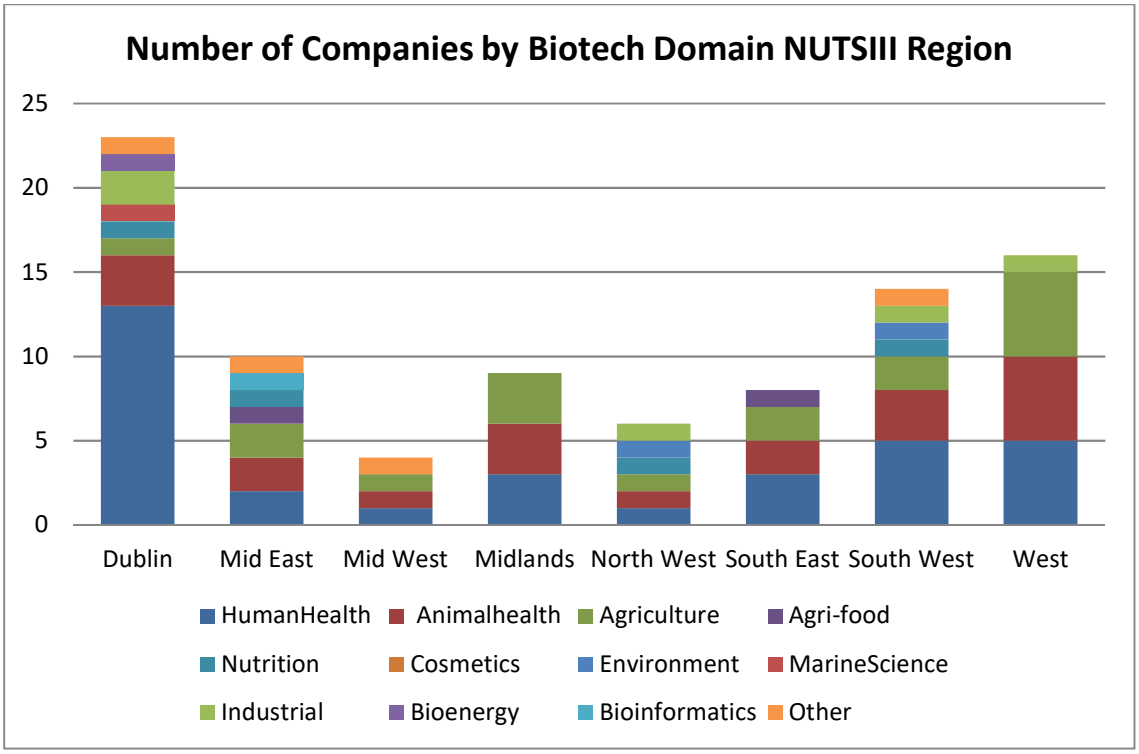
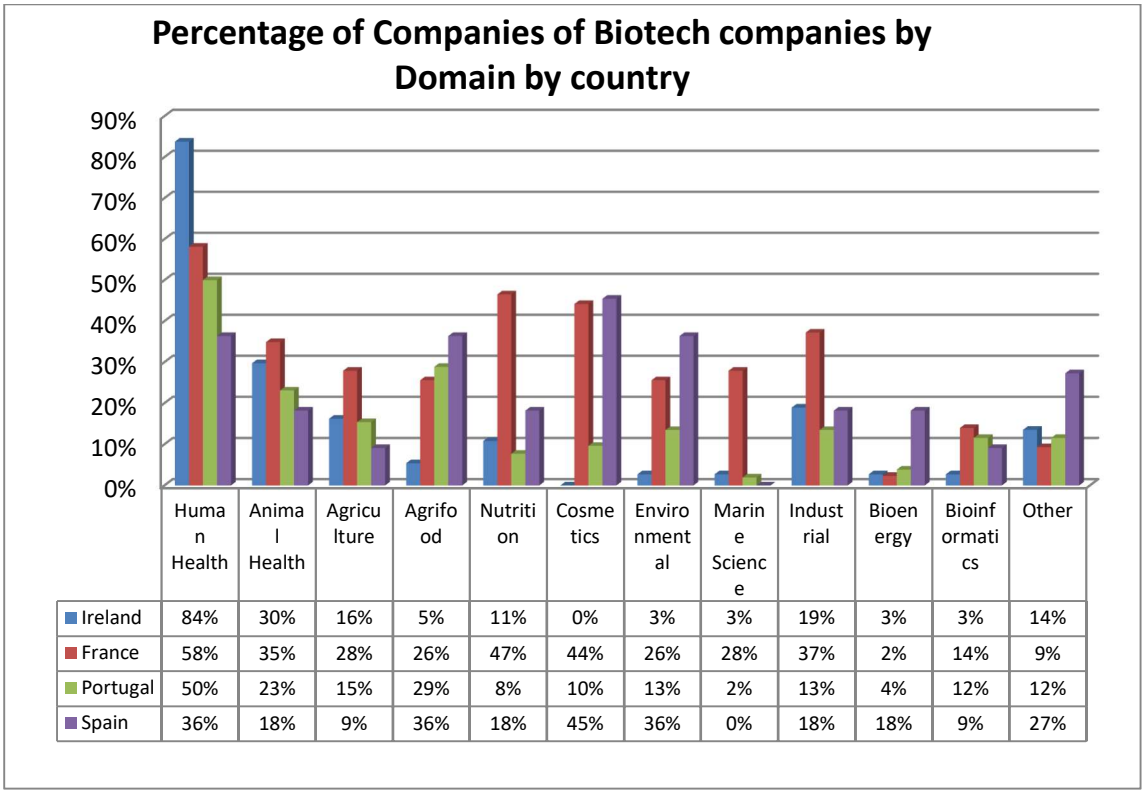


Figure 5 - Percentage of Biotechnology Companies by Domain by Country



	Human Health	Animal Health	Agriculture	Agrifood	Nutrition	Cosmetics	Environmental	Marine Science	Industrial	Bioenergy	Bioinformatics	Other
Ireland	84%	30%	16%	5%	11%	0%	3%	3%	19%	3%	3%	14%
France	58%	35%	28%	26%	47%	44%	26%	28%	37%	2%	14%	9%
Portugal	50%	23%	15%	29%	8%	10%	13%	2%	13%	4%	12%	12%
Spain	36%	18%	9%	36%	18%	45%	36%	0%	18%	18%	9%	27%

Figure 6 presents the age profile of Irish biotechnology companies. From Figure 6, it is evident that growth in the sector has been moderate from the 1990s onwards. There was a wide age variety among the companies that were surveyed, with a four companies formed in the 1960/70's but most companies surveyed were formed from 1990 onwards making the landscape today a lot richer than it was thirty years ago.

Figure 6 - Biotechnology Company Formation in Ireland

Year of Creation	No. of Companies
1967	1
1969	2
1971	1
1990	2
1991	1
1992	2
1993	1
1996	2
1997	2
1998	4
1999	1
2000	2
2001	1
2002	2
2003	2
2004	4
2005	2
2006	3
2008	1

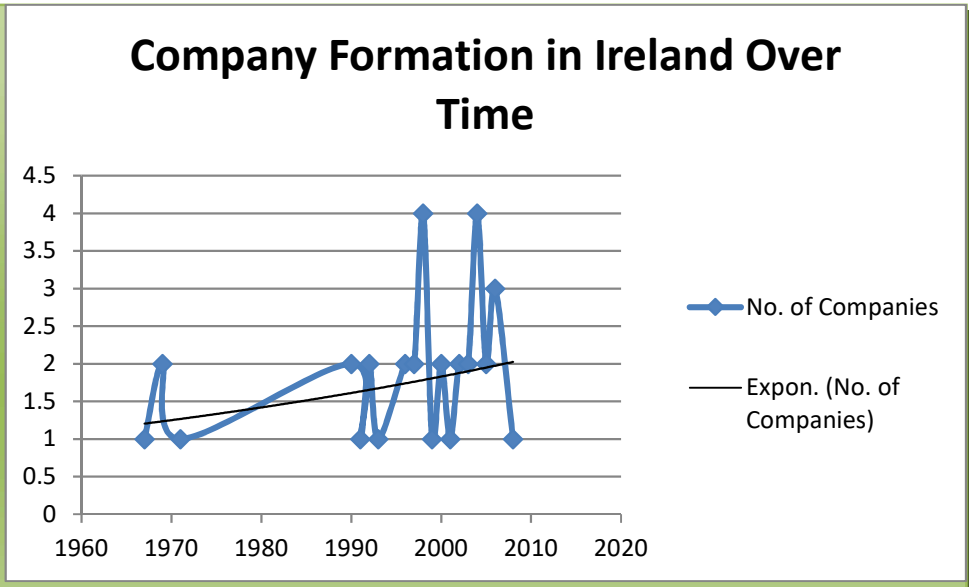


Figure 6 - Biotechnology Company Formation in Ireland

Figure 7 presents the number of companies by the employment size for each country. From Figure 7, one can see that the majority of companies in Ireland are SMEs and employee less than 25 people. This pattern is similarly found across the four SBT partner countries. Ireland has the highest number of companies in the 50-250 employee categories.

Figure 7 - Number of Companies by Employment Size Category by Country

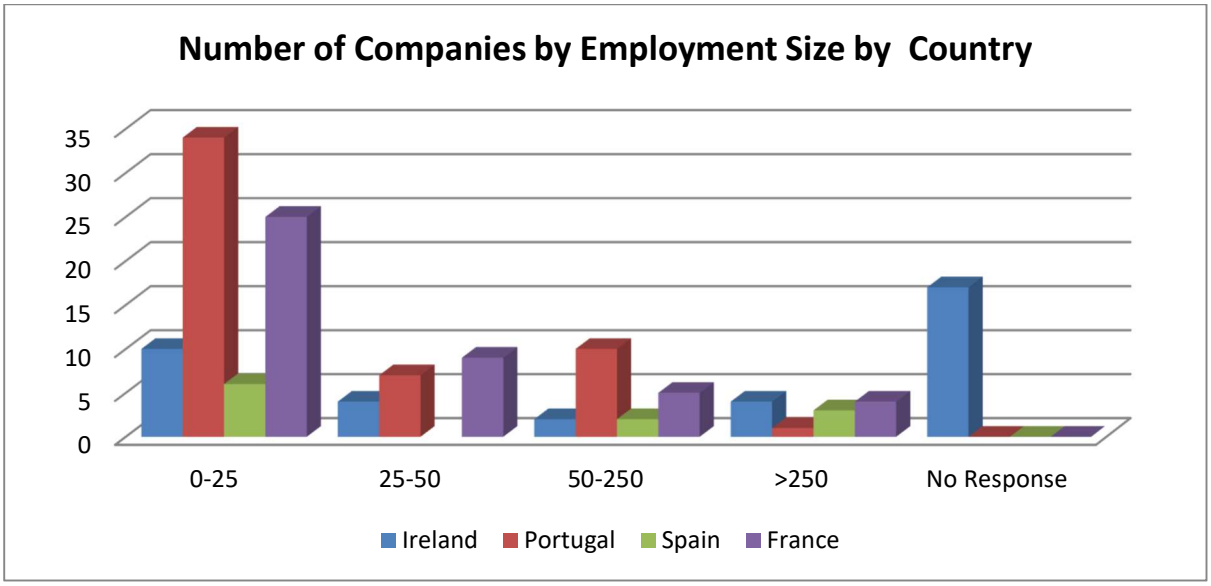


Figure 8 presents the market geographical orientation of biotechnology companies in Ireland. From Figure 8 one can see that all of companies surveyed sell their products nationally and within the EU (97-100%), with a respectable portion of the companies also selling outside the EU (91%). This reflects the typical Irish situation of a small open economy with high rates of exports, which characterises Ireland.

Figure 8 - Market Orientation of Irish Biotechnology Companies

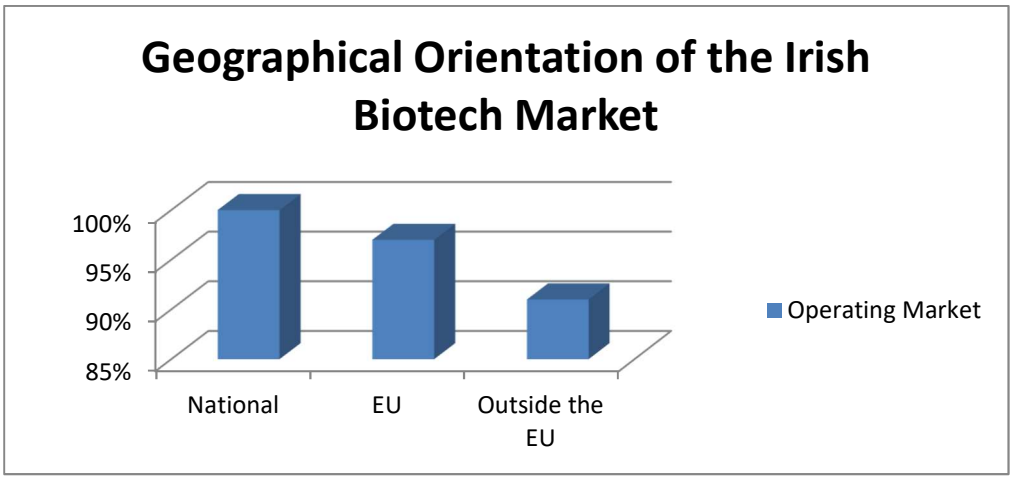
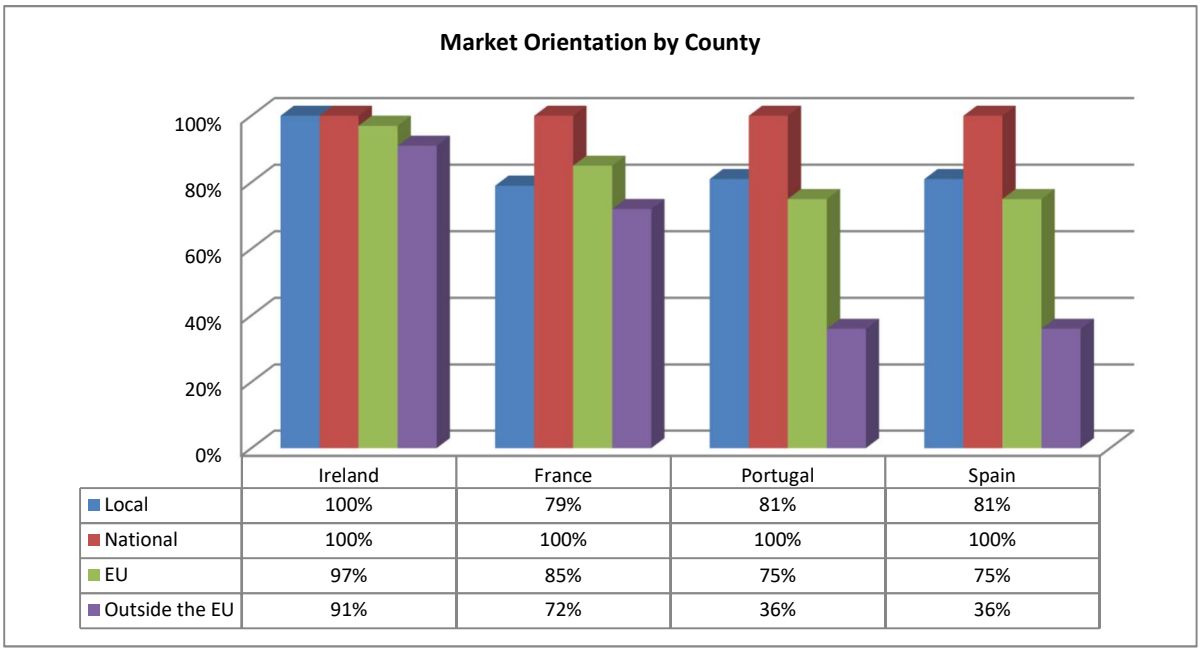


Figure 9 presents the market orientation of the surveyed biotechnology companies across the SBT partner countries. From Figure 9, one can see that Ireland has the highest percentage of companies trading outside their national and local markets. 91% of Irish biotechnology companies sell outside the EU, whilst only 72% of French companies and 36% of Spanish and Portuguese companies have expanded their markets outside the EU. This would indicate that Irish biotechnology companies are more outward focused compared to their EU counterparts.

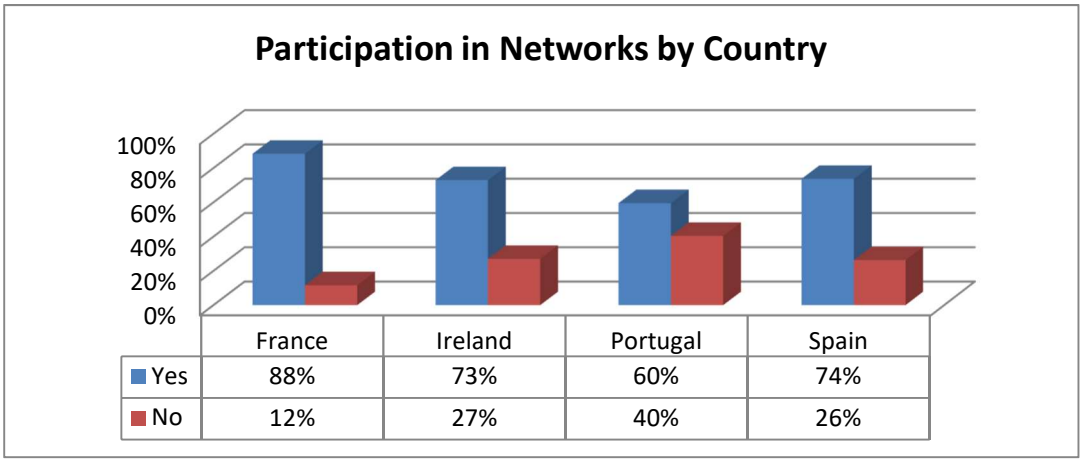
Figure 9 - Market Orientation by Country



	Ireland	France	Portugal	Spain
Local	100%	79%	81%	81%
National	100%	100%	100%	100%
EU	97%	85%	75%	75%
Outside the EU	91%	72%	36%	36%

Figure 10 continues by presenting the participation of the surveyed biotechnology companies in external networks (see Annex E) across the four SBT partnership countries. From Figure 10, it is clear that France has the highest percentage share of companies involved in networks (88%). Spain has the second highest (74%), which is very simular to Ireland at 73% and Portugal has the least amount of biotechnology companies involved in networks (60%).

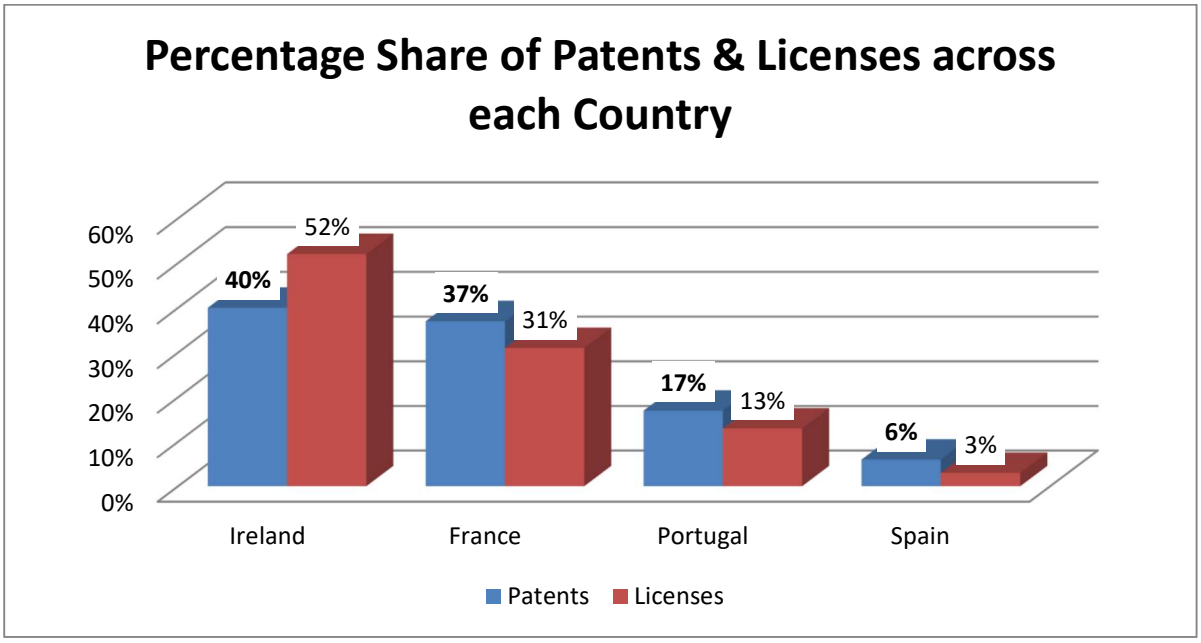
Figure 10 - Participation in Networks by Country



	France	Ireland	Portugal	Spain
Yes	88%	73%	60%	74%
No	12%	27%	40%	26%

Figure 11 presents the percentage share of patents and licenses across the four SBT partner companies. From Figure 11, one can see that Irish biotechnology companies have the highest percentage share of patents (40%) and licenses (52%). French companies have the next highest (37%), whilst Spain has the lowest (6%).

Figure 11 - Company Patents & Licenses across SBT Partner Companies



3.2 Needs and Barriers in the Biotechnology Industry in Ireland

Table 3 presents the barriers to R&D in Irish biotechnology companies as stated by the companies themselves. From table 3 one can see that all companies stated that the cost of engaging in biotechnology based R&D was a significant barrier to R&D activities in Ireland. 89% of companies stated that accessing the required technology and equipment was a significant barrier and 81% of companies stated accessing information was a significant barrier. The management and protection of Intellectual Property Rights also appears as significant obstacle to the commercialisation of research outputs (84%).

Table 3 - Stated Barriers to R&D in Irish Biotechnology Companies

Barriers to R&D in Ireland	Percentage
Costs	100
Access Technologies	89
Patent & Licensing Issues	84
Access Information	81
Other	81
Regulation	73
Access to qualified Human Resources	54
Public Perception	11

Table 4 presents the barriers to R&D across the four SBT partner countries as stated by the companies themselves. From Figure 13 it is evident that the cost of R&D was the highest stated barrier to engaging in R&D across the four SBT partner countries, with 79% of French companies stating it was a significant barrier, 77% of Portuguese companies and 72% of Spanish companies. In France, 51% of companies stated that regulation was a significant barrier. In Portugal, 77% of companies stated that access to information was a significant barrier and in Spain, 55% of companies stated that access to qualified human resources was a significant barrier.

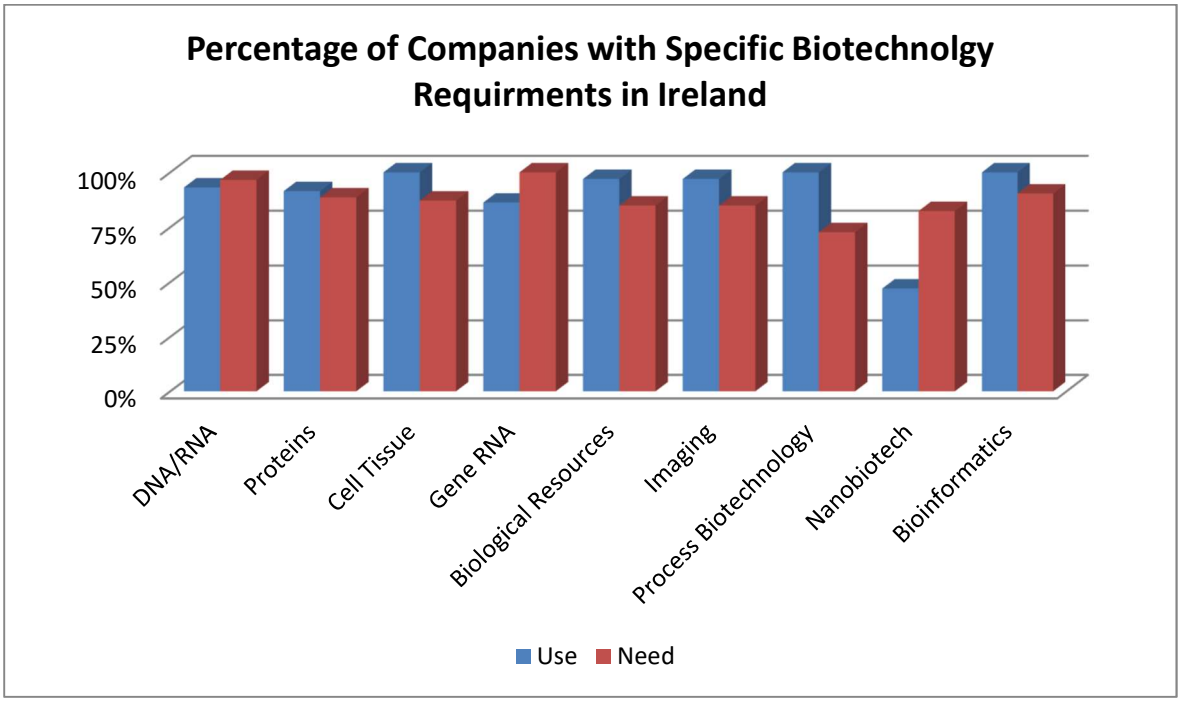
Table 4 - Stated Barriers to R&D for Biotechnology Companies across the four SBT countries

	Costs	Regulation	Access Technology	Patent & Licenses Issues	Access Information	Access to Qualified HR	Public Perception	Other
Ireland	10%	73%	89%	84%	81%	54%	11%	81%
France	79%	51%	42%	28%	26%	21%	14%	16%
Portugal	77%	31%	31%	17%	77%	15%	13%	77%
Spain	72%	27%	27%	18%	36%	55%	18%	0%

Figure 12 presents the techniques used in Irish biotechnology companies and the biotechnology technique needs in Irish companies. Of the companies surveyed, 78% stated that they had protein and other molecule technique based needs, 78% stated that they had gene RNA technique needs and 76% of companies stated that they had biological resources and imaging needs. (A full breakdown of techniques can be seen in Annex B & C).

From Figure 12, one can distinguish the biotechnology segments with the largest gaps between technological requirements and actual capacity. The nanobiotechnology category has the highest difference between technological needs (87%) and the current capacity (47%). Technique needs are also greater in the DNA/RNA (93% use relative to 97% need) and Gene RNA (86% use relative to 100% need) category in Ireland.

Figure 12 - Percentage of Irish Companies that use & have needs for Biotechnology Techniques



It is evident from the data collected across the four SBT countries, that 100% of companies across the four partner countries use process biotechnology techniques. In France, 100% of companies use nanotechnology based techniques (compared to only 47% in Ireland). In Portugal, 88% of companies use DNA/RNA techniques and in Spain, 100% of companies use Gene RNA and Cell based techniques. In France, 79% of companies state that they have bioinformatic needs. In Portugal, 44% of companies have DNA/RNA based needs and in Spain, 27% of companies stated that have protein, biological resources and process biotechnology technique-based needs. Comparatively, Irish biotechnology companies have higher stated technique based needs than companies based in the SBT partner countries. (See Annex C for tables).

4. Conclusions

Connecting science with business is difficult in a new and innovative environment. The difficulties surrounding innovation often positively correlate with the limited absorptive capacity of companies, namely their problems in conducting and accessing R&D initiatives. Within such an environment, it is difficult to translate the benefits of scientific developments to new products and processes. Even if new biotechnology firms are the underlying engines of research and development in a particular industry, the transfer of new knowledge to their wider sector, for example the agro-food or pharmaceuticals sector, may be difficult. The study presented in this report focused on the profile of biotechnology companies in Ireland, particularly their R&D based uses and needs and their comparative position within the EU biotechnology sector. The study found that the majority of Irish Biotechnology companies are based in Dublin, with Cork and Galway also having a high proportion of companies. The study found that similar to the three other partner countries within the SBT partnership, Human Health has a particularly important weight for biotechnology companies in Ireland.

The formation of Irish biotechnology companies has grown since the 1960s, particularly during the last decade. While growth in the sector has lagged behind both France and Portugal, it is important to note that both France and Portugal have a longer history of biotechnology based companies.

Intellectual Property rights are an important aspect of performance and strategy for companies in the Biotechnology sector with 61.2% of the interviewed companies across the SBT partnership indicating that they have registered patents and half have bought IPR to develop their activities. Irish companies have the highest percentage of registered patents and licenses (41%).

In terms of market orientation, Ireland is a small open economy that historically has high export rates across a variety of sectors, including agriculture, IT and pharmaceuticals. This pattern is also evident in the biotechnology sector with Ireland having the highest rate of trading to external markets (EU -97%, ouside the EU – 91%) of the four SBT partner countries.

Research has indicated that belonging to sectoral networks increases the viability and management capacity of a sector (Kogut, 2000). This study found that biotechnology is a highly networked activity. However, while 88% of French companies are involved in networks, only 73% of Irish biotechnology firms are involved in a network. This would indicate a need to incentivise network formation in the sector through public infrastructures such as providing network based funding and specialized network coordinators available.

In terms of barriers to R&D in the Irish biotechnology sector, this study found that companies are constrained mainly by the high costs of investment, access to technologies and unclear regulatory requirements. These factors were also highlighted as significant barriers in the other three SBT partner countries. These factors mean that companies in the biotechnology sector often find it difficult to meet their full productive potential. As such, the regulation and cost structure associated with accessing biotechnology techniques requires significant reformulation if it is to actively meet the needs of the biotechnology sector. Zhang et al., (2011) provide a comprehensive overview of a number of methods - entrepreneurial, partnership and state developmental - for the development of biotechnology based innovation.The biotechnology needs of companies in Ireland and across the

four SBT countries are quite diverse and current capacity does not overcome existing needs. The different country profiles and different installed capacity creates opportunities where network economies can emerge from interaction among ShareBiotech countries. Networking can create benefits to regional organizations, research groups and companies by eliminating gaps in the provision of techniques and competencies in specific biotechnology areas.

EU networks can play a significant role in collecting information and proposing solutions to overcome knowledge barriers and R&D needs. Bringing together both companies and research groups has the potential to help to reduce the training gap in some specific techniques and identify partners to help stimulate more cooperation initiatives in the Atlantic area. For companies, a particular aspect where the EU networks may be of crucial importance is the consolidation of a more open, accessible and professional network of technological core facilities (research centers) that can provide access to biotechnology infrastructures, equipments and competencies. Recommendations for regional authorities and national development agencies will also stem from the ShareBiotech activity, and will be available to inform the new policies for economic development and innovation.

5. References

Batchelder, K. and Miller, P. (2006), A change in the market-investing in diagnostics, *Nature Biotechnology,* 24, 922–926.

BMW Assembly, (2012), Map of Regions in Ireland, available at: http://www.iro.ie/bmw_assembly.html

Enterprise Ireland, 2010, The Life Sciences Directory, available at: http://www.biotechnologyireland.com/SITE/UPLOAD/DOCUMENT/LifeSciencesDirectory.pdf

Enterprise Ireland, 2011, Biotechnology Ireland Directory, available at: http://www.biotechnologyireland.com/bfora/systems/xmlviewer/default.asp?arg=DS_BIR_COMP_46/_az.xsl/47

Kogut, B. (2000), The Network as Knowledge: Generative Rules and the Emergence of structure, *Strategic Management Journal,* 21, 405–425.

Ireland, D. and Hind, D. (2007), Harmonizing science and business agendas for growth in new biotechnology firms: Case comparisons from five countries, *Technovation,* 27, 676–692.

Morrissey, K., Hynes, S., Cuddy, M. and O'Donoghue, C., (2010), Ireland's Ocean Economy, SEMRU Report, available at: http://www.nuigalway.ie/semru/documents/final_report_small.pdf

OECD, (2011), Key Biotechnology Indicators, updated Dec 2011, available at: www.oecd.org/sti/biotechnology/indicators

OECD, (2009), Guidelines for a Harmonised Statistical Approach to Biotechnology Research and Development in the Government and Higher Education Sectors, OECD: Paris.

SE Regional Assembly, (2012), SE Regions in Ireland, available at: http://www.seregassembly.ie/en/

Zhang, F., Cooke, P. and Wu, F., (2011), State-sponsored Research and Development: A Case Study of China's Biotechnology, *Regional Studies*, 45: 5, 575-595.

6. Annexure and Appendix

6.1 Annex A - Companies surveyed by the ShareBiotech project in Ireland

Table 1 - The 36 Surveyed Companies in Ireland

Company Name	County	Region	Address
AER Ltd.	Kerry	SE	Mounthawk Business Centre, Trallee, Co. Kerry.
Aerogen Ltd.	Galway	BMW	IDA Business Park, Dangan, Co. Galway.
Allimentary Health Ltd.	Cork	BMW	Building 2800. Cork Airport Business Park, Co Cork.
Alltech Ireland Ltd.	Meath	SE	Sarney, Summerhill Rd. Dunboyne, Co. Meath.
Argutus Medical Ltd.	Dublin	SE	Unit 9, Trinity College & Enterprise Campus, Pearse Street, Co. Dublin.
Beeline Healthcare Ltd.	Dublin	SE	Crag Cresent, Clondalkin Industrial Estate
Berand Neuropharmacology	Dublin	SE	NovaUCD, Belfield Innovation Park, Dublin 4, Co. Dublin.
Bimeda Ireland	Dublin	SE	Broomhill Rd. Tallaght, Dublin 24, Co. Dublin.
Bio Thin	Dublin	SE	93 The Rise, Mount Merrion, Co. Dublin.
BioEUTIKON Ltd.	Dublin	SE	R&D Building, Dublin City University, Co. Dublin.
Brandon Products Ltd.	Dublin	SE	162 Clontarf Rd., Dublin 3., Co. Dublin.
CeBec Group Ltd	Galway	SE	Unit 16, Innovation and BUSINESS Centre, GMIT, D
Cellix Ltd.	Dublin	SE	Unit 3.81,Trinity Centre for Health Sciences, Jamses Street, Dublin 8, Co. Dublin.
CELTIC CATALYSTS	Dublin	SE	NOVA UCD, Dublin 4., Co.Dublin.
Elan	Westmeath	BMW	Monksland Industrial Estate, Athlone, Co. Westmeath.
Enfer Scientific	Kildare	SE	Enfer Group, Unit T, M7 Business Park, Newhall, Naas, Co. Kildare.
Enzolve Technologies Ltd.	Dublin	SE	Conway Institute Building, Belfield Innovation Park, UCD, Belfield Dublin 4, Co. Dublin.
Genable Technologies Ltd.	Dublin	SE	Smurfit Institute of Genetics,Trinity College Dublin, Co. Dublin.
Genzyme Ireland	Waterford	SE	IDA Industrial Park, Old Kilmeaden Road, Waterford.
Innocoll Pharmaceuticals Ltd.	Westmeath	BMW	Midlands Innovation and Research centre, Athlone, Co.Westmeath.
Luxcel BioSciences Ltd.	Cork	BMW	BioInnovation Centre, University College Cork, Co. Cork.
Marigot Ltd. t/a Celtic Sea Minerals	Cork	SE	Strand Farm, Currigaline, Co. Cork.
Megazyme International Ireland Ltd.	Wicklow	SE	Bray Buisness Park, Bray, Co. Wicklow.
Oilean Glas Teo	Donegal	BMW	Ballymoon Industrial Estate, Kilcar, Co. Donegal.
Opsona Therapeutics Ltd	Dublin	SE	Room 2.13 Institute for Molecular Medicine, Trinity Centre for Health Sciences, St.Jamses Hospital, Duiblin 8, Co. Dublin.
Ovagen Group Ltd.	Mayo	BMW	Carrentrila, Ballina, Co. Mayo.
Pfizer Ireland	Dublin	SE	Grange Castle Buisness Park, Clondalkin, Co. Dublin.
Protecas HEALTH	Dublin	SE	Unit 15, Block 4B, Blanchardstown Corporate Park, Dublin 15, Co. Dublin.
Proxy Biomedical Ltd.	Galway	BMW	Coilleach, Spiddal Co. Galway.
Reliance Gene Medix Ltd.	Offaly	BMW	Business and Technology Park, Srah Tullamore, Co. Offaly.
Schering Plough Brinny Co.	Cork	SE	Inishannon Co Cork.
Sigmoid Pharma	Dublin	SE	The Invent Centre, Dublin City University, Dublin 9, Co. Dublin.
Stokes Bio Ltd.	Limerick	BMW	Lonsdale Rd, Plassey Technology Park, Castletroy, Co. Limerick.

ThromboGenics Ltd.	Dublin	SE	Unit 14, Bridgefort Office Park, Walkinstown Avenue, Dublin 12, Co. Dublin.
Trinity Biotech	Dublin	SE	IDA Business Park, Southern Cross Road, Bray, Co.Wicklow.
Trinity Enterprise Centre	Dublin	SE	Unit 2, Trinity Enterprise Centre, Pearse St. Dublin 2, Co. Dublin.

6.2 Annex B - Breakdown of Techniques by OECD Category

Table 2 - Breakdown of Techniques by OECD Category

1. **DNA/RNA**	2. **Proteins and other Molecules**	3. **Cell Tissue Culturing and Engineering**	4. **Gene and RNA Vectors**
PCR/qPCR/RT-PCR	Sequencing of proteins and peptides	Cell/Tissue Culture	Gene Therapy
Sequencing	Synthesis and engineering of proteins and peptides	Tissue Engineering	Animal Transgenesis
Genotyping	Protein isolation and purification	Vaccine/Immune Stimulant	Vegetal Transgenesis
Transcriptomics	Proteomics	Recombinant Vaccine	Micro-Organisms Transgenesis
DAN/RNA Microarray	Structural analysis	Cellular Therapy, stem cells	Viral Vectors
Northern and Western blots	High trough-put screening and synthesis	Embryo Manipulation	Synthetic Vectors
Antisens Technology	Improved delivery methods for large molecules drugs		
Gene Probes	Monoclonal and polyclonal antibodies		
	Metabolomics		

Table 2 - Breakdown of Techniques by OECD Category (Continued)

5. Biological Resources and Accociated Facilities	**6. Imaging and Related Instrumentation DNA/RNA**	**7. Process Biotechnology Techniques**	**8. Nanobiotechnology**	**9. Bioinformatics**
Animal Models	Magnetic Resonance Imaging	Fermentation for Food or Beverage Production	Nanoencapsulation of Bioactive Products	Data Storage
Plant Models	Computed Tomography	Fermentation for Enzymes Production	Nanoparticle Formulation	Construction and Management of Databases
Micro-Organisms Models	Positron Emission Tomography (PET)	Fermentation for Active Compounds Production	High Trough-Put Experimentation, Micolabs, Microrobotics	Data Analysis and Biostatistics
Housing and Facilities for Animal Experimentation	SPECT : Single Photon Emission Computed Tomography	Fermentation for Biobased Building Blocks Production	Active Compound Delivery Methods	Sequence Analysis
Housing and Facilities for Plant Experimentation	Optical Imaging: Bioluminescence	Fermentation for Biomaterials Production (PHA, PLA, …)	Nanostructures	Structural Analysis, Molecular Modelling
Animal Breeding	Optical Imaging: Fluorescence	Biocatalysis : Enzymatic Hydrolysis or Enzymatic Organic Synthesis	Characterization of Nanoparticles	Insilico Tests

Plant Breeding	Optical Imaging: Confocal Imaging	Bioenergy	Incorporation of Chemical Ligands to the Nanoparticle Surface	System Modelling
Biological Resources Centres, Banks, Collections	Optical Imaging : (multi)Photonic Imaging		In Vitro Citotoxicity Evaluation of Nanoparticles	Integrative Biology
Experimental Farms	Electronic Microscopy			Software Development
	Ultrasounds			Computing Power
	Radiography			
	Infra-Red Imaging			

6.3 Annex C - Results from the Survey – Breakdown of Techniques by OECD Category

Figure 1 - DNA/RNA Breakdown, Uses and Needs in Ireland

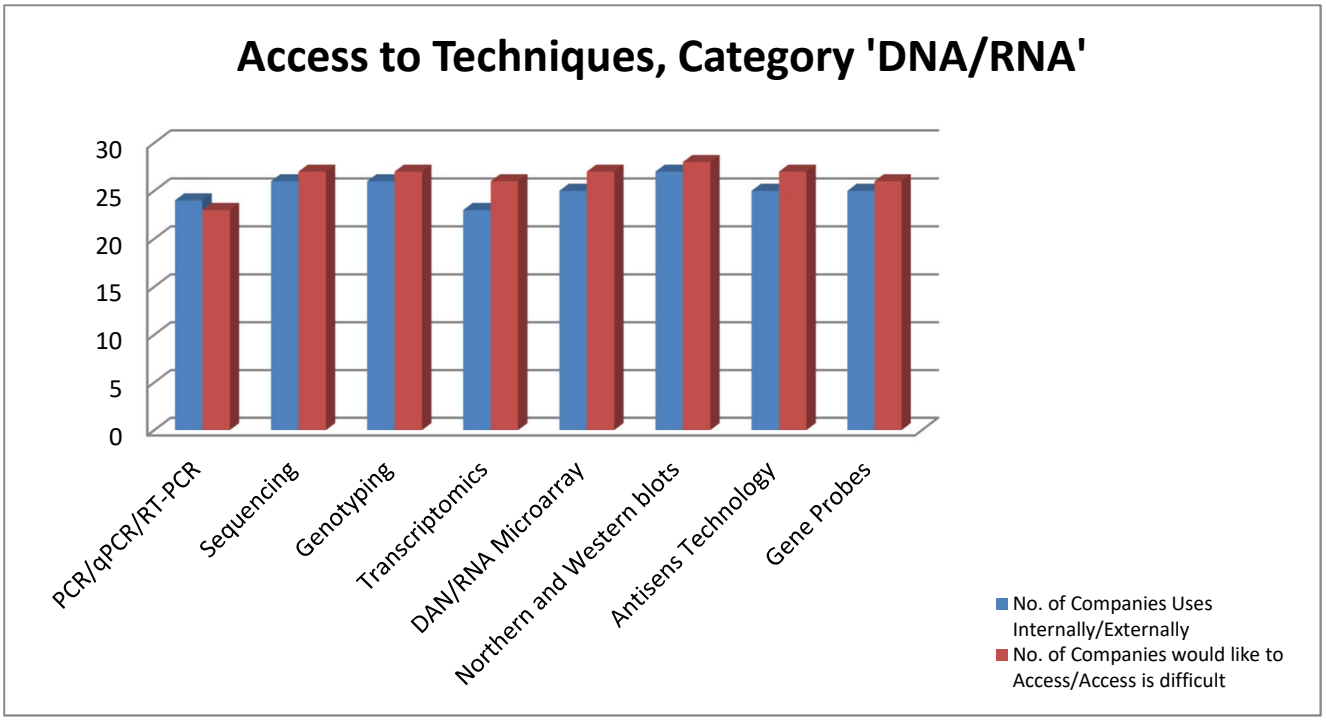


Figure 2 - Proteins and other Molecules Breakdown, Uses and Needs in Ireland

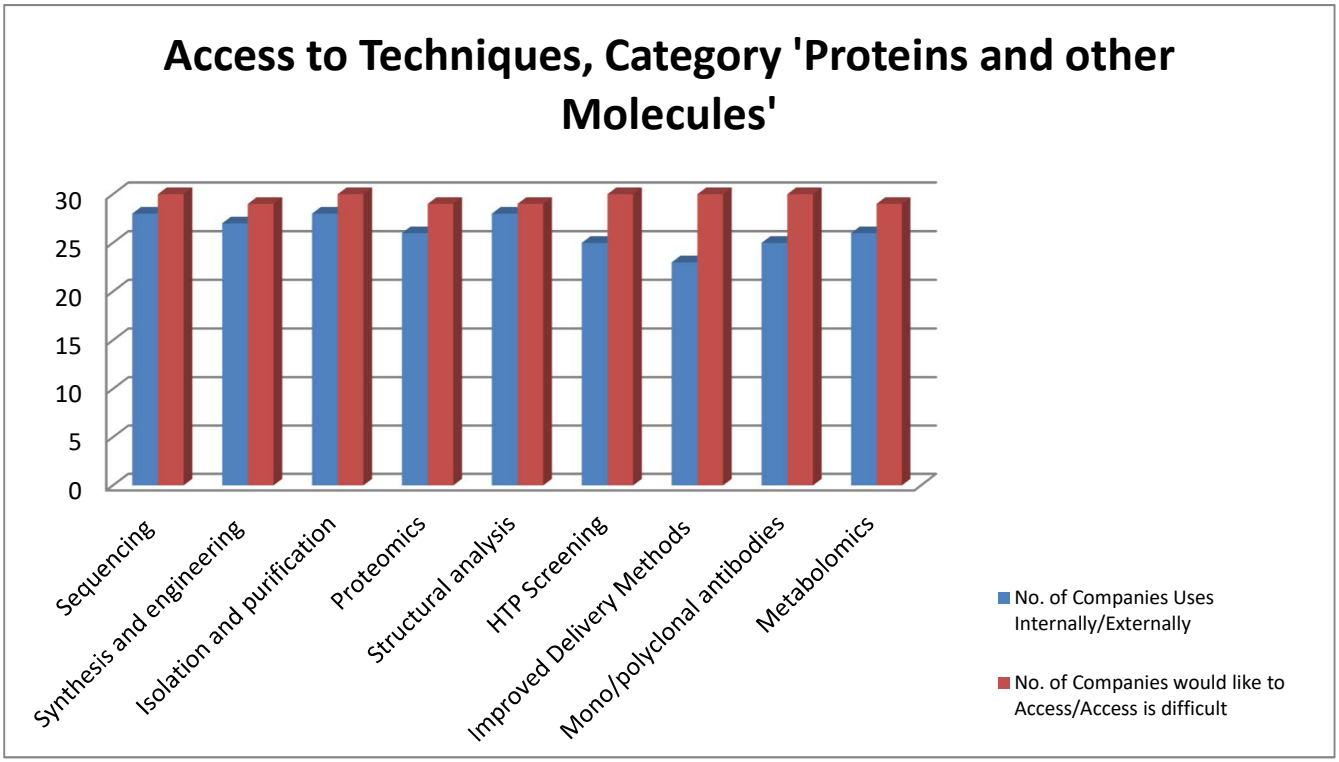


Figure 3 - Cell Tissue Culturing and Engineering Breakdown, Uses and Needs in Ireland

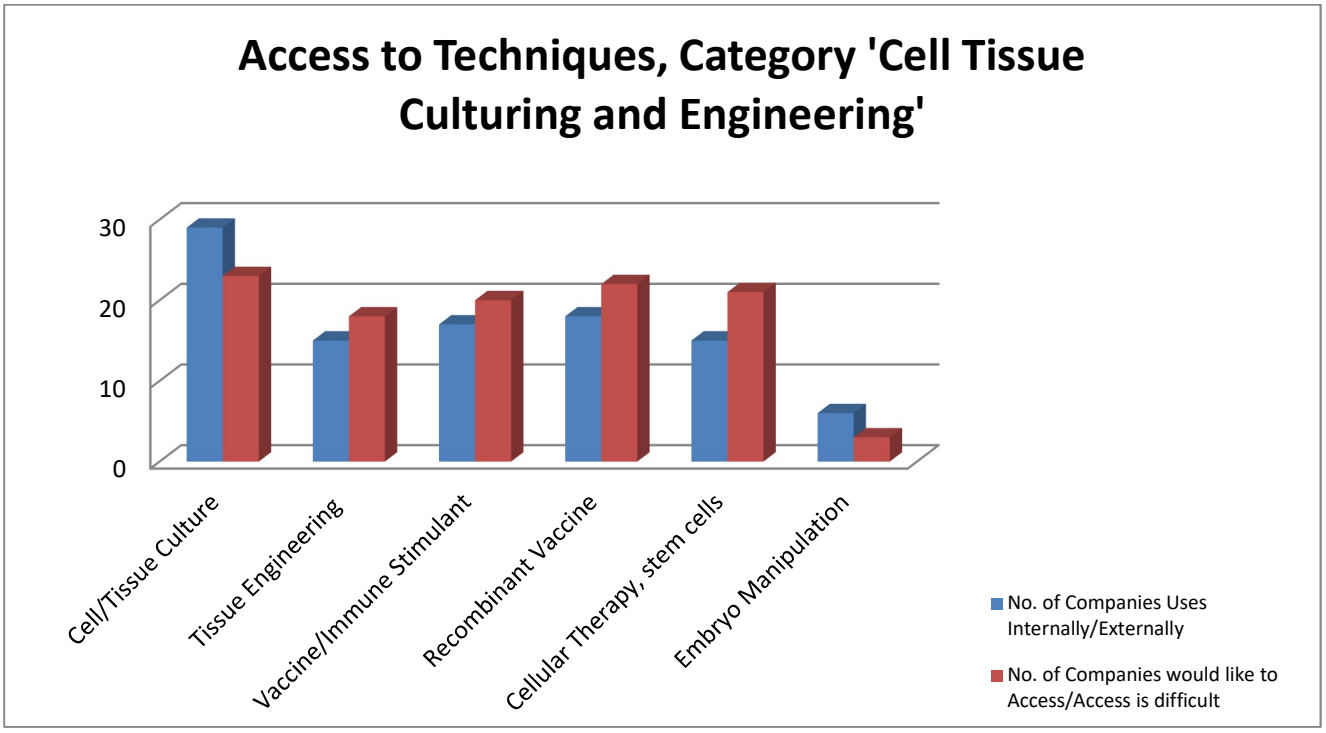


Figure 4 - Gene and RNA Vectors Breakdown, Uses and Needs in Ireland

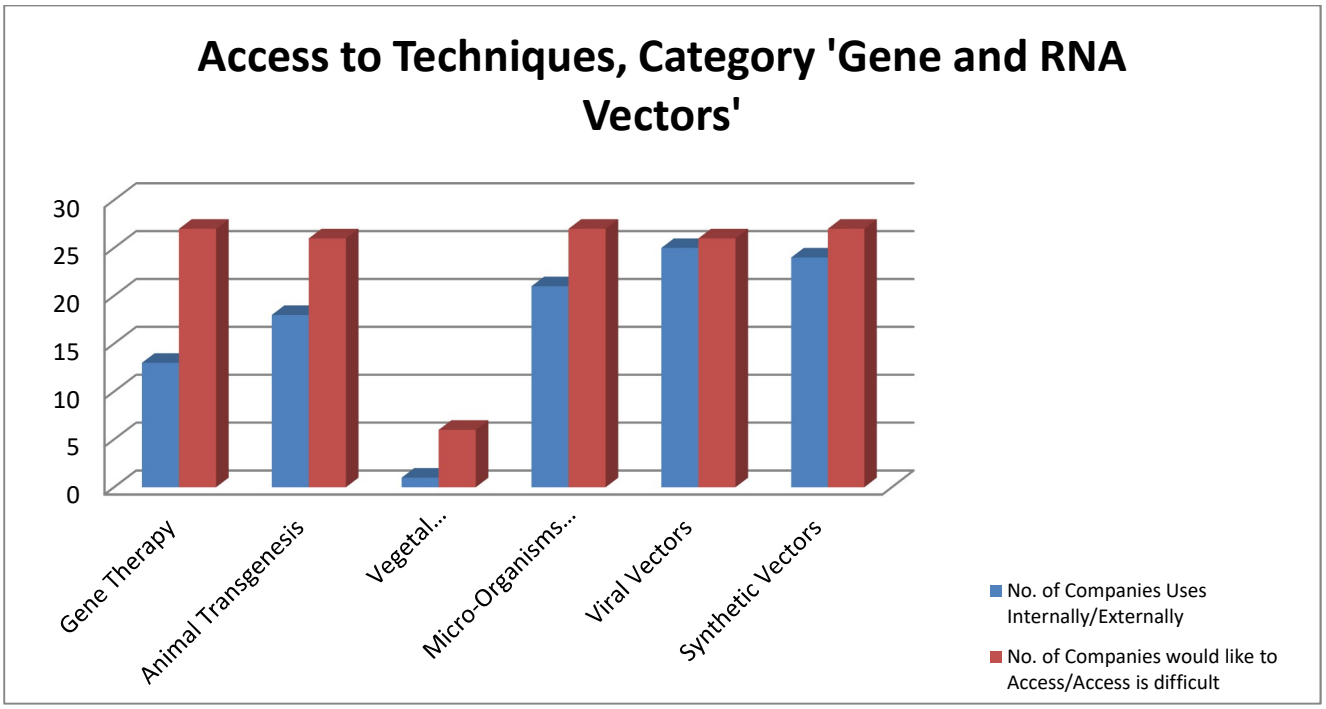


Figure 5 - Biological Resources and Associated Facilities Breakdown, Uses and Needs in Ireland

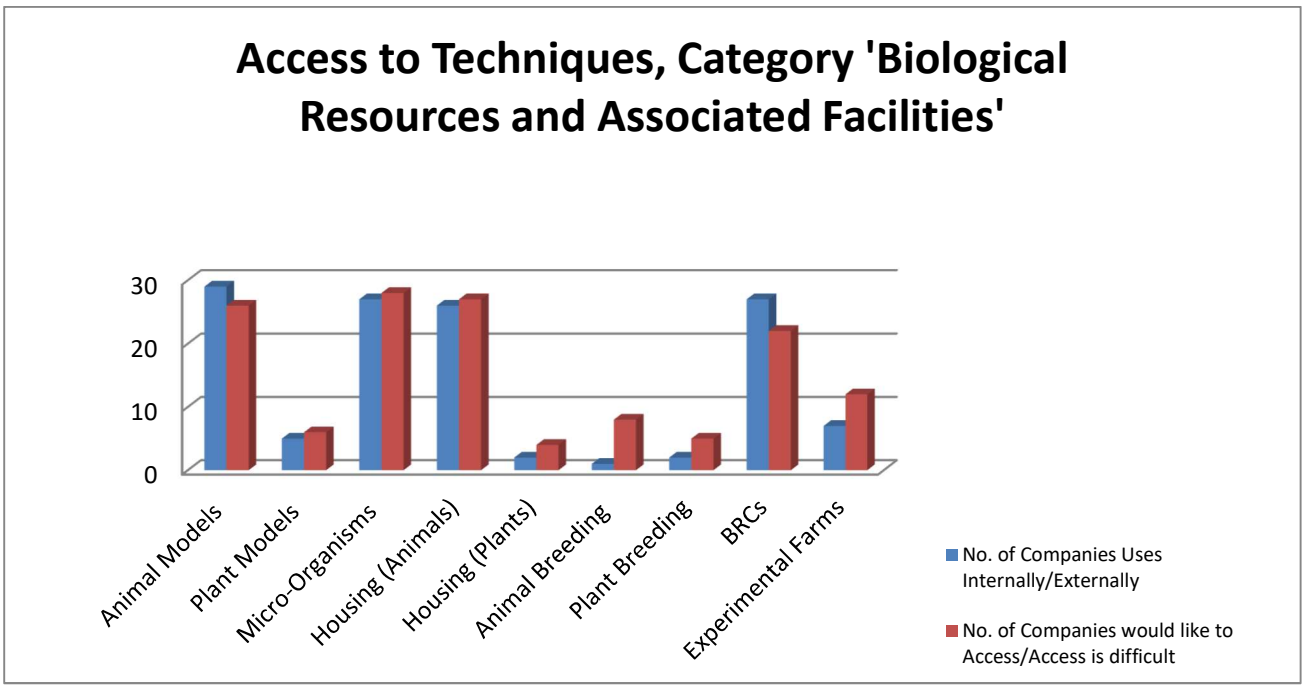


Figure 6 - Imaging and Related Instrumentation DNA/RNA Breakdown, Uses and Needs in Ireland

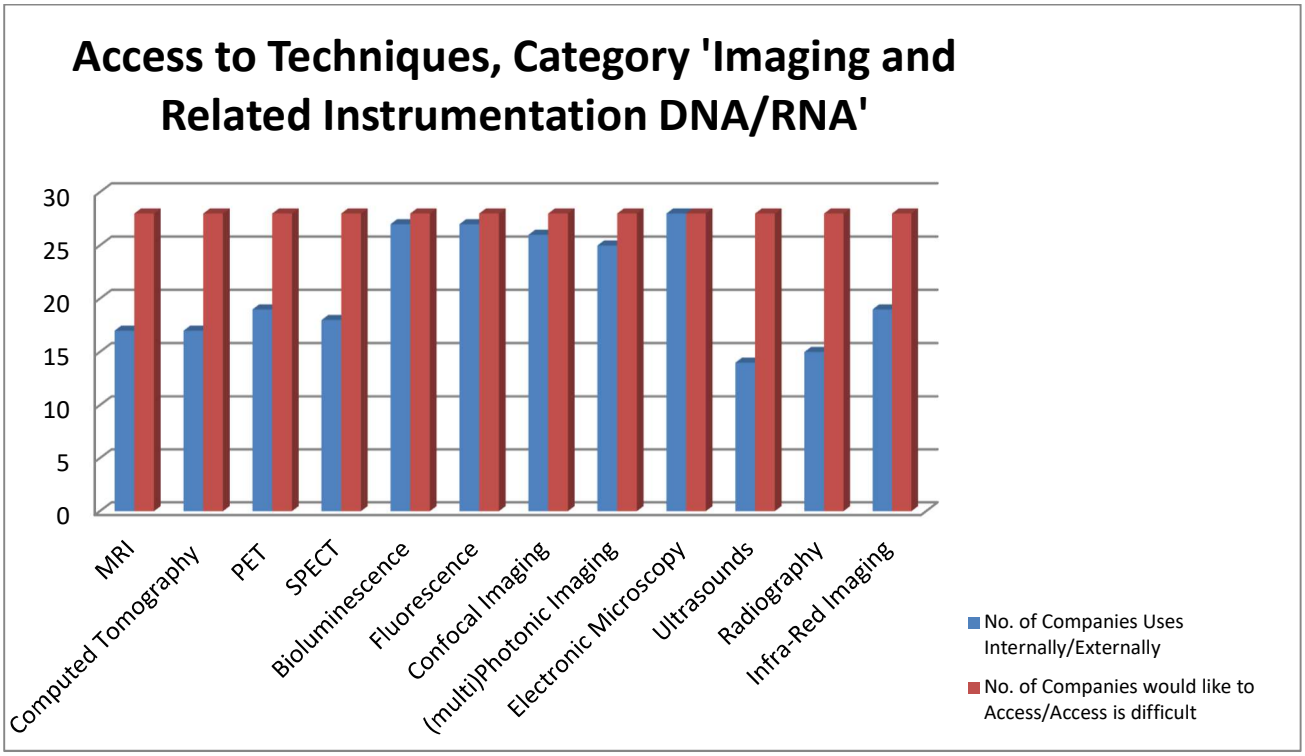


Figure 7 - Process Biotechnology Techniques Breakdown, Uses and Needs in Ireland

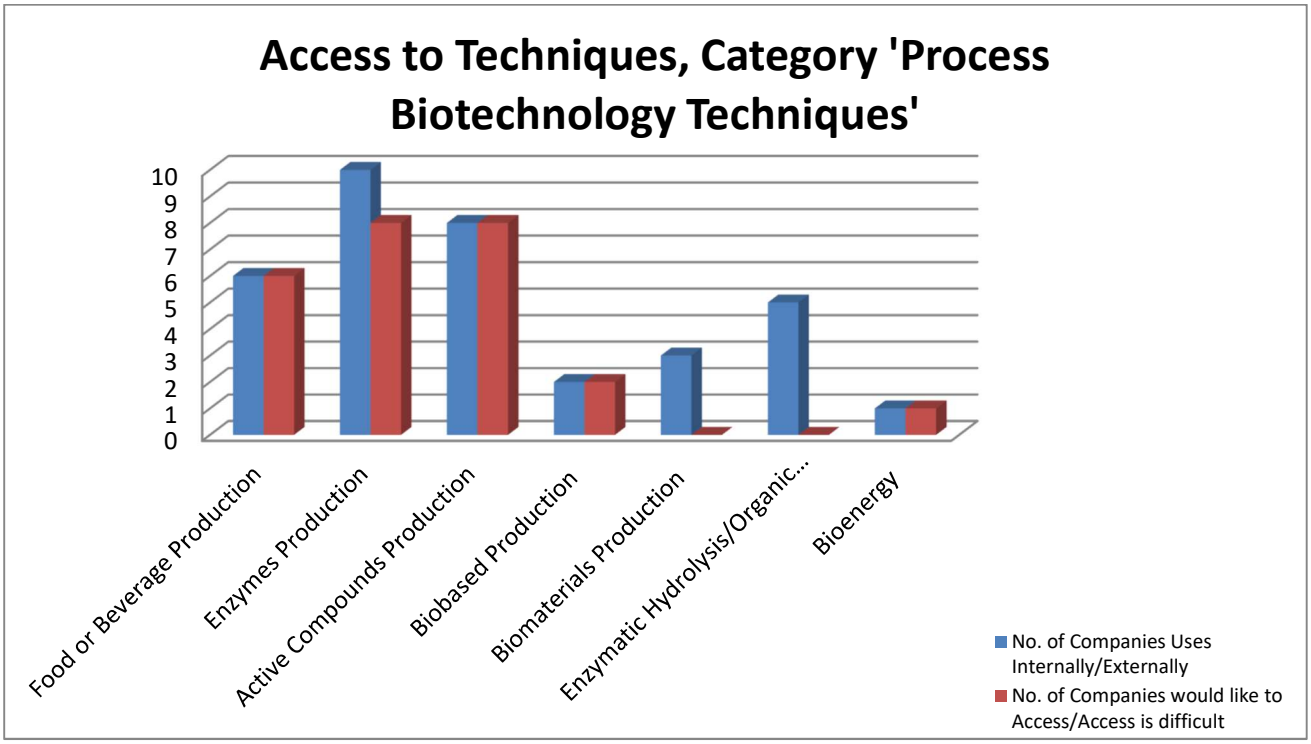


Figure 8 - Nanobiotechnology Breakdown, Uses and Needs in Ireland

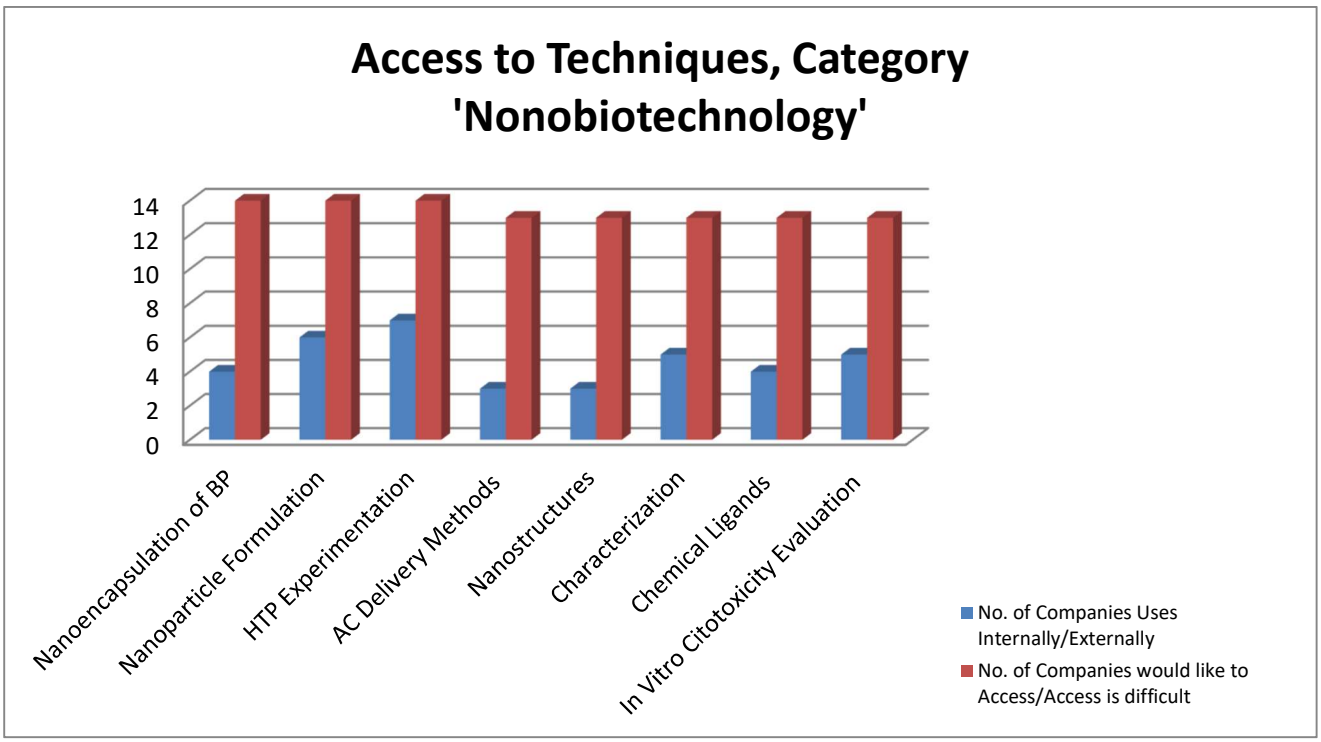


Figure 9 - Bioinformatics Breakdown, Uses and Needs in Ireland

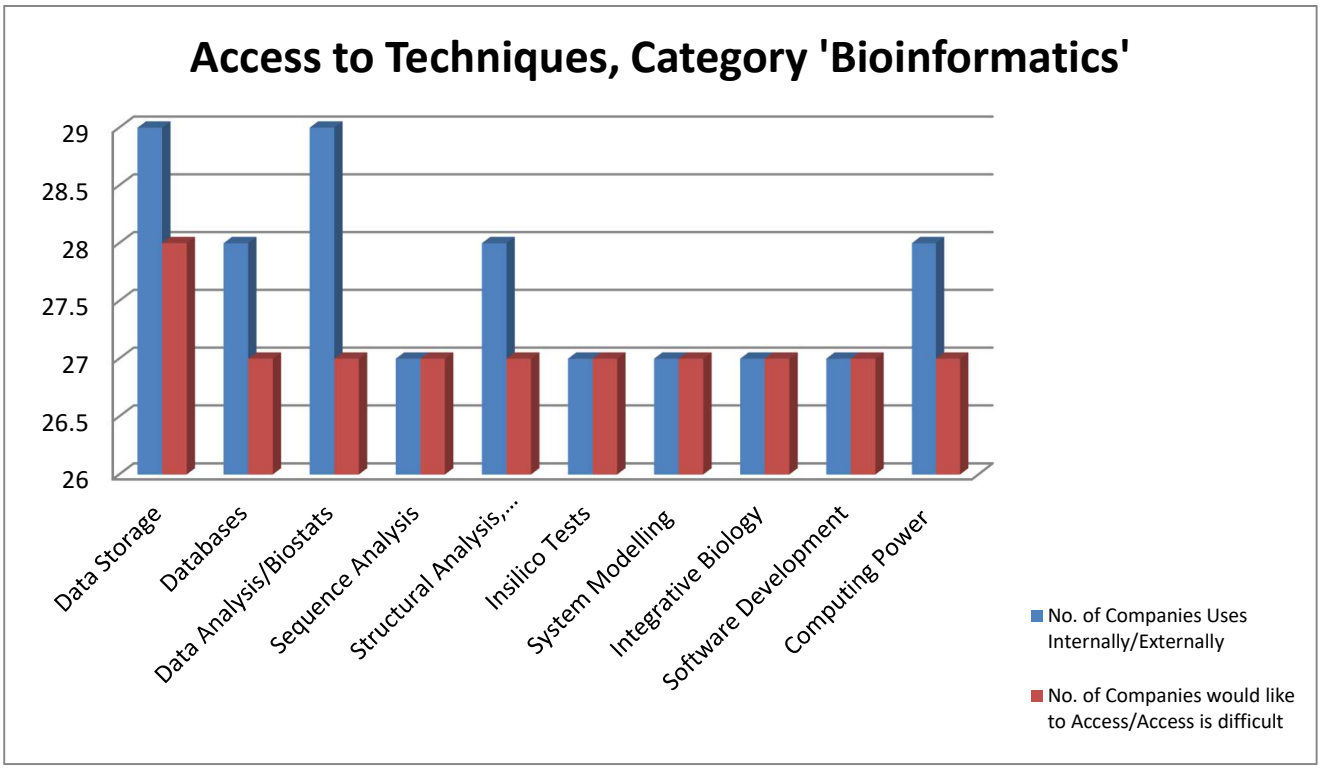


Table 3 - Biological Techniques Used across Country

	DNA/RNA	Proteins	Cell	Gene RNA	Biological Resources	Imaging	Process Biotechnology	Nanobiotech	Bioinformatics
France	97%	37%	97%	92%	95%	94%	100%	100%	87%
Ireland	93%	89%	100%	86%	97%	97%	100%	47%	100%
Portugal	88%	52%	67%	50%	69%	71%	100%	73%	85%
Spain	80%	67%	100%	100%	75%	80%	100%	50%	50%

Table 4 - Stated Biotechnology Needs across Country

	DNA/RNA	Proteins	Cell	Gene RNA	Biological Resources	Imaging	Process Biotechnology	Nanobiotech	Bioinformatics
France	50%	37%	38%	33%	58%	45%	69%	0%	49%
Ireland	97%	89%	87%	100%	85%	85%	73%	82%	90%
Portugal	50%	52%	62%	67%	58%	57%	58%	64%	42%
Spain	**60%**	**67%**	**0%**	**0%**	**67%**	**40%**	**33%**	**50%**	**50%**

6.4 Annex D - OECD Biotechnology Indicators

Organisation for Economic Co-operation & Development (OECD) Key biotechnology indicators (updated Dec 2011)

1. Biotechnology firms
- Number of biotechnology firms, 2010 or latest available year
- Percentage of small biotechnology firms (fewer than 50 employees), 2010 or latest available year

2. Biotechnology R&D
- Total biotechnology R&D expenditures in the business sector, 2010 or latest available year
- Biotechnology R&D intensity, 2010 or latest available year
- Percentage of biotechnology R&D performed in the services sector by dedicated biotechnology R&D firms, 2010 or latest available year
- Percentage of biotechnology R&D performed by small biotechnology R&D firms (fewer than 50 employees), 2010 or latest available year

3. Public-sector biotechnology R&D
- Biotechnology R&D expenditures by the public sector, millions of USD PPP, 2009 or latest available year
- Biotechnology R&D expenditures by the public sector as a percentage of public sector R&D, 2009 or latest available year

4. Biotechnology applications
- Percentage of dedicated biotechnology firms by application, latest available year
- Percentage of biotechnology R&D investments by application, latest available year

5. Biotechnology patents
- Share of countries in biotechnology patents filed under PCT, 2007-09
- Revealed technological advantage in biotechnology, 1997-99 and 2007-09

Booklet available for download at www.oecd.org/sti/biotechnology/indicators

6.5 Annex E - Networks (Clusters, Scientific Parks, Company Association, etc.)

Table 5 – Stated Networks from the Survey

Networks (Cluster, Scientific Park, Company Association, etc.)
Bioenergy and Biorefining Competence Centre
Biomedical Cluster Spiddal Galway
Conway Institute, UCD
Industrial Development Authority Ireland Network
Institute for Molecular Medicine
Irish Medical Device Association
National Programme of Marine Biotechnology
ShareBiotech Atlantic Area Network
Smurfit Institute of Genetics
The Enfer Group Network
The Regenerative Medicine Institute, NUI Galway
Trinity Technology & Enterprise Campus ,TCD
University Innovation Centres - eg. Bioinnovation Centre UCC, Midlands Innovation and Research Centre , Trinity Enterprise Centre, GMIT Innovation Buisness Centre.

6.6 Appendix - Company Survey Template

ShareBiotech

COMPANIES SURVEY

Needs for advanced techniques in Life Sciences

This survey is developed by the European project "ShareBiotech", with the objective to reinforce the important contribution that Life Sciences and Biotechnology can offer towards the development of the Knowledge-Based Economy, in the Atlantic Area (www.sharebiotech.net)

The survey specifically aims to detect the needs of companies in Life Sciences and Biotechnology, regarding access to advanced techniques and associated expertise.
It should be filled in by the person responsible for R&D within the company.

ATLANTIC AREA Transnational Programme
ESPACIO ATLÁNTICO Programa Transnacional
ESPACE ATLANTIQUE Programme Transnational
ESPAÇO ATLÂNTICO Programa Transnacional

European Union
European Regional Development Fund

PART 1: GENERAL INFORMATION ABOUT THE COMPANY

A. Name of the company:

B. Year of setting-up:

C. Address:

D. Main activity*:

E. Main scientific domains of the company:

a) Human Health	☐ Yes ☐ no	g) Environment	☐yes ☐ no
b) Animal health, Veterinary	☐ yes ☐ no	h) Marine science	☐ yes ☐ no
c) Agriculture (including animal breeding), aquaculture and silviculture	☐ yes ☐ no	i) Industrial processing	☐ yes ☐ no
d) Agro-food (including beverages)	☐ yes ☐ no	j) Bioenergy	☐ yes ☐ no
e) Nutrition, nutraceuticals	☐ yes ☐ no	k) Bioinformatics	☐ yes ☐ no
f) Cosmetics	☐ yes ☐ no	l) Other **(please specify)**:	☐ yes ☐ no

F. Company website:

G. Is your company a member of a network(s) (cluster, scientific park, company association, etc.)? If so, which one(s)?

H. Number of persons employed in your company, in July 2010; in headcount units (please tick a box below):

0-25 ☐	**25-50 ☐**	**50-250 ☐**	**> 250 ☐**

I. Is your enterprise part of an enterprise group?

(A group consists of two or more legally defined enterprises under common ownership. Each enterprise in the group may serve different markets, as with national or regional subsidiaries, or serve different product markets. The head office is also part of an enterprise group.)

J. In which country is the company/group headquarters located?

K. Contact person in your company (= the interviewee):

First name	Last name	Title and Role	Gender	Phone	Email
			Mr ☐ Ms☐		

L. Second contact person in your company (optional):

First name	Last name	Title and Role	Gender	Phone	Email
			Mr☐ Ms ☐		

**You may specify your company activities on page 15*

PART 2: PRODUCTS (GOODS AND SERVICES) AND INTEREST IN BIOTECHNOLOGY

1. Please describe your three main products:

2. Do you consider that biotechnology is central to your company activities or strategy?

3. Is your firm currently developing products or processes that require the use of biotechnology? Which ones?

4. In which geographic markets did your enterprise sell goods or services from 2008 to 2010?

1. Local/Regional within [your country]
2. National
3. Other European Union (EU) countries, EFTA, or EU candidate
4. All other countries

* Include the following countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Turkey, Spain, Sweden and the United Kingdom.

PART 3: R&D ACTIVITIES AND COLLABORATION

1. Does your company conduct R&D activities?

☐ No	☐ Yes, Since when:	☐ in-house R&D activities ☐collaborative R&D projects ☐outsourced R&D activities

2. Please describe 1 or 2 relevant **in-house or collaborative** research projects your company has implemented (projects using advanced techniques in life sciences/biotechnology):

In-house project 1	
Main purpose:	
Date or period:	
Partners:	
Advantages:	
Disadvantages:	

In-house project 2	
Main purpose:	
Date or period:	
Partners:	
Advantages:	
Disadvantages:	

3. Please describe 1 or 2 outsourced R&D projects your company has conducted recently:(Projects using advanced techniques in life sciences/biotechnology):

Out-sourced project 1	
Main purpose:	
Date or period:	
Partners:	
Advantages:	
Disadvantages:	

Out-sourced project 2	
Main purpose:	
Date or period:	
Partners:	
Advantages:	
Disadvantages:	

4. Has your company registered patents?

5. Has your company bought patent rights (licences)?

6. What is the main R&D question/problem your company is facing at the moment?

7. How do you intend to answer/solve it?

PART 4: BARRIERS TO R&D ACTIVITIES

1. Which of the following factors are significant barriers to your company R&D capacity?

Costs to conduct R&D activities	☐
Access to technology	☐
Access to information	☐
Access to skilled human resources	☐
Public perception/acceptance	☐
Regulatory requirements	☐
Patent rights held by others/high licensing costs	☐
Other	☐

2. Please explain the barriers:

PART 5: Specific uses and needs for biotechnologies and related techniques

A . OECD category DNA/RNA

genomics, pharmacogenomics, gene probes, genetic engineering, DNA/RNA sequencing/synthesis/amplification, gene expression profiling, and use of antisense technology.

USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐ PCR / qPCR / RT-PCR	☐	☐	☐ PCR / qPCR / RT-PCR
☐Sequencing	☐	☐	☐Sequencing
☐ Genotyping	☐	☐	☐ Genotyping
☐ transcriptomics	☐	☐	☐ transcriptomics
☐ DNA / RNA microarray	☐	☐	☐ DNA / RNA microarray
☐ Northern and Western blots	☐	☐	☐ Northern and Western blots
☐ antisens technology (SiRNA)	☐	☐	☐ antisens technology (SiRNA)
☐ gene probes (e.g. FISH technology)	☐	☐	☐ gene probes (e.g. FISH technology)
☐ Other:	☐	☐	☐ Other: .....

Which of these techniques do your company use, and what for? *Please explain, specify if it is a regular or an occasional need* **Please specify how does your company access these techniques** *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*			**What does your company need these techniques for?** *Please explain* **What are the barriers to access these techniques?** *Please explain*

B. OECD category Proteins and other molecules

Sequencing/synthesis/engineering of proteins and peptides (including large molecule hormones); improved delivery methods for large molecule drugs; proteomics, protein isolation and purification, signaling, identification of cell.

USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐ Sequencing of proteins and peptides	☐	☐	☐ Sequencing of proteins and peptides
☐ Synthesis and engineering of proteins and peptides	☐	☐	☐ Synthesis and engineering of proteins and peptides
☐ protein isolation and purification	☐	☐	☐ protein isolation and purification
☐ proteomics	☐	☐	☐ proteomics
☐ structural analysis	☐	☐	☐ structural analysis
☐ High trough-put screening and synthesis (drug discovery)	☐	☐	☐ High trough-put screening and synthesis (drug discovery)
☐ Improved delivery methods for large molecules drugs (vectorisation)	☐	☐	☐ Improved delivery methods for large molecules drugs (vectorisation)
☐ Monoclonal and polyclonal antibodies	☐	☐	☐ Monoclonal and polyclonal antibodies
☐ Metabolomics	☐	☐	☐ Metabolomics
☐ Other:	☐	☐	☐ Other: .....
Which of these techniques do your company use, and what for?			

Please explain, specify if it is a regular or an occasional need **Please specify how does your company access these techniques** *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*	**What does your company need these techniques for?** *Please explain* **What are the barriers to access these techniques?** *Please explain*

C. OECD categoryCell tissue culture and engineering

Cell/tissue culture, tissue engineering (including tissue scaffolds and biomedical engineering), cellular fusion, vaccine/immune stimulants, embryo manipulation

USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐ Cell/tissue culture	☐	☐	☐ Cell/tissue culture
☐ tissue engineering (e.g. medical device incorporating cells or tissues, transplantation, ex vivo organ reconstruction)	☐	☐	☐ tissue engineering (e.g. medical device incorporating cells or tissues, transplantation, ex vivo organ reconstruction)
☐ Vaccine/immune stimulant	☐	☐	☐ Vaccine/immune stimulant
☐ Recombinant vaccine	☐	☐	☐ Recombinant vaccine
☐ Cellular therapy, stem cells	☐	☐	☐ Cellular therapy, stem cells
☐ embryo manipulation	☐	☐	☐ embryo manipulation
☐ Other:	☐	☐	☐ Other: .....
Which of these techniques do your company use, and what for? *Please explain, specify if it is a regular or an occasional need*			**What does your company need these techniques for?** *Please explain*

Please specify how does your company access these techniques *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*	**What are the barriers to access these techniques?** *Please explain*

D. OECD category Gene and RNA vectors

Gene therapy, viral vectors

USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐ Gene therapy	☐	☐	☐ Gene therapy
☐ Animal transgenesis	☐	☐	☐ Animal transgenesis
☐ Vegetal transgenesis	☐	☐	☐ Vegetal transgenesis
☐ micro-organisms transgenesis	☐	☐	☐ micro-organisms transgenesis
☐ Viral vectors	☐	☐	☐ Viral vectors
☐ Synthetic vectors	☐	☐	☐ Synthetic vectors
☐ Other:.....	☐	☐	☐ Other:.....
Which of these techniques do your company use, and what for? *Please explain, specify if it is a regular or an occasional need*			**What does your company need these techniques for?** *Please explain*

Please specify how does your company access these techniques *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*	**What are the barriers to access these techniques?** *Please explain*

E. Category Biological resources and associated facilities			
USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐ Animal models	☐	☐	☐ Animal models
☐ Plant models	☐	☐	☐ Plant models
☐ Micro-organisms models	☐	☐	☐ Micro-organisms models
☐ housing and facilities for animal experimentation	☐	☐	☐ housing and facilities for animal experimentation
☐ housing and facilities for plant experimentation (greenhouses, etc.)	☐	☐	☐ housing and facilities for plant experimentation (greenhouses, etc.)
☐ animal breeding,	☐	☐	☐ animal breeding,
☐ plant breeding	☐	☐	☐ plant breeding
☐ biological resources centres, banks, collections	☐	☐	☐ biological resources centres, banks, collections
☐ Experimental farms	☐	☐	☐ Experimental farms
☐ Other:	☐	☐	☐ Other: .....

Which of these techniques do your company use, and what for? *Please explain, specify if it is a regular or an occasional need*	**What does your company need these techniques for?** *Please explain*
Please specify how does your company access these techniques *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*	**What are the barriers to access these techniques?** *Please explain*

F. category Imaging and related instrumentationDNA/RNA .

USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐ Magnetic resonance Imaging	☐	☐	☐ Magnetic resonance Imaging
☐ Computed Tomography	☐	☐	☐ Computed Tomography
☐ Positron Emission Tomography (PET)	☐	☐	☐ Positron Emission Tomography (PET)
☐ SPECT : Single Photon Emission Computed Tomography.	☐	☐	☐ SPECT : Single Photon Emission Computed Tomography.
☐ Optical Imaging: bioluminescence	☐	☐	☐ Optical Imaging: bioluminescence
☐ Optical Imaging: fluorescence	☐	☐	☐ Optical Imaging: fluorescence
☐ Optical Imaging: confocal imaging	☐	☐	☐ Optical Imaging: confocal imaging
☐ Optical Imaging : (multi)photonic imaging	☐	☐	☐ Optical Imaging : (multi)photonic imaging
☐ Electronic microscopy	☐	☐	☐ Electronic microscopy
☐ Ultrasounds	☐	☐	☐ Ultrasounds
☐ Radiography	☐	☐	☐ Radiography
☐ Infra-red imaging	☐	☐	☐ Infra-red imaging
☐ Other:	☐	☐	☐ Other: .....

Which of these techniques do your company use, and what for? *Please explain, specify if it is a regular or an occasional need* **Please specify how does your company access these techniques** *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*			**What does your company need these techniques for?** *Please explain* **What are the barriers to access these techniques?** *Please explain*

G . OECD category Process biotechnology techniques:

Fermentation using bioreactors, bioprocessing, bioleaching, biopulping, biobleaching, biodesulphurisation, bioremediation, biofiltration and phytoremediation.

USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐ Fermentation for food or beverage production (traditional fermentation)	☐	☐	☐ Fermentation for food or beverage production (traditional fermentation)
☐ Fermentation for enzymes production	☐	☐	☐ Fermentation for enzymes production
☐ Fermentation for active compounds production	☐	☐	☐ Fermentation for active compounds production
☐ Fermentation for biobased building blocks production (succinic acid, propanediol, butanol, glycolic acid …)	☐	☐	☐ Fermentation for biobased building blocks production (succinic acid, propanediol, butanol, glycolic acid …)
☐ Fermentation for biomaterials production (PHA, PLA, …)	☐	☐	☐ Fermentation for biomaterials production (PHA, PLA, …)
☐ Biocatalysis : enzymatic hydrolysis or enzymatic organic synthesis	☐	☐	☐ Biocatalysis : enzymatic hydrolysis or enzymatic organic synthesis
☐ Bioenergy : 1st (sucrose, starch based bioethanol and sunflower, rapeseed oil based bioester), 2nd (cellulose based bioethanol), 3rd generation (microalgae oil based bioester)	☐	☐	☐ Bioenergy : 1st (sucrose, starch based bioethanol and sunflower, rapeseed oil based bioester), 2nd (cellulose based bioethanol), 3rd generation (microalgae oil based bioester)
	☐	☐	

☐ Other bioenergy technologies : please specify			☐ Other bioenergy technologies : please specify
Which of these techniques do your company use, and what for? *Please explain, specify if it is a regular or an occasional need* **Please specify how does your company access these techniques** *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*			**What does your company need these techniques for?** *Please explain* **What are the barriers to access these techniques?** *Please explain*

H. OECD category Nanobiotechnology

Applies the tools and processes of nano/microfabrication to build devices for studying biosystems and applications in drug delivery, diagnostics

USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐Nanoencapsulation of bioactive products	☐	☐	☐Nanoencapsulation of bioactive products
☐Nanoparticle formulation	☐	☐	☐Nanoparticle formulation
☐ High trough-put experimentation, micolabs, microrobotics	☐	☐	☐ High trough-put experimentation, micolabs, microrobotics
☐ Active coumpond delivery methods (vectorisation)	☐	☐	☐ Active coumpond delivery methods (vectorisation)
☐Nanostructures	☐	☐	☐Nanostructures
☐Characterization of nanoparticles	☐	☐	☐Characterization of nanoparticles
☐Incorporation of chemical ligands to the nanoparticle surface	☐	☐	☐Incorporation of chemical ligands to the nanoparticle surface
☐In vitro citotoxicity evaluation of nanoparticles	☐	☐	☐In vitro citotoxicity evaluation of nanoparticles
☐other	☐	☐	☐other : .....

Which of these techniques do your company use, and what for?
Please explain, specify if it is a regular or an occasional need

Please specify how does your company access these techniques
Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad

What does your company need these techniques for?

Please explain

What are the barriers to access these techniques?

Please explain

I. OECD category Bioinformatics

Construction of databases on genomes, protein sequences; modelling complex biological processes, including systems biology

USES Which of these techniques does your company use?			**NEEDS** Which of these techniques would your company like to access? (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐ Data storage	☐	☐	☐ Data storage
☐ Construction and management of databases	☐	☐	☐ Construction and management of databases
☐ data analysis and biostatistics	☐	☐	☐ data analysis and biostatistics
☐ Sequence analysis	☐	☐	☐ Sequence analysis
☐ Structural analysis, molecular modelling	☐	☐	☐ Structural analysis, molecular modelling
☐ Insilico tests (virtual screening)	☐	☐	☐ Insilico tests (virtual screening)
☐ System modelling (biological processes, ecosystems,etc.)	☐	☐	☐ System modelling (biological processes, ecosystems,etc.)
☐ Integrative biology	☐	☐	☐ Integrative biology
☐ Software development	☐	☐	☐ Software development
☐ Computing power (calculation)	☐	☐	☐ Computing power (calculation)
☐ Other:	☐	☐	☐ Other: .....

Which of these techniques do your company use, and what for? *Please explain, specify if it is a regular or an occasional need* **Please specify how does your company access these techniques** *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*	**What does your company need these techniques for?** *Please explain* **What are the barriers to access these techniques?** *Please explain*

J . Other (additional category)			
USES **Which of these techniques does your company use?**			**NEEDS** **Which of these techniques would your company like to access?** (techniques which are not currently used or where access is difficult)
	Internal access	External access	
☐	☐	☐	☐
☐	☐	☐	☐
☐	☐	☐	☐
☐	☐	☐	☐
☐	☐	☐	☐
☐	☐	☐	☐
☐	☐	☐	☐
☐	☐	☐	☐
☐	☐	☐	☐
Which of these techniques do your company use, and what for? *Please explain, specify if it is a regular or an occasional need*			**What does your company need these techniques for?**

Please specify how does your company access these techniques *Please explain: i) internal or external access; ii) public or private structure; ii) in your country or abroad*	*Please explain* **What are the barriers to access these techniques?** *Please explain*

K. Do researchers, engineers or technicians from your company have training needs regarding techniques and related skills?

☐ No

☐ Yes - *Please explain*

L. Does your company have other needs for the advancement of R&D activities?

☐ No

☐ Yes - *Please explain*

PART 6: ADDITIONAL INFORMATION ABOUT YOUR COMPANY (OPTIONAL)

PART 7: INTERVIEWER'S SYNTHESIS AND FEEDBACK

(to be filled in by the interviewer after the interview)

Each interviewer is kindly asked to write a short report in English after every interview:

- *Main needs as regards techniques:*
- *Main barriers for access to specific techniques:*
- *Main needs as regards training:*
- *Specific needs (1-3) that ShareBiotech can address during its lifetime:*
- *General Comments on the information reported*
- *Suggestions for Improvement*

MANY THANKS FOR COMPLETING THIS SURVEY

The ShareBiotech Consortium will analyse this information to identify Life Sciencestechnology needs and barriers.

References

7.