The Sector Skills Council for Science, Engineering and Manufacturing Technologies

Bioscience Sector Skills Agreement

Stage 3: Gap Analysis – UK

Version 3, December 2007

Contents

1 The Bioscience Sector Skills Agreement

The Bioscience SSA covers the following sectors:

- Research based pharmaceutical companies that discover, develop, market and distribute medication and drugs.
- Research and development in pharmaceutical manufacturing companies.
- Bioscience companies that are a spin-off from universities.
- The application of bioscience to produce innovative medicines and therapeutics.
- The application of bioscience for the processing and production of materials i.e. the use of bioscience in engineering industries. This currently excludes agricultural bio-technology and bioscience that is for the processing and production of chemicals and energy.
- Research and experimental development

Therefore, the Bioscience SSA does not attempt to cover the pharmaceuticals industry *per se* (SIC 24.4: Manufacture of pharmaceuticals, medicinal chemicals and botanical products), which is covered by Cogent SSC. Even so, it has not been entirely possible to separate pharmaceutical research or development from pharmaceutical manufacturing.

Similarly, the medical devices sector, technically a small part of the electronic engineering sector, is included here, since it is important in the development of the application of bioscience.

All those employers who were interested in contributing to the SSA were included in the research and consultations. Therefore, meetings across the UK have included representatives from companies involved in pharmaceutical research, development and manufacture, medical devices and diagnostics and biotechnology, as well as higher and further education institutions (as employers and providers of science skills) – all those that have an interest in the supply of scientists to the sector.

2 Introduction

This report provides a link between the first two stages of the Sector Skills Agreement: the Skills Needs Analysis and the Assessment of Current Provision, and informs the later action planning stages: Scoping Collaborative Action and the development of the Costed Action Plan. It summarises the demand issues and identifies the trends in supply to highlight the gaps in workforce development.

The scenario planning brings together the issues highlighted in the earlier stages and focuses on what needs to be done to ensure a successful future for the sector in the UK.

Vision for the sector

The Bioscience Sector Strategy Group (SSG) comprises Bioscience employers, representatives from Trade Unions, the DBERR Bioscience Unit and Industry Associations. The SSG developed the following vision for the sector:

- **Strategic Alignment of the UK Bioscience Sector needs with the education supply chain to ensure a good supply of well qualified and appropriately skilled employees.**

- **Transform the perception of the sector to be attractive and underpinned by effective Information, Advice and Guidance.**

Supporting points and aspirations:

- UK Bioscience Sector Internationally recognised for World Class Science, Education & Research training provision with significant reach (accessibility).
- An increase in science literacy across the UK.
- An aspiration to become a net exporter of science talent
- Match the skills demand with the supply ‘Skills Balance Sheet’
- Identify ‘CORE’ subjects and activities within the curriculum i.e. the STEM subjects and a focus on Practical skills
- Requirement for some form of high level review on an on-going basis

3 Science Policy Context in the UK

The Science and innovation investment framework 2004-2014[1] was launched in July 2004 and a discussion paper on the Next Steps[2] was published in March 2006 for consultation. It outlined the Government's commitment to raising science spending faster than the rate of growth of the economy as a whole and increasing UK R&D investment as a proportion of national income and 'put particular emphasis on stimulating business-university collaboration and making the science base more responsive to the needs of the economy'. Figure 3.1 shows the main themes and key measures of the framework.

Figure 3.1: The Science and Innovation Investment Framework, 2004-2014

The Science and Innovation Investment Framework

The *Science and Innovation Investment Framework 2004-2014* set out a comprehensive vision for UK science and innovation, along six principal themes:

- **world-class research at the UK's strongest centres of excellence;**
- **greater responsiveness of the publicly-funded research base to the needs of the economy and public services;**
- **increased business investment in R&D, and increased business engagement in drawing on the UK science base for ideas and talent;**
- **a strong supply of scientists, engineers and technologists;**
- **sustainable and financially robust universities and public laboratories across the UK; and**
- **confidence and increased awareness across UK society in scientific research and its innovative applications.**

Some of the key measures to underpin this vision included:

- **additional funding of over £1 billion over 2005-2008 to enhance the sustainability of the science base;**
- **dedicated funding for knowledge transfer from universities in England through the Higher Education Innovation Fund, rising to £110 million per annum by 2007-08;**
- **funding for industry-led collaborative research through the DTI Technology Strategy, rising to at least £178 million per annum by 2007-08;**
- **the Government's response to the Lambert Review of business-university collaboration, including new responsibilities for the Regional Development Agencies (RDAs) in this area; and**
- **measures to improve the teaching and learning of science, technology, engineering and mathematics (STEM) subjects at all levels.**

The Government has since built on these measures, for example by:

- **announcing in the 2004 Pre-Budget Report a new mandatory target for Government departments and agencies to place 2.5 per cent of their extra-mural R&D contracts with small- and medium-sized enterprises (SMEs), under the Small Business Research Initiative (SBRI);**
- **announcing in the 2005 Pre-Budget Report a package of measures to improve the environment for medical R&D in the UK, including a new NHS research strategy, and measures to promote excellence in clinical research and to facilitate the conduct of clinical trials; and**
- **announcing in the 2005 Pre-Budget Report an independent review of Intellectual Property (IP) in the UK, led by Andrew Gowers, to ensure that the**

In terms of Science, Technology, Engineering and Mathematics (STEM) skills, the Government also outlined a number of 'new ambitions' to improve STEM skills, including to:

- Achieve year on year increases in the number of young people taking A levels in physics, chemistry and mathematics.
- Continually improve the number of pupils getting at least level 6 at the end of Key Stage 3 (11-14 year olds).

[1] HM Treasury/DTI/DfES, July 2004, *Science & innovation framework 2004-2014*.
[2] HM Treasury/DTI/DfES/Dept of Health, July 2004, *Science and innovation framework 2004-2014: next steps.*

- Continually improve the number of pupils achieving A*-B and A*-C grades in two science GCSEs.
- Step up recruitment, retraining and retention of physics, chemistry and mathematics specialist teachers.

Obviously, the science that is missing from these ambitions is Biology, which is particularly important to the Bioscience industry.

Each nation and region within the UK also put emphasis on science and STEM skills within their economic strategies. These are outlined in the individual Gap Analysis consultative reports for England, Scotland, Wales and Northern Ireland.

England

Within England each of the Regional Development Agencies (RDAs) has five statutory purposes[3], which are to:

- Further economic development and regeneration.
- Promote business efficiency, investment and competitiveness.
- Promote employment.
- Enhance development and application of skill relevant to employment.
- Contribute to sustainable development.

Each RDAs agenda includes regeneration, taking forward regional competitiveness, taking a lead on inward investment and, working with regional partners, ensuring the development of a skills action plan to ensure that the skills training available matches the needs of the labour market and to this end, each RDA has developed Regional Skills Partnerships.

Each region has an area of bioscience that it seeks to promote as a cluster or priority sector, and there are a number of regional organisations that support the bioscience clusters within each region.

The table below summarises the regional priorities.

Table 3.2: Bioscience regional priority sectors

Region	Priority sector
North West	Biomedical – including biotechnology, pharmaceuticals and healthcare
North East	Biotechnology, healthcare and life sciences
Yorkshire & the Humber	Bioscience, Healthcare technologies
West Midlands	Medical technologies
East Midlands	Healthcare – life and health technologies: pharmaceutical, biotechnology, medical instrument manufacturing
East of England	Pharmaceuticals and biotechnology; high technology, research and development
South West	Biomedical and healthcare
South East	Health Technologies - Pharma Bio and Healthcare, R&D
London	Life sciences

[3] Pera, July 2007, *Bioscience Regional Activity and Profile* – unpublished report prepared for SEMTA.

Northern Ireland

The Economic Vision for Northern Ireland[4] aims to make Northern Ireland more productive and internationally competitive. Key areas of focus include the creation of higher value-added jobs and increased adult learning and training. The Vision also identified the need for an increase in the level of investment in R&D, combined with focus on enterprise and innovation.

The Life Sciences sector was identified as a priority technology sector in the Northern Ireland Regional Innovation Strategy[5] and is therefore a priority for Invest NI. It includes sub-sectors such as biotechnology, therapeutics, diagnostics and devices, drug delivery gene therapy, bioinformatics, clinical trials, agricultural biotechnology and industrial biotechnology. Invest NI promotes two key areas of the Life Sciences: cancer biotechnology and medical devices.

Invest NI have a number of programmes which aim to support investment in research and development, particularly in emerging clusters of excellence, such as life and health sciences.

- Foresight NI and other similar projects encourage networking between industry and academia to maximise the impact of research and development.
- The Higher Education Innovation Fund is designed to foster research and development and tech transfer within academia by assisting universities to reach out to businesses and to capture and exploit intellectual property.
- The Proof of Concept programme provides financial support for university researchers in the pre-commercialisation of leading-edge technology.
- The NITech Fund offers similar support for financing the commercialisation of research and development in businesses.

The Department of Enterprise, Trade and Investment (DETI) has also identified five 'key future priority technologies' in the Regional Innovation Strategy Action Plan[6], one of which is Life Sciences. It is in these priority technologies that resources will be concentrated:

1. Information & Communication Technologies
2. Life Sciences (encompassing Biotechnology)
3. Aerospace Technologies
4. Nanotechnologies
5. Agri-food Technologies

Invest NI has provided funding towards the development of the industry association, BioBusiness NI. It has also supported the development of 18 research and development centres, in partnership with the Department for Employment and Learning, through the research and technological development (RTD) Centres of Excellence programme. These centres have been developed to 'stimulate leading-edge, industrially exploitable and commercially-focused research. Five of these centres cover research and development in bioscience-related areas:

1. RTD Centre of Excellence in Proteomics (Randox Laboratories Ltd)
2. Centre for Functional Genomic & Molecular Biodiversity (University of Ulster
3. Speciality Pharmaceuticals Centre (Alhow Laboratories Ltd)
4. Centre of Excellence for R&D in Controlled Drug Delivery (Warner Chilcott Ltd)
5. Medical Polymers Research Institute (Queen's University Belfast)

[4] Department of Enterprise, Trade and Investment (Feb 2005) Economic Vision for Northern Ireland

[5] Department of Enterprise, Trade and Investment (March 2006) The Regional Innovation Strategy for Northern Ireland: Action plan, Sept 2004 to August 2006.

[6] Department of Enterprise, Trade and Investment (March 2006) *The Regional Innovation Strategy for Northern Ireland: Action plan*, Sept 2004 to August 2006.

The Engineering Training Council NI (ETC), under agreement and on behalf of SEMTA, operates as the Sector Skills Council in Northern Ireland.

Scotland

Scotland has a fully integrated life sciences strategy. The Scottish Life Science Strategy: Achieving Critical Mass, the 2020 Vision, published in 2005, sets out short and long term milestones for the sector.[7] From this strategy the Life Sciences Alliance was formed. This is a collaboration between senior representatives from the industry, universities, research institutions, NHS Scotland, Scottish Funding Council, financial institutions, the Scottish government and the Enterprise Networks. It is a national brand identity and the Alliance is encouraging prolific use of the Life Science logo on stationery, business cards and in presentations to promote awareness of the brand.

The Life Science Alliance aims to:

- Develop a framework of proposals to increase staff exchange between industry, academia and other areas of the sector
- Design a career plan mechanism to attract graduates and professionals to clusters, and to retain and nurture them as their careers progress
- Develop proposals setting out the contribution of the life sciences community to enhancing science and technology education in Scotland and attracting first-class teachers and students

Both Scottish Enterprise and the Highlands and Islands Enterprise has significantly increased investment in the fast-growing life sciences sector, in particular the area of health sciences.

Entrepreneurial initiatives such as Proof of Concept, SMART and SPUR are helping to attract major interest from abroad. Seven life science companies have been born out of entrepreneurial academics receiving PoC funding.

Another initiative, the Translational Medicine Research Collaboration has been developed between US pharmaceutical giant Wyeth, four Scottish universities, NHS Scotland Boards and the Scottish Enterprise. It is a world first in translational medicine, combining commercial, clinical and academic expertise. Twenty eight projects were announced in January 2007 attracting a high level investment, creating new jobs and bringing the possibility of spinout companies. Other key success stories have been the Strathclyde Institute of Medical Devices, Scottish Health Innovations Ltd, and the Centre for Regenerative Medicine.

The financial sectors and the network of business angels have been vital in incubating the new innovative companies.

The Scottish Government has recently published its new lifelong skills strategy[8] which builds on the Scottish Government's emphasis on the importance of science.

Wales

'Wales: a Better Country' is the Welsh Assembly Government's strategy for the whole country and aims to promote a diverse, competitive, high added-value economy with high quality skills and education that minimises the demand on the environment.

[7] Scottish Life Sciences Annual Review 2006/07
[8] The Scottish Government Skills for Scotland (2007)

Ten priority sector fora have been identified in Wales: automotive; aerospace; agri-food; technology; pharmaceuticals and biochemistry; financial services; creative industries; construction; hospitality, leisure and tourism; and social care. These areas are recognised as being of particular importance and it is hoped that this priority sector approach will help to identify gaps and develop a coherent, strategic approach.

Key bioactivity areas in Wales include diagnostics, medical technology, clinical trials and drug development, systems biology and agricultural biotechnology. SMARTCymru funds and supports R&D and technological innovation in Wales.

There are several Centres of Excellence specialising in key bioscience fields in Wales, such as the AberBioCentre in Aberystwyth.

4 Scenario Planning

The scenario thinking was developed at a series of five workshops facilitated and led by the DTI Futurefocus team.

Futurefocus undertook the five workshops in the following locations:

27 February 2007	**Manchester**
15 March 2007	**London**
24 April 2007	**Edinburgh**
26 April 2007	**Bridgend**
8 June 2007	**Nottingham**

The workshops were designed to assist engaging with sector representatives in order to:

- Identify what is driving change.
- Identify the key trends in society the environment and technology that will impact the bioscience and pharmaceutical industry.
- Prioritise the key trends in order of importance and uncertainty and consider the implications for supply and demand in the labour market and types of skills.
- Consider the key critical success factors for the sector and look at the implications of the trends for the critical success factors.
- Develop a positive and negative scenario.
- Identifying the key actions by employers, Higher Education, Further Education, Government and other stakeholders that the SSA would need to influence.

The scenario planning also contributed to the consultation on the Stage 1 Skills Needs Analysis, particularly on the key drivers of business competitiveness and their implications for demand for skills; future skills and priorities. It built on the Critical Success Factors (CSFs) identified by the SSG by considering how these are affected by various possible future developments and it therefore helped to prioritise the issues and identifying the actions that need to be taken and by whom. It also identified views on the reasons why these actions have not already been undertaken with substantial impact, which is important in drawing up the plan for collaborative action. The scenario planning also helped in categorising the actions needed into short, medium and long term.

The number of employers involved in the scenario planning workshops was disappointing, even though some of the events were shortened in order to encourage more participation. Additional methods of consultation were included at all stages of the SSA:

- Scenario planning workshops – included review and consultation of the CSFs
- Skills Needs Analysis consultation presentations, questionnaire and interviews with employers
- Stage 2 supplementary employer questionnaire
- Stage 2 training provider questionnaire
- Stage 2 HE interviews

The scenario planning process included looking at what is driving change. Participants developed two scenarios for 2020, one positive and one negative. They considered the importance of the change drivers for demand and supply in the labour market and the implications for the types of skills required.

Participants also considered the CSFs and added to them as appropriate. They went on to consider what the implications of the trends in each of the two scenarios for the CSFs were, how to prioritise the issues and what the key actions would need to be to work towards the positive scenario or mitigate the negative scenario.

They developed short, medium and log term action areas, with measures of success, identified the barriers and how to overcome them and considered the question of why this wasn't happening now. Then they identified who needs to take action: the government, HE, employers, etc.

The positive scenario, developed from an aggregation of all the scenario planning events is shown in Table 4.1 on pages 9 and 10.

The Goals and Critical Success Factors

A summary of the goals and the CSFs developed by the Bioscience SSG and augmented by the consultations around the UK is given below:

Goal: Technical and scientific workforce development – ensure availability of a high quality technical and scientific workforce across all disciplines and functions.

CSFs: (1) Actively encourage HE and FE to take into account the workplace requirements of industry when designing and revising courses.
(2) Assist schools in promoting science and delivering an exciting and purposeful science curriculum.
(3) Ensure CPD is available in key science areas and where it is required.

Goal: Recruitment and retention – Capacity building – attraction and retention of high quality staff in sufficient numbers to meet employer requirements.

CSFs: (1) Young people keen to be scientists and engineers.
(2) Further development and wider communication of company culture.

Goal: Management and leadership – exceptional management and leadership talent working across all sizes of organisation.

CSFs: (1) Strategic leaders fully able to grow UK businesses.
(2) Operational leaders able to deliver agreed strategies
(3) Worldwide talent electing to work in UK Bioscience sector
(4) Pool of serial entrepreneurs and intrapreneurs.
(5) Attractive environment for top talent.

Table 4.1 The Positive Scenario

• Globalisation is a challenge; however UK is in a good position to exploit the advantages. The legislative framework is positive and takes account of health and safety issues within a risk benefit framework.
• UK is "number one" in bioscience from the global perspective. There is an abundance of high quality candidates for science and technology roles who benefit from interesting and creative careers in companies. The UK leads in technology development. There are high expectations of what bioscience can achieve and bioscience has strengthened the economic position of Britain. There is a stable political environment, with the government supportive of the bioscience industry in recognition of value of the sector to the economy. The sector has been successful in making break through in disease management such as Cystic Fibrosis.
• There is a positive relationship between sector and society. The bioscience sector is involved in solving various environmental issues and leading debate on broad areas of influence including – fuel, epidemics, food, bio remedial etc. This has resulted in a more positive perception of the sector and increasing scope for solutions from science to large environmental problems. There is a higher level of htrust in science and informed public debate. There is a strong degree of ethical consensus. The image and awareness of the sector is positive with role models and sector champions. There are "Science Translators" in senior positions in both government and corporations who are able to present science and market the ideas and concepts to people. Improvements in education and public debate has resulted in increasing knowledge and perceived or real and access to information sources, often uncensored. Public debate is informed and championed by relevant people to ensure promotion of public education of science. This is particularly relevant around University hubs that are attempting to commercialise their own resources, IP, services and consultants. There is a strong networked science base and the UK recognised as "number one" for science and innovation.
• Science, education and training is recognised as being world class with greater rigour in school science teaching and separate sciences at GCSE. Teaching is recognised as a prestigious occupation and there are more scientists than ever teaching in schools. There is a strong higher education and universities network with opportunities for people to move around from academic roles to business to regulation. There is funding for universities to deliver suitable science courses and there are more scientists than ever teaching in schools as people were seconded who were passionate about science. This has resulted in young people being informed of the possibilities of science at the earliest age. There has been opportunity for a review of the education system from ages 3-18 to develop the broad principles and the whole agenda in a connected way to deliver good skills including strong language skills. UK education is now internationally held in high esteem. UK produces top quality science graduates who become leading scientists of the future. International jobs available to UK graduates who are ready to invest in their own CPD and there is an increased willingness to collaborate, innovate and take risks. There are good career ladders in bio medical research. International jobs bring people from overseas and there is a flow of high calibre of graduates coming into companies and abundant high quality multifaceted university students and skilled workers at all levels as candidates for science and technology roles and interesting and creative careers in companies based in the UK.

• There are strong links between industry and academia which have enabled ground breaking spinouts from leading UK academic institution. Collaboration and swift innovation have been evident when rapid deployment was necessary to enable solutions to a health problem and prevent a global disaster.
• UK has a strong reputation for innovation and a track record of people coming together from different disciplines to develop new products to respond to problems in the environment. Bio-chemical technological solutions have resulted from cross -sector discipline problem solving. New communications technologies have been developed as well as new materials and clean fuel sources which are cheap and impact the cost of production.
• The ageing population provides demand and opportunities for drug development. Increased life expectancy is matched by better health care and work/life balance. Personalised medicine and preventative health care is increasingly delivered through expanding community drop in health centres to take health monitoring to the public. New and improved medicines give a better quality of life.
• UK becomes a genuine bioscience network of big companies and SMEs and an environment exists to nurture small companies and provide a community to exploit ideas, share resources. International companies are attracted to the UK to exploit skill base.
• There is a truly global industry with demand from China and emerging markets. Africa and South America emerge as stable political forces and more balanced economies. China and Eastern Europe no longer seen as the major source for science skills. There is strong economic growth in Africa as a result of use of bioscience to develop crops.
• Single EU with common currency and more sharing of knowledge across Europe. EU collaboration, verify results from research. European companies able to take advantage of joint working backed by EU assembly.
• Devolution and regional approach may create a more positive environment similar to US model of federal states.

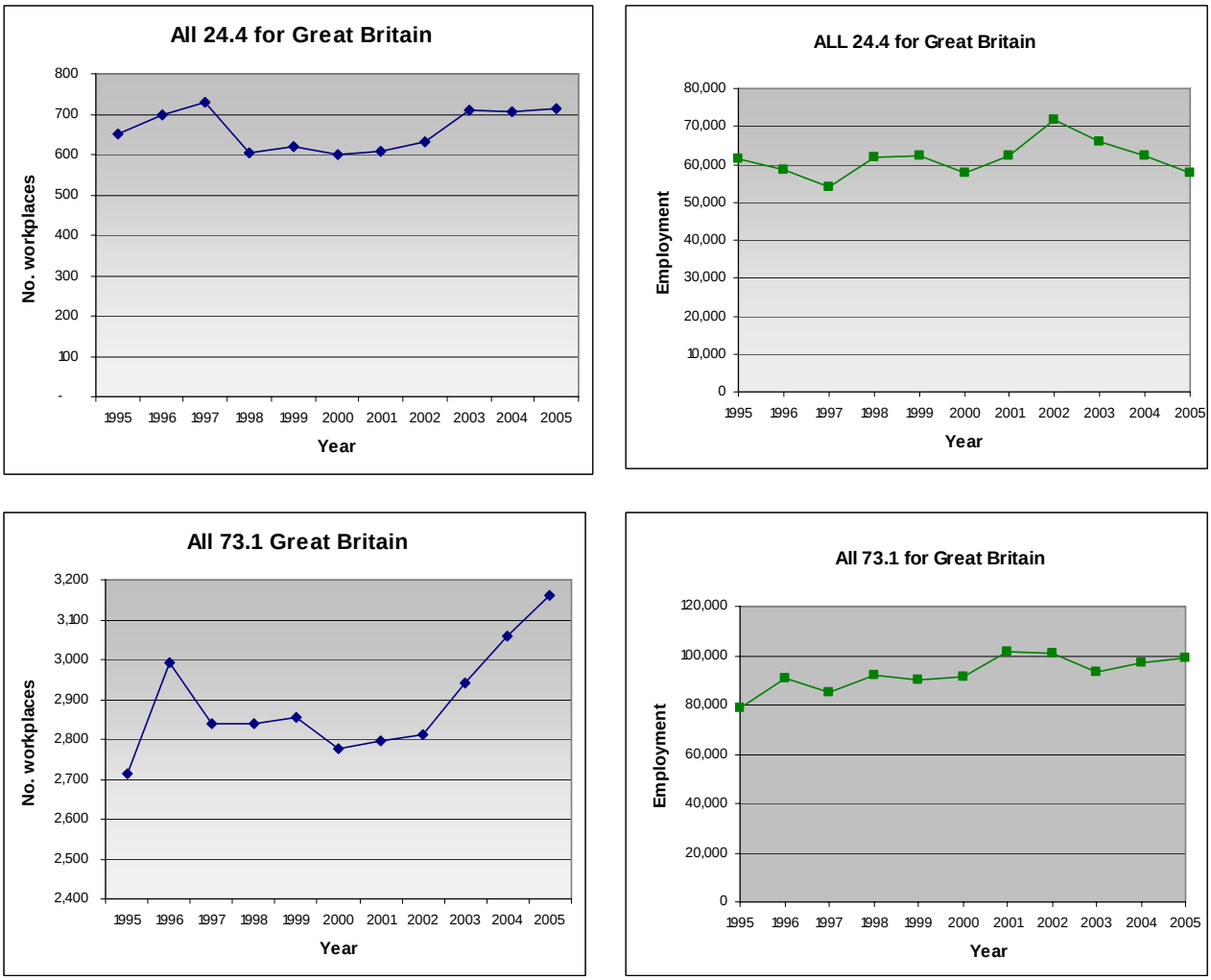
5 Summary of demand

5.1 Profile of the Bioscience sector

The dynamic nature of the bioscience industry and the difficulties in defining its scope, particularly in terms of SIC codes, means that the employment and workplace figures quoted by the DTI, and the industry itself, vary depending on the definition of the parts of the sector covered. For example, large pharmaceutical companies are not included in the DTI's figures for biotechnology, but medical devices companies are included.

The graphs below show how employment and the number of workplaces has changed in pharmaceutical manufacturing (SIC 24.4) and research and experimental design in natural sciences and engineering (SIC 73.1). These figures are not available at the same level of detail for Northern Ireland. Invest NI estimate that there are 50-60 companies employing almost 4,000 people in the Northern Ireland 'Life Sciences' sector.

Figure 5.1 Workplace and employment trends in Great Britain 1995-2005



Source: ABI 1996-2006

Bioscience forms only part of the pharmaceutical manufacturing sector (that dealing with R&D) and part of research and experimental design (that dealing with research in the natural sciences, particularly (but not exclusively) biological sciences.

5.2 The Bioscience Labour Market

The SEMTA Labour Market Survey[9] shows the Bioscience sector has a young age profile. Even so, the retirement of key staff is still an issue for some companies. Women are well represented in the sector, although there are fewer at more senior levels.

Over the last year, most companies had increased employment and most expected to grow in the coming year.

The LMS also shows that, compared to other sectors, bioscience has very high levels of:

- Hard-to-Fill Vacancies HtFVs (experienced by 39% of companies)
- Skills Shortages Vacancies (SSVs) (experienced by 22% of companies)
- Skills Gaps in the current workforce (experienced by 29% of companies).

There is strong competition for science skills, internationally and from other sectors. Just over one quarter of the companies that contributed to the LMS had recruited graduates from overseas in the previous year.

82% of the companies had engaged in training and CPD activity and this is also high. However, there is training that is mandatory across parts of the sector to meet regulatory requirements which means that training activity within the sector needs to be maintained.

Hard-to-Fill Vacancies and Skills Shortages

The main areas of HtFVs and skills shortages cover a wide range of generally scientific skills:

- Biological and medical sciences
- Chemical sciences
- Process engineering
- Mathematics and statistics.

In terms of specific scientific areas, the greatest skills shortages are in:

- Clinical/pharmacology/experimental medicine
- Bioscience and molecular biology
- Analytical and physical chemistry
- Process and chemical engineering
- *In vivo* sciences
- Bioinformatics.

Skills Gaps in the current workforce

Skills gaps are found in a range of both scientific and generic skills.

The main scientific skills gaps were in:

[9] SEMTA (2006) Labour Market Survey of the Pharmaceutical and Bioscience sectors

- Bioscience and molecular biology
- Analytical and physical chemistry
- Biochemistry
- Biotechnology/biopharmaceuticals
- Geomics/proteomics/metabolomics
- Synthetic organic chemistry/medicinal chemistry
- Mathematics or statistics.

The main generic skills gaps were in:

- Business skills
- Management skills
- IT skills (general)
- Project management
- Team working
- Regulation.

6 Assessment of Provision

6.1 Background

The major skills shortages in the bioscience sector are substantially higher than the UK average across all industries. These are having serious consequences for companies – including loss of products in pipeline, projects not taken forward. This makes a *prima facie* case that the education and training system is not delivering the quantity and quality of recruits needed. Many companies are actively pursuing recruits from outside the UK for skilled science posts.

What do employers look for?

While employers experience a range of skills shortages and gaps, they are clear that when they are recruiting, generally at graduate level, they are first and foremost looking for a depth of scientific knowledge and skills, in Chemistry, Biological science Mathematics.

They are also looking for interdisciplinary awareness, practical skills, experience in industry, the ability to work to regulatory standards and communication skills.

In terms of first degrees they have a preference for four-year degrees (batchelor or masters) and degrees with industrial placements are strongly favoured.

Some combined degrees, if they are with another science or mathematics are relevant to the sector, but other combined degrees are not of use to employers.

Employers are also looking to recruit graduates with first or upper second class degrees.

Changes in science and technology

With scientific developments proceeding rapidly, there are also some highly specialist skills that employers are seeking, which require specialist training and courses. These areas include bioprocessing and biomanufacturing as the sector moves to the biological delivery of drugs and medicines. There is also an increased requirement for the ‘omics’ disciplines, such as genomics, proteomics, metabolomics, etc.

There is also a need for multidisciplinary approaches covering genetics, molecular biology, biochemistry, IT, mathematics and statistics. There is a growth in the use of *in silico* design tools and *in silico* modeling.

6.2 Current provision

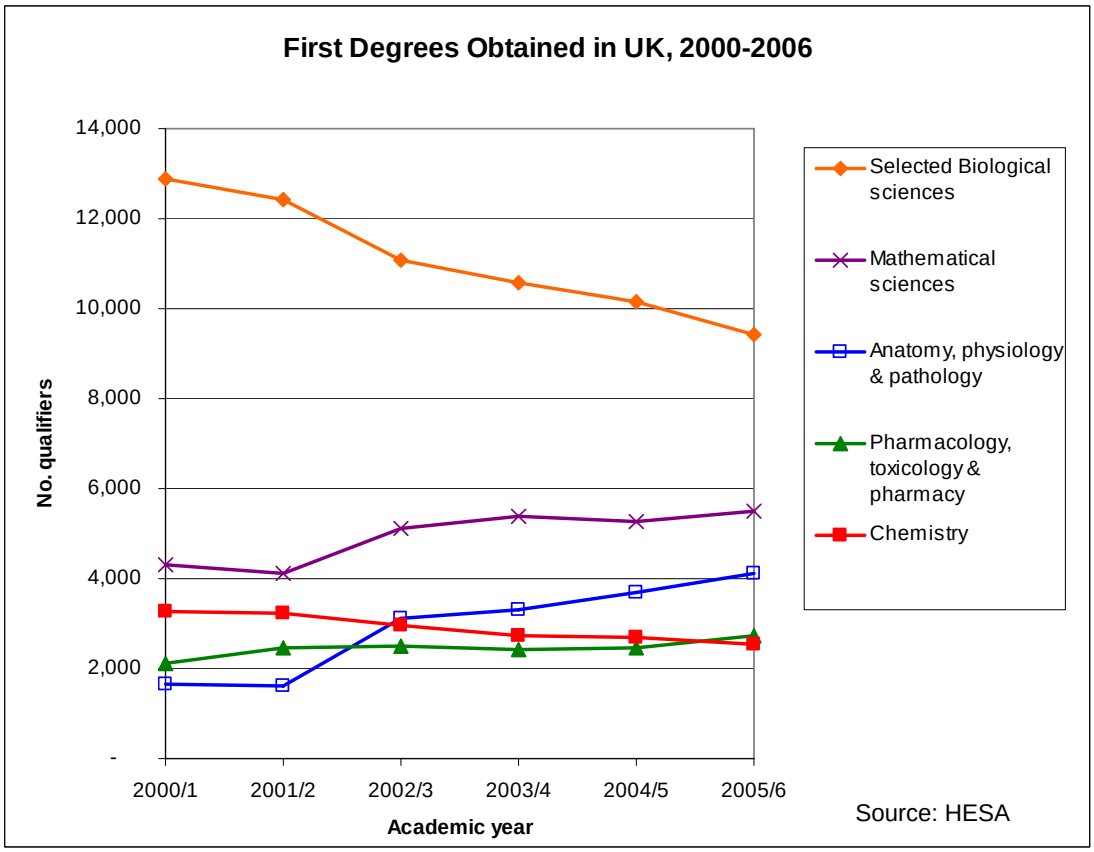
6.2.1 Higher Education (HE)

The main entry to the bioscience sector, especially for laboratory scientists and research scientists, is from universities, particularly those with established scientific Research Departments.

Since 2004, the number of universities offering courses in biological sciences has gone down. There are 20 fewer universities offering for Biology-related subjects; 13 fewer offering Microbiology. There are 19 fewer universities offering Chemistry. The decline in provision of Chemistry has triggered action but the situation for biological sciences has not received great attention.

Over the last six years, the number of first degrees gained by all students in Biological Sciences has declined by 27% if Sports science and Psychology are excluded from the figures. In Molecular Biology, Biophysics & Biochemistry there is a 6% decline and in Chemistry a 22% decline.

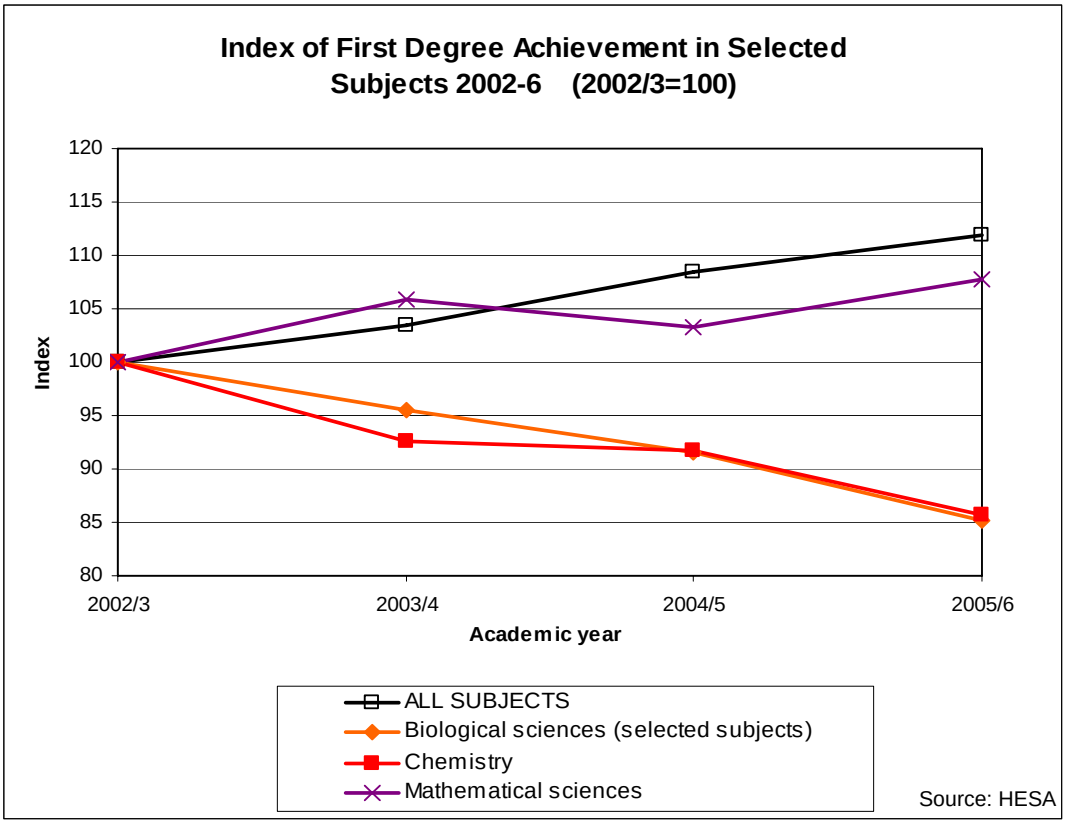
Figure 6.1: Number of first degrees obtained in UK in subjects relevant to Bioscience



About 5% of all the first degrees achieved in 2006 were in the sciences relevant to the bioscience sector. Overall, 9,400 students gained first degrees in relevant Biological sciences, with a further 4,100 in Anatomy Physiology & Pathology; 2,500 in Chemistry and around 600 in Pharmacology or Toxicology (if the numbers doing Pharmacy are excluded).

Even where there has been an increase in the numbers graduating as in mathematics, this has not kept up with the increase in overall student numbers in all subjects (see Figure 6.2 below).

Figure 6.2: Index of first degree achievement in selected subjects



First Destination data indicate that a minority of graduates from these courses enter the sector. Among Biology graduates 3% join the pharmaceutical sector, 6% take up jobs in research and 8% go into HE. For Microbiology the figures are each 9%. In Molecular Biology the figures are 9%, 9% and 16%, while for Chemistry they are 13%, 8% and 13%. The proportions are far smaller for graduates in Pharmacology, Toxicology & Pharmacy graduates and for Anatomy Physiology and Pathology.

6.2.2 Vocational HE, Further Education (FE) and Work-based Learning (WBL)

Technical skills for Laboratory Technicians, bio-manufacturing technicians and other skilled occupations at Level 3 are provided by colleges of Further Education (FE).

Fourteen colleges in England, 9 in Scotland and one in each of Wales and Northern Ireland, offer Higher National Diplomas in subjects such as Applied Biology, Biomedical Sciences, Chemistry, Pharmaceutical Science/Chemistry. Across the whole of the UK there are relatively few HNDs achieved in the Bioscience-related subjects: only 130 students gained Higher National qualifications in Biology in 2006 and in each of the other subjects relevant to Bioscience there are no more than a few dozen.

About 20 Universities in England offer the new Foundation degrees in science, although take up is low, with only 130 new entrants per year in Biological Sciences excluding Sports Science and Psychology. Foundation Degrees do not apply in Scotland and Northern Ireland. In Wales, HEIs are free to develop and offer Foundation Degrees in their portfolios, including through franchise arrangements with FE colleges, although none are currently offered in bioscience-related subjects. Unlike in England, there is no specific policy direction in Wales at present to expand this route above other types of provision.

In England, Wales and Northern Ireland, there are 84 colleges that offer at least one 'BTEC qualification'[10] in Applied Sciences and in 2005-6 almost 2,000 qualifications were awarded. FE colleges also teach GCE 'A' levels in science.

In 2005/6, there were about 400 people in training on the Laboratory and Associated Technical Activities National Vocational Qualification at all levels. There are Apprenticeship programmes and also a new Young Apprenticeship in Science for young people still in school to gain experience in the sector.

This part of the training infrastructure is clearly under-utilised by the bioscience sector.

6.2.3 Secondary Education

Few people are recruited directly from school into the Bioscience sector, but relevant school qualifications are a requirement of entry into courses in HE and FE. Science is compulsory up to Key Stage 4, but in England, Wales and Northern Ireland only a very small minority go on to take GCE A levels in science. 6.8% of all leavers achieve an A level in Biology, 5% in Chemistry, 3.4% in Physics and 7.5% in Mathematics. In Scotland the figures are much higher: 8.8% of all leavers achieve a Higher qualification at Level 6 (A-C) in Biology. Similarly, 2.8% achieve a Higher at Level 6 in Human Biology, 9.4% in Chemistry, 9.1% in Physics and 17.9% in Mathematics. Additionally, 1.6% of all leavers achieve a Higher at Level 7 (A-C) in Biology, 1.8% in Chemistry, 1.5% in Physics and 2.4% in Mathematics.

Changes to the school science and maths curriculum have meant that students are reportedly less well prepared to take up tertiary level study. Academics report that first year students lack fluency in algebraic manipulations; the analytical powers for multistep problems and a proper appreciation of precision and proof. Remedial action in university reduces what can be taught in a 3 year degree.

There is no clearly established set of career pathways to guide young people in the choices they make when considering careers in science.

[10] National Diplomas, National Certificates, First Certificates and GNVQs.

6.2.4 CPD

There is also a range of specialist private training companies offering courses in generic and management skills as well as continuing professional development. Senior scientific staff often keep their skills up to date through more informal specialist networks and conferences. BBSRC and others sponsor specialist courses. Three universities offer MBAs for bioscientists.

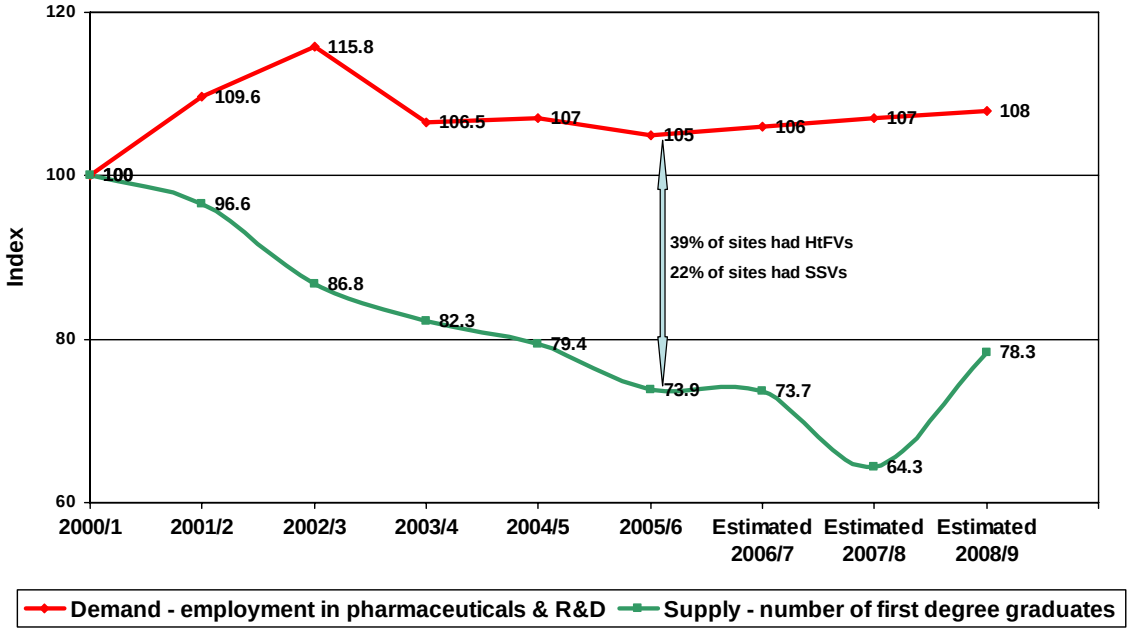
For teaching staff and school Laboratory Assistants, Science Learning Centres provide CPD courses for teachers and for school laboratory technicians. Other schemes, for example in Northern Ireland, offer the chance for academics to spend time in industry. These are popular and help to establish networks between industry and education.

7 Gap Analysis

Overall, the current system is not providing the number of cutting edge researchers, good bench scientists, or skilled technicians required for the development of bioscience and the adoption of biotechnologies in manufacturing. Supply is not meeting demand and is in fact diverging from it as figure 7.1 below shows in terms of the number of first degree graduates in chemistry and the relevant biological sciences.

Figure 7.1

Supply of first degree graduates in relevant Biological Sciences and Chemistry and Demand (employment change) in the Bioscience Sector



Sources: Employment – Annual Business Inquiry (ONS)

First degree graduates and number of 1st year students – HESA

One of the most significant trends of recent years has been the strong growth in numbers of young people going into Higher Education, but this has not been reflected in the number of students undertaking chemistry and the relevant biological sciences.

While sizes of cohorts through the relevant courses, in particular within Higher Education provision have waxed and waned between specific subjects, overall many of the courses of relevance to Bioscience have suffered since the 1990s from a fall in the numbers of young people wanting to study highly technical subjects, not least since they are often perceived to be (too) difficult. There are some indications of shifts back away from this trend, particularly within schools, but the 'appetite' of the fast-growing sector for an increasing flow of good science graduates and post-graduates requires not just a reversal of falls, but strong increases.

Employers within the Bioscience sector appear to recruit comparatively very low fractions of the First Degree graduates in relevant HE subjects – many good science graduates go to work in other sectors. This suggests that effort to improve the attractiveness of work in the Sector is probably needed, to be focused both at university students, and probably, in order to ensure that negative stereotypes are overcome, at secondary school students.

Within the relevance subjects, the specific courses of interest to Bioscience employers are those involving some time in industry, and, for joint Honours degrees, those whose second subject is appropriately complementary (rather than 'less mainstream').

In addition to the main science subjects, there is interest from some employers in new areas like Bio-informatics and more engineering-oriented degrees in Chemical and Process Engineering. This depends on the particular product/market niche of the company.

In principle, it would be desirable to try to increase the comparatively small numbers of young people who choose science subjects at school and then Science, Technology Engineering and Mathematics courses at university. It is likely that the greatest influence Bioscience employers would have in contributing to tacking this problem is as part of the overall national strategies emerging. SEMTA will review the relevant steps and advise employers on the steps likely to have the greatest impact.

Within the Vocational Education and Training provision system, there are a number of relevant courses. While not all newer provision has yet found strong employer take-up by employers, SEMTA will work with employers to examine how those achieving in this area might be able to provide good candidates in certain occupational areas.

Considerable refinement and improvements have been made over recent years to provision in schools. Cohorts of those choosing relevant GCSE and A Level (and equivalent) courses have recently been growing, but the challenge of encouraging more good young people to take such subjects continues.

It is understandable and natural that, in a fast-growing and fast-moving industry like bioscience, with a strong element of research and development and products and services of considerable technical complexity, the main focus on recruitment has been on the supply of the leading technical people, which has resulted in the greatest interest on Higher Education, and on the flows of people with First and Postgraduate Degrees in relevant subjects. However, a valuable opportunity exists in the development of the SEMTA Bioscience Sector Skills Agreement for Bioscience employers to review their past assumptions and practices to see whether new options might be available, given the various constraints that exist.

The major players in the Sector, in particular the large Pharmaceutical companies, are already engaging actively with the Education agenda at all levels, both in terms of a number of specific initiatives and in terms of following and contributing to the various policy developments. This provides a sound base for developing an effective Sector Skills Agreement.

Summary

- **Skills shortages and gaps are higher in the bioscience sector than in other sectors**
- **The number of universities offering bioscience-related subjects is declining**
- **The number of first degrees gained in bioscience-related subjects has declined over the last six years: by 27% in Biological Sciences and by 23% in Chemistry**
- **Only a small minority of the graduates in these relevant subjects enter the bioscience industry or go onto higher degrees in the subject.**
- **Only 5% of all the higher educational qualifications achieved in 2006 were in the sciences relevant to the bioscience sector**
- **The take up of Foundations Degrees, HNC/Ds and BTEC National Certificates is low and there may be opportunities to expand capacity in this area to increase the number of technicians coming into the industry by this route.**

8 Proposed actions

Before moving into the actions the following statement aims to characterise the Bioscience sector and articulate the characteristics and challenges faced by the sector.

Characteristics and Issues

In contrast with other parts of the SEMTA footprint the Bioscience Sector has some unique issues and challenges, which are characterised below. It is however, important to recognise some strong linkages and threads of common need throughout the entire footprint.

- Bioscience in contrast with Automotive, Aerospace and Marine sectors is a relatively young sector and appears to less well understood, in-part underpinned by a general lack of science literacy across the population.
- There are some similarities with Electronics that the employer base has few large companies and a high number of small organisations which makes the sector difficult to engage at a representative level.
- The sector appears to have a higher reliance and dependency on high level skills at degree, doctorate and post-doctorate level and has moved away from the FE and WBL aspect of skills and knowledge acquisition, although this is now recognised as a risk.
- The sector has to wrestle with more challenging moral and social issues than other parts of the footprint, which has an adverse impact on the image of the sector.
- Biology is a science subject generally exclusive to this sector.

The issues and concerns that emerged across stages 1 and 2 of the SSA, primarily fall into the following themes:

1. Leadership & Entrepreneurships
2. Networks and Clusters
3. Image and Attractiveness of the Sector
4. Availability of a top quality workforce

Leadership & Entrepreneurship: Viewed as a significant area of opportunity and improvement for the sector, not only in the large companies, but also in the smaller biological labs where often technically competent and academically strong young entrepreneurs require improved support and business acumen/skills to grow and develop the business. We need to encourage leadership at a regional/local level in partnership and through existing clusters and networks in order to develop a critical mass of influence.					
Priority	**Action**	**Semta / ETCNI activity**	**Employer activity**	**Delivery partner activity**	**Measure of Success**
Develop a pool of strategic leaders to drive, challenge and champion the sector as a whole - including SMEs and larger organisations - to create real value for industry, which is more robust	Develop, broaden and endorse access to the BBSRC 'YES' Programme (Young Entrepreneurs Scheme) http://www.biotechnologyyes.co.uk/ (M)	Promote and endorse scheme. Identify funding to expand	BIA / BIA SCOTLAND to develop and endorse BBSRC 'YES' Programme	BBSRC to further develop and expand 'YES' Programme across other Higher Education Institutions / expand number of HEIs involved Other delivery partners: BIA / BIA SCOTLAND & ABPI	Increase in number of undergraduates involved in YES programme.
	Identify and establish a leadership body for the sector across the UK	Liaise with relevant government departments of agencies such as the Technology Strategy Board	Work with Semta / ETCNI, government departments and agencies, clusters groups and contribute members of leadership body	Regional and national clusters & networks to act as a focal point to bring leadership body together DBERR, TSB, cluster organisations to promote role of leadership body	Leadership body established and having impact across the UK in increased take-up of managerial & leadership training
Promote value and importance of CPD	Identify good MBA modules appropriate for the sector, plus, identify existing good provision (S)	Identify and promote appropriate MBA modules	Contribute to MBA courses. Release staff for MBA courses. Identify appropriate MBAs	BBSRC, BIA, ABPI to promote and identify 'good' MBAs with appropriate bioscience content	Increase in numbers of MBA course with appropriate bioscience content
		Identify other areas of CPD for entrepreneurship e.g. consider development of appropriate NOS	Release staff for CPD activity & encourage take up	BBSRC, BIA, ABPI to promote and identify good practice CPD for leaders and entrepreneurs appropriate bioscience i.e. with recognition of Intellectual Property Rights and regulatory environment. Prospect & other Trade Union leaders to help identify CPD required by the workforce	Increased CPD activity
Ensure correct approach is taken by Home Office re work permits for overseas non-EU bioscientists	Move quickly to ensure correct approach is taken by Home Office re work permits for overseas non-EU bioscientists (S)	Semta / ETCNI to provide evidence to Home Office Migration Advisory Committee re work permits	Employers to recruit overseas workers through Skills Shortage Occupation list (tier 1) route	Semta / ETCNI to work with BIA / BIA SCOTLAND / ABPI and other SSCs on the Skills Advisory Panel of border and Immigration Agency to provide evidence	Reduction in skills shortages in high level occupations

S indicates Short–term action, M indicates medium–term action, L indicates long–term action.

Networks and Clusters: Networks and Clusters are viewed as a CRITICAL enabler and cluster development is central to the growth of bioscience and has been supported by the government since the 1999 Sainsbury report (Biotechnology Clusters - Report of a team led by Lord Sainsbury, Minister for Science) . Skills are an important component of successful clusters, along with proximity to suppliers and markets. Delivery of provision will be more successful if pursued through the clusters and networks already developed.					
Priority	**Action**	**Semta / ETCNI activity**	**Employer activity**	**Delivery partner activity**	**Measure of Success**
Support networks & clusters in expanding skills - related activities	Research & develop a UK picture of the bioscience sector landscape , stakeholders and networks	Map stakeholders clusters and networks and their linkages	Identify emerging clusters and contribute relevant information on linkages	Existing networks & clusters to enable development of the UK map for their areas	Map provides a consolidated view across the UK that is used by employers & stakeholders to improve cluster development
	Look to see whether clusters could share short course provision where close or by distance learning i.e. share work of one cluster across others	Identify clusters & encourage co-operation across clusters	Promote skills within their clusters	Clusters within each region / nation to promote skills delivery and work with national bodies such as the Science Forum & National Science Learning Centre	Increase level of skills delivery within each region
	Where areas have lower skills gaps - arrange links between other clusters to 'promote' / share good practice in relation to skills	Investigate how clusters have contributed to lower skills gaps		Take into account findings of research & promote good practice identified Delivery partners: Other clusters working together across the UK	Reduction in skills gaps in the sector
	All provision to take into account the role of cluster development in bioscience (and other knowledge-based industries). Clusters tend to be centred around HEIs. Investigate ways of including FE and VET in clusters	Encourage links between FE & HE in interested clusters	Identify occupations / roles that could be best filled by a vocationally trained workforce e.g. technicians	FE, HEI, VET providers' business units to co-operate Other delivery partners: Cluster organisations	FE & VET providers linked in to clusters and developing VET to meet employers' needs
	Establish a mechanism to provide a robust demand signal from the sector on a continuous basis	Continue & enhance labour market research in the sector to provide detailed understanding of skills shortages and gaps	Continue to labour market research and provide insight into emerging technologies and future scientific developments	Liaise with employers to provide enhanced labour market information at a regional level, to identify specific skills.	Action and initiatives undertaken as a result of the labour market research. Increased level of skills delivery within region / cluster

Image and attractiveness: To help the public at large have a better informed understanding of science generally (science literacy) and Bioscience as a consequence of improved general education and a more balanced representation of information in the public domain i.e. industry take a more participative role in this area. Encourage young people aspire to a career in science and engineering. Increase the number of adults employed in other sectors to consider Bioscience as an attractive and rewarding sector when retraining and up-skilling as a consequence of redeployment and/or career advancement.					
Priority	**Action**	**Semta / ETCNI activity**	**Employer activity**	**Delivery partner activity**	**Measure of Success**
Improve public understanding of science generally (scientific literacy) and particularly understanding of Bioscience	Develop image activity plan	Lead development of image activity plan	Employers to enable development of plan through their PR and Marketing departments	Input from Cogent and Trade Associations. Input from Science Media Centre	Image activity plan developed of implemented and image of sector is improved
		Establish a team to review and develop quick wins and review the image approach	SSG to contribute	Team to include Cogent and Trade Associations	
	Expand the influence of the Science Media Centre (SMC) to the public in a coherent fashion	Promote SMC	Use & contribute information to the SMC	Trade Associations, Research Councils, Clusters & STEMNET to work with SMC	
Develop a policy for Information, Advice and Guidance, in order to improve / enhance with partner bodies	Develop a policy and strategy to improve IAG for the sector	Liaise with other bodies in developing IAG policy careers advice	Employers to enable STEM careers advice and activities	Support from Careers Service, Careers Scotland, Careers Wales, Careers Service Northern Ireland, Connexions, Next Step, LearnDirect, JobCentre Plus, Institute of Career Guidance, Association of Graduate Careers Advisory Services, ABPI, BIA, Science Council, etb, Cogent and Union Learn to develop IAG at various levels	More people interested in working in the sector
For young people to aspire to a career in Science	Establish clear set of career pathways for science	Develop a draft route map and, following employer-led feedback, publish UK wide (with appropriate guidance for all 4 nations)	Promote bioscience through providing work placements , visits, science ambassadors, etc.	Careers activity: etb, JobCentre Plus, Science Council developing by 2008 route / career pathways	Bioscience sector able to recruit new staff more easily. Reduction in hard to fill vacancies and skills shortages
	Make better use of (exploit) existing organisations in support of the challenge in communicating the messages better an in a more coherent fashion	Supply LMI to appropriate organisations to support promotion of sector	Taking part in careers activities in schools, universities, career fairs, etc.	upport from Careers Service, Careers Scotland, Careers Wales, Careers Service Northern Ireland, Connexions, Next Step, LearnDirect, JobCentre Plus, Institute of Career Guidance, Association of Graduate Careers Advisory Services, ABPI, BIA, Science Council, etb, Cogent and Union Learn to develop IAG at various levels	

	Support Schools in the promotion of science & delivering the subjects in a purposeful science curriculum Support links between schools, bioscience employers and HEIs through work experience schemes and site visits	Promotion and communication	Taking part in careers activities in schools through employers websites	Schools to commit time for visits (influence head teachers)	Increase in take up of appropriate science subjects at school (national courses at intermediate and higher/advanced higher). Increase in numbers wanting to take biological sciences, appropriate biomedical science, chemistry and maths at degree level
Emphasise the importance and value of all science subjects with linkage to associated career paths. This can be supported by STEMNET, TAs, Research Councils, Industry and the launch of the NEW Diploma lines in England	Promotion of science subjects, particularly relevant biological sciences, chemistry & maths	Contribute to national reviews of Science Policy. Seek resources to support implementation of relevant qualification e.g. build on GCSE Applied Science & support Science Diploma	Promote bioscience though providing work placements visits, science ambassadors, etc. Taking part in careers activities in schools through employers websites	Promote science with DCSF, DIUS, STEMNET, Professional bodies, RSC, BBSRC, etb, Biosciences Federation, Science Council and Cluster organisations	Increased number of graduates going into the bioscience sector and PhDs being retained by the sector in the UK

Top quality workforce: Closing the skills gap by increasing the supply of quality people. Identify 'CORE' subjects and activities within the curriculum i.e. the STEM subjects and a focus on Practical skills.					
Priority	**Action**	**Semta / ETCNI activity**	**Employer activity**	**Delivery partner activity**	**Measure of Success**
Improve practical skills as an integrated component of the education system at all levels	Development of appropriate National Occupational Standards (NOS) for the sector with a strong emphasis on practical skills and application	Semta / ETCNI to develop NOS for the sector with a strong emphasis on practical skills and application Practical skills provision linked to SQS developments and progression routes. To be highlighted in route map of career pathways	Contribute to the NOS development and review	Awarding Bodies to Quality Assure NOS (accredit/certificate)	Adoption and use of NOS to meet skills deficiencies and gaps. Employers using NOS to solve skills gaps
	Identify the range of practical skills required to en-rich the curriculum and learning process, plus identify where and how these can be acquired i.e. Science Learning Centres and Techniums Develop a mechanism to better utilise spare laboratory capacity in universities to be exploited by schools and FE	Semta / ETCNI to develop list of practical skills with employers	Bio SSG to collaborate on identification of practical skills required to en-rich the curriculum and learning process	Providers at all levels to enhance delivery of practical skills Other delivery partners: HE / FE /VET providers and BBSRC	Reduction in practical skills deficiencies in new recruits and the current workforce
	Industry to be invited to participate in the Bioscience Subject Benchmarking exercise to review and redefine Subject Benchmarking Statements at Higher Education level, and therefore influence the HE output directly, particularly in relation to practical skills	Semta / ETCNI to organise / enable meetings with funding councils, Research Council and SSG	Review & help redefine subject Benchmarking Statements at Higher Education Level Other delivery partners: QAA	Funding Councils & Research council to assist in reviewing and redefining Subject Benchmarking Statements at Higher Education level	Employer representatives involved in Bioscience Subject Benchmarking. More emphasis given to practical skills in degrees
	Review the demand for 'sandwich courses' with a view to ramp up this activity across the UK. This will help bolster the practical experience so desperately sought after within the sector	Investigate demand for sandwich courses	Offering Sandwich placements	HEIs, FE to expand provision of sandwich courses	Reduction in practical skills shortages & gaps

Reduce skills shortages: Where there are particular skills shortages we need to develop a robust and substantive demand signal in order to gear-up a range of suitable solutions to address the needs articulated	Increase number of graduates with appropriate scientific skills in the following disciplines: Biological sciences Biomedical sciences Chemical sciences Process engineering Mathematics / Statistics Specific scientific areas to be addressed are: Clinical/pharmacology/experimental medicine Bioscience and molecular biology Analytical and physical chemistry Process and chemical engineering In vivo sciences Bioinformatics	Promote importance of biological sciences to government to gain status of physics, chemistry and mathematics	Industry links with HE to be expanded through visits, work placements, etc.	Higher Education Institutions expanding number of places on relevant biological science courses Other delivery partners: Higher Education Funding Councils and DIUS	Increases in number taking up the relevant sciences
	Move quickly to ensure correct approach is taken by Home Office re work permits for overseas non-EU bio scientists (S)	Semta / ETCNI to provide evidence to Home Office Migration Advisory Committee re work permits	Employers to recruit overseas workers through Skills Shortage Occupation list (tier 1) route	BIA / BIA SCOTLAND / ABPI to work with Semta / ETCNI to provide evidence	Reduction in skills shortages in hard to fill vacancies and skills shortages across the sector
	Assess opportunities for industry to recruit from non-HE (non-traditional) routes e.g. from FE, through Apprenticeships (Modern Apprenticeships in Scotland), etc. (following on from the development of NOS) (M)	Examine market for non-traditional (non-HE) recruits to the sector	Consider recruiting through vocational HE, FE and VET routes (L)	Develop appropriate provision that meets the needs identified in the employers' demand signal. Awarding Bodies to explore potential for delivering relevant qualifications Other delivery partners: HE / FE /VET providers and funding councils	Reduction in hard-to-fill vacancies particularly technician, craft and operator level
		Promote routes into industry from VET	Industry collaboration with FE and VET providers	FE to develop business links with bioscience sector employers and HE in local clusters	Increase in numbers moving onto HE courses in relevant subjects
Promote and develop a responsive system in order to design short courses to address the emerging high level specialist demand signals and up-skilling requirements for the sector. This will require a process to gather the demand signals in order to develop a solution/service.	Highlight examples of good practice in promoting links between employers and the supply side	Highlight examples of good practice in promoting links between employers and the supply side	Increase employers links to Business Units of HE, FE and VET providers	Improving links between the Business Units of HEIs, FE & VET providers and the sector	More employees involved in CPD

	Ensure CPD is available in key science areas and where it is required. Promote relevant networking , short courses, etc.	Promote the key science areas within Science Learning Centres, Techniums, Research Council, etc	Promote CPD	Promotion of relevant + provision partners: BBSRC, Science Learning Centres, Techniums, HE/ FE /VET providers	
Change Metrics for undergrads and university outputs to make more responsive to employer needs	Identify measures that are meaningful to the sector	Work with employers to identify those HE programmes / degrees that best meet their needs	Identify courses that employers value and provide evidence in terms of the relevant metrics	Institutions to endorse courses valued by industry Incentives offered to subsidise courses and qualifications valued / endorsed by industry	Increase in courses identified as meeting employer needs. Decrease in level of skills shortages across the sector