The Sector Skills Council for Science, Engineering and Manufacturing Technologies

Bioscience Sector Skills Agreement

Stage 3: Gap Analysis – Northern Ireland

Draft 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 Policy Context in Northern Ireland

The Skills Strategy for Northern Ireland[1] is a Department for Employment and Learning initiative, the draft of which was launched in 2004. Its key aims are to raise the overall skills level in Northern Ireland and to address the high economic inactivity. Whilst unemployment has reached a record low (4.7%) economic inactivity in Northern Ireland has remained between 27-30% since the mid 1980s.

The Skills Strategy aims to help individuals progress up the 'skills ladder' improving the overall skills level in the process; improve the employability and skills of those excluded from the labour force, particularly through the Welfare to Work initiative; and to ensure high productivity and competitiveness to secure Northern Ireland's position in the global marketplace.

The Skills Strategy identified three groups of skills:

1. Essential skills: Literacy, numeracy and, increasingly, ICT;
2. Employability skills: such as team working, problem solving, and flexibility;
3. Work-based skills: employer-specific skills.

The strategy recognises the key role SSCs can play in addressing the major skills concerns of individual sectors. SSCs must increase employer engagement by developing local representation and networking arrangements.

The Economic Vision of Northern Ireland set out the country's long-term economic objectives as well as incorporating related social welfare issues. The aim of the Vision is 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 Skills Strategy for Northern Ireland Implementation Programme[2] addressed four themes underpinning the Economic Vision:

1. Understanding the demand for skills;
2. Improving the skills level of the workforce;
3. Improving the quality and the relevance of education and training;
4. Tackling the skills barriers to employment and employability.

The Vision also identified the need for an increase in the level of investment in R&D, which is lower in Northern Ireland than in the rest of the UK, and is combined with focus on enterprise and innovation. These skills seem to be missing from the working culture and thus need to be encouraged in order to improve performance.

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.

[1] DELNI (2004) *Success Through Skills: the Skills Strategy for Northern Ireland*
[2] DELNI (2006) *Success Through Skills: the Skills Strategy for Northern Ireland – A Programme for Implementation*

- 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[3], 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

The Essential Skills for Living Strategy and Action Plan for Adult Literacy was launched in October 2002 with the aim of improving the levels of literacy and numeracy. The Strategy was a response to the findings of the International Adult Literacy Survey 1996[4] that 24% of the adult population had basic skills deficiencies, a figure supported by the Labour Force Survey 2003. A pilot scheme now includes ICT as an essential skill.

The DEL has identified six priority skill areas and recruitment has increased by almost half, encouraged by targeted funding initiatives. These are areas with serious identified skill shortages – construction, ICT, manufacturing engineering, electronics, software engineering, and tourism and hospitality.

The Department has also launched an English Speakers of Other Languages initiative in response to the growing number of migrant workers in Northern Ireland. As well as working in jobs that domestic workers reject because of low wages or unattractiveness, they are often filling a genuine skills gap.

Northern Ireland has its own regulatory and examination body for work and colleges, the Council for Curriculum, Examination and Assessment, although the four UK nations have a joint body for standards setting, the UK Co-ordinating Group. Northern Ireland also has its own system of equal opportunities legislation implemented by the Equality Commission for Northern Ireland.

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

[3] Department of Enterprise, Trade and Investment (March 2006) *The Regional Innovation Strategy for Northern Ireland: Action plan*, Sept 2004 to August 2006.
[4] Northern Ireland Statistics and Research Agency (NISRA) (1996) *International Adult Literacy Survey*

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 Futurefocus team did not run a formal workshop in Northern Ireland, but scenario planning was undertaken by SEMTA/ETC at the BioBusinessNI meeting in Belfast in March 2007. The outcomes of this event are summarised in Section 5.3 - Skills Needs Analysis and Critical Success Factors (CSFs)

The Futurefocus 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.

Key factors for cluster development in Northern Ireland

There was not a full day Futurefocus workshop held in Northern Ireland, because the 'Capability study' was underway[5]. This study highlights the key factors for Cluster Development and considers the Northern Ireland capability in each one. The key success factors are:

1. **Strong science base** – with strong university departments, strong hospitals and medical schools and charities, a critical mass of researchers and the presence of World-leading scientists.
2. **Entrepreneurial culture** – including commercial awareness and entrepreneurship in Universities and research institutes, role models and recognition of entrepreneurs and second generation entrepreneurs.
3. **Growing company base** – with thriving spin-out and start-up companies and more mature 'role model' companies.
4. **Ability to attract key staff** – which needs a critical mass of employment opportunities, an image/reputation as a biotechnology cluster and being an attractive place to live.
5. **Premises and infrastructure** – with incubators close to research organisations, premises with wet labs and flexible leasing arrangements, space to expand and good transport links.
6. **Availability of finance** – Venture Capitalists, 'business angels' and public sector funding required.
7. **Business support services and large companies** – needing specialist business, legal, patent, recruitment and property advisors and large companies in related sectors.
8. **Skilled workforce** – key success factors are a high standard of education and training courses at all levels.
9. **Effective networking** – which needs a shared aspiration to be a cluster, regional trade associations, shared equipment and infrastructure and frequent collaborations.

[5] Invest Northern Ireland (2007), in collaboration with BioBusiness Northern Ireland, *NI Life and Health Technologies Sector: Capabilities Study, Gap Analysis and Collaborative Network Assessment.*

It can be seen that these key success factors are closely allied to those coming out of the work on Critical Success Factors (CSFs) (shown below) undertaken by the Bioscience SSG and ratified at the various scenario planning meetings and by the review of CSFs at the BioBusiness NI meeting.

The Goals and Critical Success Factors

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 thrust 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.

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.

Invest NI estimate that there are 50-60 companies employing almost 4,000 people in the Northern Ireland 'Life Sciences' sector. Turnover is about £300m pa.

The Life Sciences sector was identified as a priority technology sector in the Northern Ireland Regional Innovation Strategy[6] 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. Other areas where Northern Ireland has niche strengths are: tissue engineering, diabetes, bioinformatics, clinical trials, neurodegenerative diseases and infectious diseases.

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)

5.2 The Bioscience Labour Market

The SEMTA Labour Market Survey[7] 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.

[6] Department of Enterprise, Trade and Investment (March 2006) The Regional Innovation Strategy for Northern Ireland: Action plan, Sept 2004 to August 2006.
[7] SEMTA (2006) Labour Market Survey of the Pharmaceutical and Bioscience sectors

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:

- 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.

5.3 The Bioscience Labour Market in Northern Ireland

There were ten companies that contributed responses to the SEMTA LMS in Northern Ireland: four pharmaceutical R&D companies, two contract research companies and one each in biopharmaceutical R&D/medical biotechnology, agricultural biotechnology, process engineering and one university spin-out company. There was one large company, three medium-sized and six small companies (<25 employees).

With such small numbers involved, it is not possible to say whether the labour market in Northern Ireland differs from that in the rest of the UK. A summary of the responses from the Northern Ireland participants is given below:

- Six out of the 10 companies in Northern Ireland did not believe that the loss of staff due to retirement would be a problem to them in the next five years.
- Three of the companies had grown in the previous 12 months and two had declined in employment.
- One company expected employment to grow over the next 12 months and two companies expected it to decrease.
- Seven companies had recruited in the previous 12 months and, of these, two had experienced HtFVs. These were not in scientific occupations, but in finance/accounting.
- Two of the companies stated that they had skills gaps in the current workforce in four occupations, all scientific: science managers, senior scientists, senior researchers and laboratory scientists.
- Seven of the 10 companies have a training plan and eight of the 10 had arranged training in the previous 12 months. Probably reflecting their different sizes, companies spent varying amounts on training, with one company spending £50,000-100,000 in the last year.
- The companies used a wide range of training methods:

Table 5.1. Type of training/CPD in previous 12 months: Northern Ireland

Type of training/CPD	No. of sites
Off-the-job training	8
International conferences	6
Specialist meetings	6
On-the-job training	6
Expert mentoring	5
Online training	5
Employer networks or fora	4
Day release	3
Total number of companies engaged in training/CPD	**8**

Source: SEMTA LMS (2006)

- Four of the companies expected training expenditure to increase in the coming year.
- Barriers to training: seven of the companies said that they could not afford the time off for staff to train. Two said that there were not any barriers to training.

Further evidence from NI

The NI Life and Health Technologies Sector report[8] is based on interviews with 33 companies in the medical devices, pharmaceuticals, biotechnology and clinical trails sectors. In relation to the skilled workforce, the main specific skills gaps that are identified are for:

- Pure science graduates
- Analytical chemistry
- Graduates/PhDs insufficiently prepared to transfer knowledge to the industry
- Lab technicians (remuneration at this level not sufficiently attractive)
- Design engineers
- Mechanical and electrical engineers.

The view is expressed that, while the quality of the NI education system is at least comparable to that in the rest of the UK, it is still not sufficiently geared to meet industry needs. There is concern that 'the current imbalance between skills demand and supply stems from the declining uptake of science subjects at primary and secondary education'. Both these views echo those expressed in all the SSA consultation workshops.

Skills Needs Analysis and Critical Success Factors (CSFs)

The Skills Needs Analysis and the CSFs that had been identified by the Bioscience employers were reviewed at a BioBusiness NI meeting in March 2007. There was general agreement that the SNA highlighted the main issues for the sector that would need to be addressed to ensure it grows and is successful in the future. In confirming the issues identified, the Northern Ireland employers commented that:

- Skills issues tended to mainly affect larger companies rather than smaller ones. Until smaller companies try to grow and it is likely that they then also meet same skills and recruitment issues.

- Skills shortages for NI were likely to be higher than those shown by the few respondents and that more detailed qualitative data should be collected to get a better feel for the issues, because the could be masked by the overall figures. One employer mentioned that some of their production and maintenance workers were workers from Poland and another mentioned having a high number of applicants with MSc/PhD for technician roles. This shows that the labour market is not working efficiently.

- In terms of which skills Northern Ireland employers would put high on their list, analytical chemistry was mentioned. A university representative mentioned that some analytical chemistry courses had been closed – it is not possible to run courses that students will/do not choose.

- One employer voiced concern that there was a need to return to core sciences as areas of study since it was unclear what students had actually experienced from the mixed / combined courses that applicants presented to them.

[8] Invest Northern Ireland (2007), in collaboration with BioBusiness Northern Ireland, *NI Life and Health Technologies Sector: Capabilities Study, Gap Analysis and Collaborative Network Assessment.*

Management skills

- Project management skills were mentioned by one of the employers and this was recognised as an issue by the rest of the group. A combination of science and business skills is definitely required for large employers in the medical devices sector.

- It is important to develop the large pharmaceutical companies in the area to drive the growth of the smaller supply chain companies was mentioned.

- There was strong agreement that graduates with proven practical skills were essential for business. It was felt difficult to get the right people into universities and there was a suggestion that the quality of UK graduates is not as good as those from overseas. One employer felt that particularly their graduates from India were undertaking courses in India that were more in line with what undergraduate courses in the UK 'used to be like'.
- The view was expressed that in some ways university courses were having to 'step down' to poorer skilled UK school leavers, and sometimes lecturers have to cover the basics that students should already know.

- There are also examples of universities in other areas of the UK finding it extremely difficult to teach large intakes of students. The group sizes put restrictions on the lab work that could be undertaken. The use of lunchtime chemistry boosters (for undergraduates) was mentioned as being successful. There was also concern that undergraduate applicants were under the impression that there are greater numbers of jobs in psychology and similar subjects, so they are choosing those courses.

- The discussion around vocational courses and skills mentioned that students should be choosing specialised core courses but these should have a bench skills content. There was some employer concern that graduates with first and upper second class degrees were not up to scratch in the workplace. There was a feeling that the Government considered that everything was fine because more people are going to university but industry want to know how they can influence what is happening

Skills gaps

- It was suggested that for skills *gaps* there should be a focus on sectors and the gaps should be looked at with industry specifying the skills required and funding should be secured to engage employers and look at training through a 'school of excellence' or a Bioscience Academy. It was suggested that employers need a solution and guidance – the requirement of a "fix" for the supply-side (education) is too high, since it is not possible to change the education system in the short term. There was discussion about a think tank and the need for a school of excellence – and industry recognised courses for graduates.

- Employers said it was often useful for students to have a year out in industry. Sometimes this year is actually a university-based research year rather than a year with an employer in industry. Those that had industry experience settled faster (in employment) and were more useful as employees. When employers receive applications, they often look for work experience of some kind, even if not directly Bioscience-related.

- The value of sandwich courses was emphasised the employers said that they would support year out opportunities and indeed they already did so. They consider it to be an investment in future staff and they are aware that if a group of employers offers the opportunity – everyone benefits from work experienced graduates. The format of such an experience was discussed with many saying that a year was preferable.

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

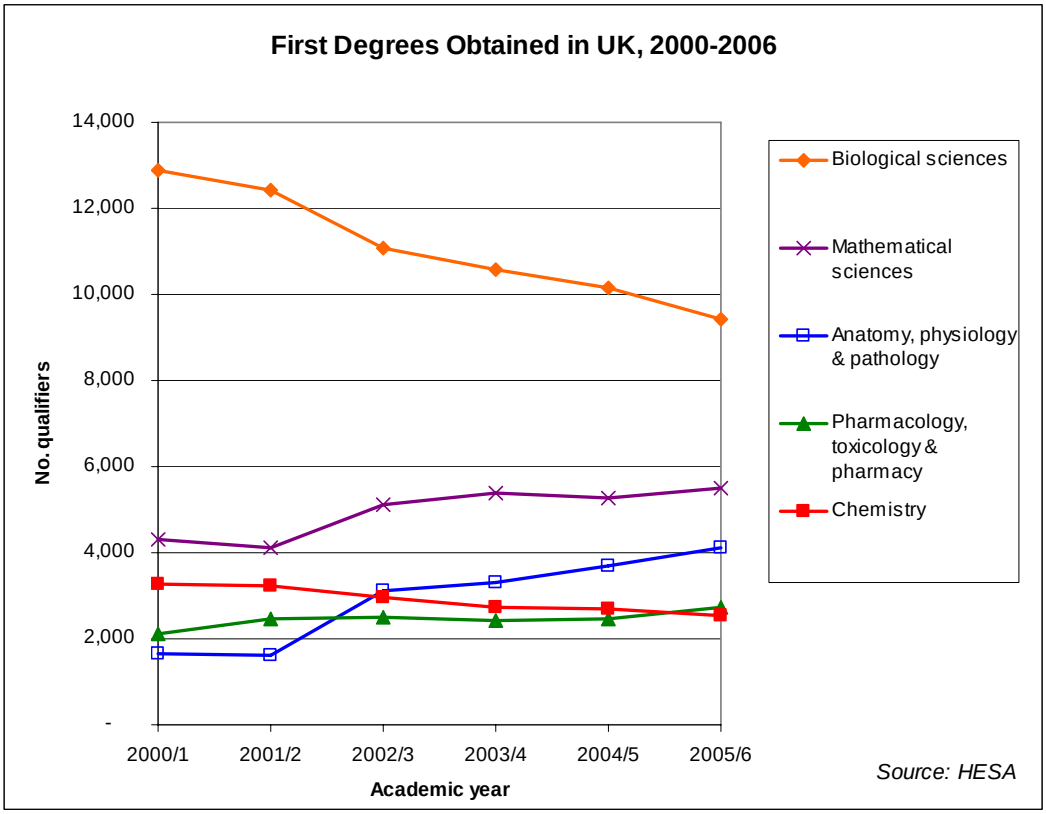
6.2.1 Higher Education (HE)

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.

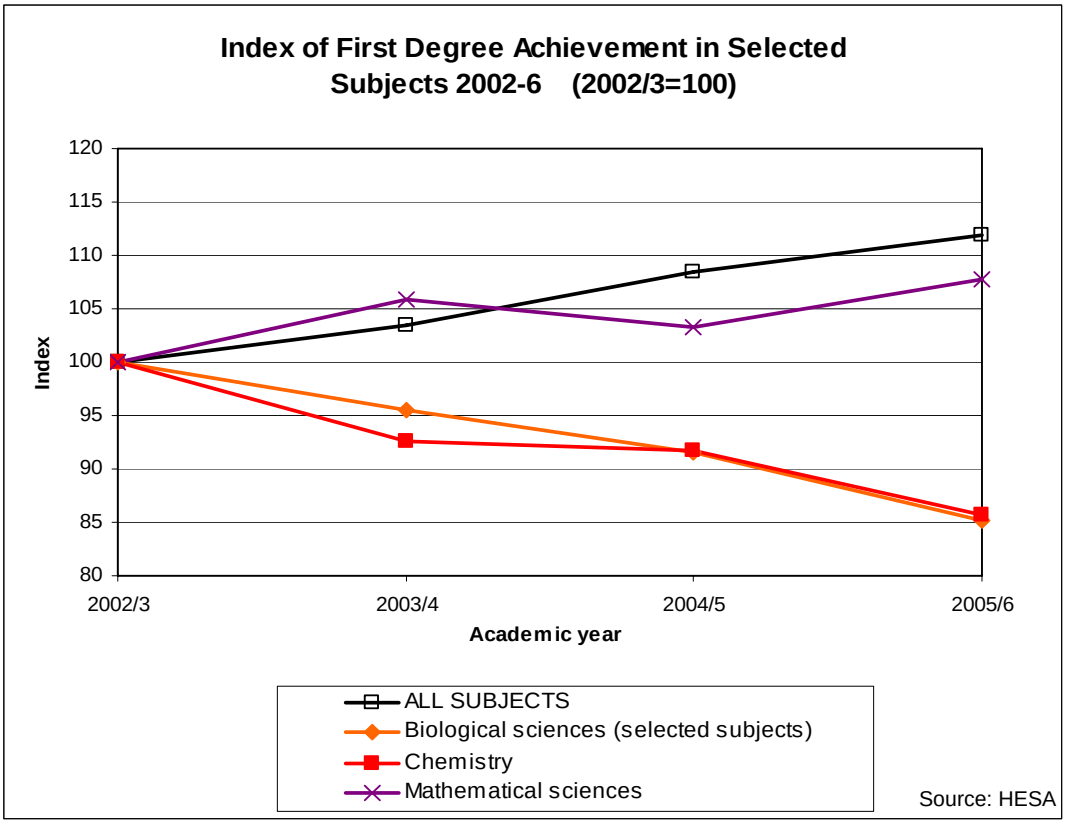
Figure 6.1: Number of first degrees obtained in UK in subjects relevant to Bioscience



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.

Provision in Northern Ireland - Higher Education

In terms of *all* qualifications awarded in *all* subjects 2.4% are awarded by the two universities in Northern Ireland[9]. These institutions, Queen's University Belfast and the University of Ulster provide a range of bioscience related courses. In Anatomy, Physiology and Pathology (3.4% of qualifications in these subjects) and in Pharmacology, Toxicology and Pharmacy (5.3%), Northern Ireland is particularly well represented. The University of Ulster is one of 25 universities across the UK that offers first degrees in Pharmacology.

Table 6.1 Available relevant Undergraduate and Postgraduate courses in Northern Ireland

Undergraduate

Queen's University Belfast (Q75)	**University of Ulster**
Anatomy	Biology
Applied Mathematics and Physics	Biomedical Engineering
Biochemistry	Biomedical Sciences
Biological Sciences	Pharmacology
Biomedical Science	
Chemistry	**Postgraduate**
Computational Mathematics	
Genetics	**Queen's University Belfast**
Mathematics	Biomolecular Structure and Function
Mathematics and Stats & Operational Research	**University of Ulster**
Medicinal Chemistry	Bioinformatics
Microbiology	Biomedical Science
Molecular Biology	Biotechnology
Physiology	Food Biotechnology

While Figure 6.1 above shows that the number of students obtaining first degrees in the relevant biological sciences and chemistry has fallen substantially in the UK as whole, in Northern Ireland this has not been the case. From 2002/3 to 2004/5, the number of graduates increased, although there has been a fallback in 2005/6. In other bioscience-related subjects there have been increases overall.

Table 6.2 HE Qualifications Obtained in Northern Ireland 2002/3 to 2005/6

	Total first degrees			
Northern Ireland	**2002/3**	**2003/4**	**2004/5**	**2005/6**
Biological sciences	130	155	155	115
Mathematical sciences	90	90	90	100
Anatomy, physiology & pathology	105	130	140	155
Pharmacology, toxicology & pharmacy	105	100	105	135
Chemistry	25	30	35	25

Source: HESA

[9] HESA (2006) Students in UK Higher Education Institutions (dataset)

Table 6.3 below shows the number of full-time first degree students in Northern Ireland in the relevant subjects, compared to the UK as a whole.

Table 6.3 HESA 2004-5 Full-time First Degree numbers in Northern Ireland (all students studying - not one cohort)

H E I	Chemistry	Biological Sciences	Subjects Allied to Medicine	TOTAL
Northern Ireland				
Ulster	-	145	1,160	1,305
Queen's Belfast	125	300	670	1,095
Total (Northern Ireland)	**125**	**445**	**1,830**	**2,400**
Total (United Kingdom)	**10,830**	**32,500**	**42,550**	**85,880**

Postgraduate courses in selected subjects

105 universities in the UK offer postgraduate qualifications in subjects of interest to the Bioscience sector. The student numbers for 2004-5 are shown in detail below, by the three main Subject Groups.

Table 6.4 HESA 2004-5 Full-time Postgraduate Degree numbers (all students studying - not one cohort)

		Chemistry	Biological Sciences	Subjects Allied to Medicine	TOTAL
Northern Ireland	Ulster	-	40	215	255
	Queen's Belfast	75	95	65	235
Total (Northern Ireland)		**75**	**135**	**280**	**490**
Total (United Kingdom)		**3,885**	**7,130**	**5,895**	**16,910**

Source: HESA

Queen's University Belfast offers postgraduate courses in Bioprocessing, but there are not any postgraduate courses available in Northern Ireland.

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, nine 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

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.

Vocational HE, FE and WBL in Northern Ireland

The table below shows the Vocational Education and Training courses provided at colleges in Northern Ireland.

Table 6.5 Vocational Education Provision in Northern Ireland

Northern Regional College	**Belfast Metropolitan College**
BTEC First Diploma Science	BTEC National Diploma in Applied Science (Laboratory and Industrial Science) (NQF Accredited)
South Eastern Regional College	BTEC First Diploma in Applied Science (NQF Accredited)
Access Biological Sciences (QUB)	Biological/Biomedical Science: Certificate in Foundation Studies (Queen's University of Belfast)
EDEXCEL BTEC HNC Science (Biology with Chemistry)	BTEC First Diploma in Applied Science
AQA GCSE in Applied Science (Double Award)	BTEC HND in Applied Biology
First Diploma in Applied Science	BTEC HND in Applied Chemistry
National Certificate in Applied Science (Medical & Forensic)	**North West Regional College**
CERTIFICATE IN FOUNDATION STUDIES (Combined Sciences)	GCE Applied Science (Double Award) with Additional Studies in AS Chemistry and AS Psychology
HND Science (Biology with Chemistry)	

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

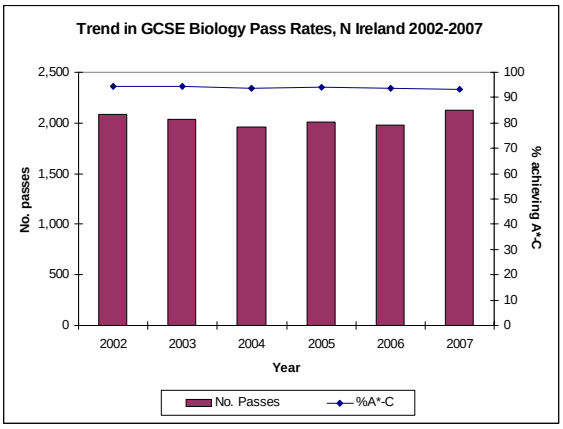
Overall, this part of the training infrastructure is clearly under-utilised by the bioscience sector. However, in Northern Ireland a face-to-face survey of 75 science companies by Further Education (FE) staff[11] found that many had used training provided by FE colleges. The main areas were, in order of interest: Health and Safety, Analytical Techniques, Laboratory Skills, Environmental Testing and Science Technician Skills.

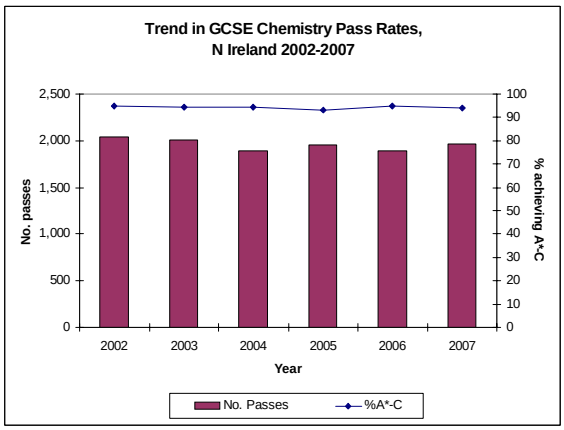
6.2.3 Secondary Education

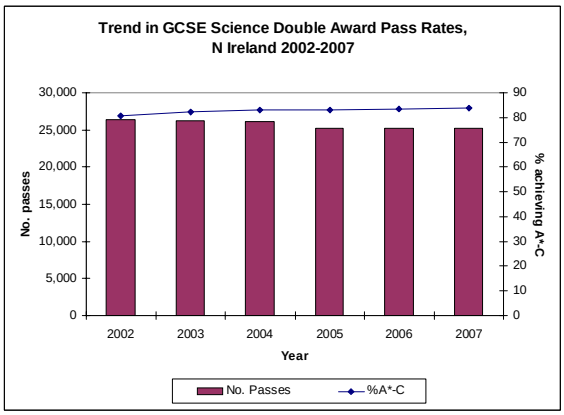
Few people are recruited directly from school into the Bioscience sector, but relevant school qualifications are a requirement of entry into courses in HE and FE. Science is compulsory up to Key Stage 4, but in England, Wales and Northern Ireland only a very small minority go on to take GCE A levels 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

Recent Trends in Northern Ireland Pass Rates in relevant GCSEs and GCE 'A' Levels are shown below. Pass rates at A*-C in both the individual sciences and the GCSE Science Double Award are higher than those in England and Wales. Similarly, GCE 'A' level, the percentage of students that achieve grades A or B is also higher.

Figure 6.3: GCSE Pass rates, Northern Ireland 2002-7

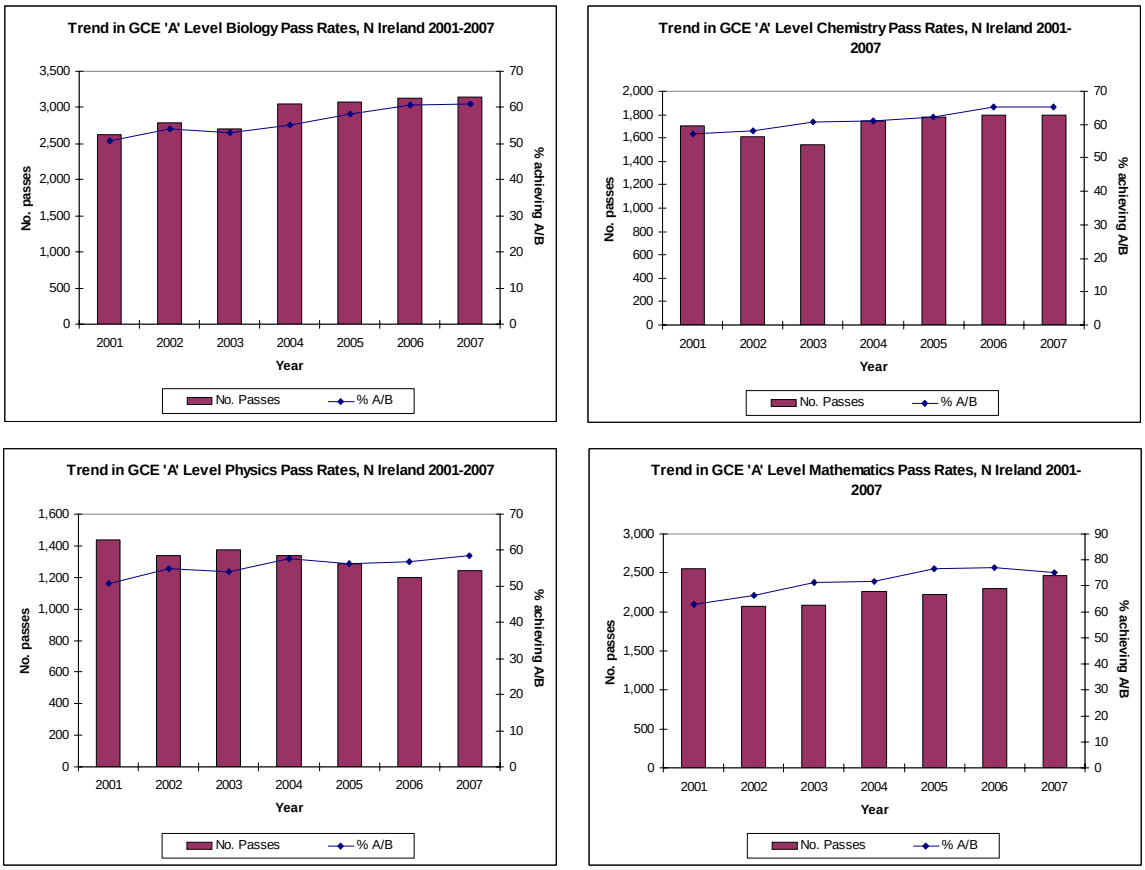






[11] ETI (2004) Science in Further Education

Figure 6.4: GCE 'A' level Science subjects pass rates, Northern Ireland 2002-7



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.

6.2.4 CPD

Enhanced CPD is supported by employers and Trade Unions in building the skills of the workforce. 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.

6.2.5 Cluster Co-ordination and Support

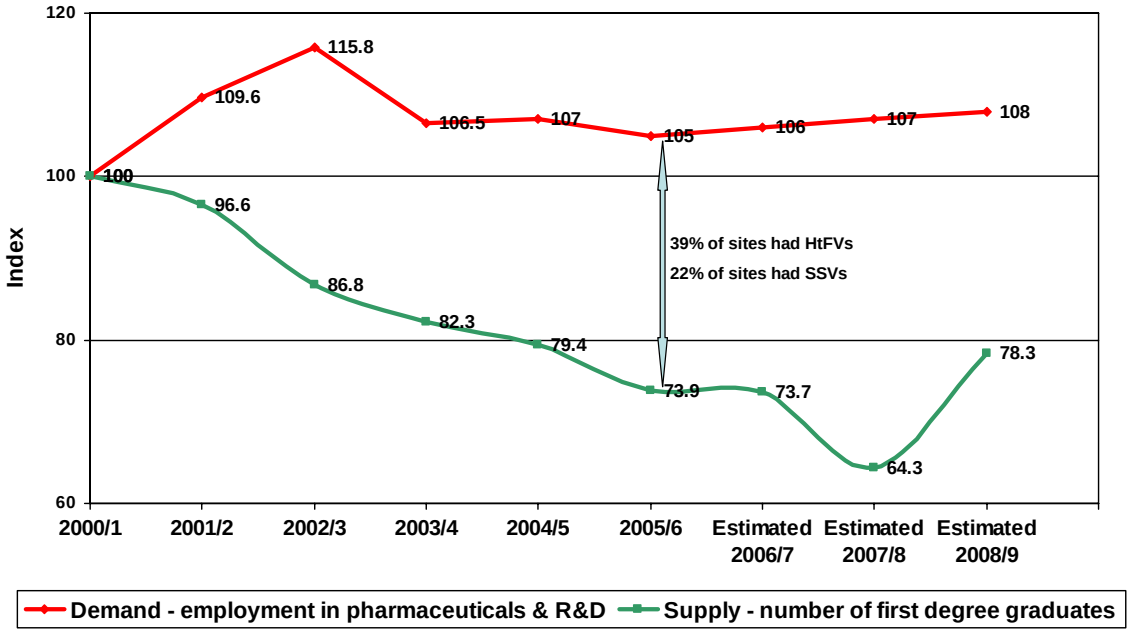
BioBusiness Northern Ireland is the business association for the Life and Health Technologies Sector in Northern Ireland. It provides a range of support services, including knowledge transfer and enabling specific learning provision when required. The cluster's skill needs are reviewed from time to time.

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 relevant 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/ETC will review the relevant steps and advise employers on the actions 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/ETC 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

- **Across the UK skills shortages and gaps are higher in the bioscience sector than in other sectors. The responses in Northern Ireland suggest that the levels of skills shortages and gaps are similar or slightly lower than in the rest of the UK.**

- **The number of universities offering bioscience-related subjects is declining in the UK. However, both the universities in Northern Ireland have continued to offer undergraduate and postgraduate courses in bioscience-related subjects.**

- **The UK figures show that, overall, 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. The situation in Northern Ireland is somewhat different, with some increases in the last four years.**

- **Only 5% of all the higher educational qualifications achieved in 2006 were in the sciences relevant to the bioscience sector**

- **A small minority of the graduates in these relevant subjects enter the bioscience industry or go onto higher degrees in the subject.**

- **The take up of vocational HE, FE and Work-based Learning, including 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.**

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 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 & 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	Clusters & networks to act as a focal point to bring leadership body together DETI, TSB, cluster organisations to promote role of leadership body Other delivery partners: BioBusinessNI, DETI, DELNI and InvestNI	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 / 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 Other delivery partners: BBNI, InvestNI	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 Northern Ireland to promote skills delivery and work with national bodies such as the Science Forum & National Science Learning Centre	Increase level of skills delivery within Northern Ireland
	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, InvestNI	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 Other delivery partners: DELNI	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 Service Northern Ireland, 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.	Support from Careers Service, Careers Service Northern Ireland, 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 (GCSE, 'A' level, Ordinary and 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.	Promote bioscience though providing work placements visits, science ambassadors, etc. Taking part in careers activities in schools through employers websites	Promote science with Department of Education NI, InvestNI, DELNI, 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 DELNI, Research Council and SSG	Review & help redefine subject Benchmarking Statements at Higher Education Level Other delivery partners: QAA	DELNI & 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 DELNI	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 / 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, 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, Research Council, etc	Promote CPD	Promotion of relevant + provision partners: BBSRC, Science Learning Centres, 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