

October 2008/38

**Policy development**

**Report**

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No action is required

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This report sets out the advice of the HEFCE chief executive's Strategically Important Subjects Advisory Group, which was delivered in June 2008. The group's primary aim was to review the policy framework that guides HEFCE's approach towards strategically important subjects.

# Strategically important and vulnerable subjects

**Final report of the 2008 advisory group**

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# Strategically important and vulnerable subjects

## Final report of the 2008 advisory group

<b>To</b>	Heads of HEFCE-funded higher education institutions Heads of HEFCE-funded further education colleges Heads of universities in Northern Ireland
<b>Of interest to those responsible for</b>	Senior management, Governance, Planning
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<b>Enquiries to</b>	Paul Hazell tel 0117 931 7452 e-mail p.hazell@hefce.ac.uk

## Executive summary

### Introduction

1. This report sets out the advice and conclusions of the HEFCE chief executive's Strategically Important Subjects Advisory Group, which was delivered in June 2008. The group's primary aim was to review the policy framework that guides HEFCE's approach towards strategically important subjects.

2. Subjects deemed strategically important and vulnerable by the Strategically Important Subjects Advisory Group are:

- science, technology, engineering and mathematics (STEM) subjects
- area studies and related minority languages, including:
  - Arabic and Turkish language studies and other Middle Eastern area studies, former Soviet Union Caucasus and central Asian area studies
  - Japanese, Chinese, Mandarin and other Far Eastern languages and area studies
  - courses relating to recent EU accession countries, especially those in Eastern Europe and the Baltic region
- modern foreign languages
- quantitative social science.

### Key points

3. The advisory group supports HEFCE's £350 million programme of work to support vulnerable subjects and suggests the following principles in relation to strategically important subjects:

- a. The group concurs with the view of the previous Strategically Important and Vulnerable Subjects (SIVS) advisory group, in

its 2005 report (HEFCE 2005/24), that it should be the Government's role at any given time to designate subjects as being strategically important, and HEFCE's role to consider whether such subjects are vulnerable and the interventions necessary to address this.

- b. The group supports the policy framework developed by the 2005 review, while emphasising the importance of skills in the workplace and the need for HEFCE to establish a framework for integrating its activities on SIVS and on employer engagement. The group also highlights the value of measures to address the supply of, as well as demand for, SIVS.
- c. HEFCE should adopt a selective approach to sustaining provision in specific places and any intervention should be characterised by innovation and collaboration, a strongly evidenced case for vulnerability and the enhancement of national provision as well as that in the specific locality.
- d. The group welcomes the progress of the key indicators of demand in STEM subjects and notes the continued impact on STEM demand of the growth of more vocational areas of science such as medicine and pharmacy.
- e. The group notes the sustained volume of modern languages provision in higher education and supports the measures recommended by Lord Dearing's Languages Review<sup>1</sup> to develop languages at lower levels.
- f. In light of the Gill Review<sup>2</sup> and the measures being taken by HEFCE to sustain specialist provision, land-based studies should no longer be considered vulnerable.
- g. The group supports HEFCE's programme of support for SIVS, and sees it as being appropriate and proportionate for the issues identified. Outcome and output measures should be in place and regularly monitored in any further funding provided.
- h. A new advisory group should be set up with a remit to consider graduate supply and demand, and the range of health-of-discipline issues arising from indicators of vulnerability. Research should be undertaken into salaries and other measures of graduate demand, which will complement information produced by Sector Skills Councils and others.
- i. A further review of the SIVS policy framework should be carried out in 2011.

#### **Action required**

- 4. No action is required in response to this document.

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<sup>1</sup> More information on the Department for Children, Schools and Families' Languages Review Group chaired by Lord Dearing, and its report 'Languages for all: languages for life, a strategy for England', can be found at [www.teachernet.gov.uk](http://www.teachernet.gov.uk) under Subjects/Modern Foreign Languages/Languages review.

<sup>2</sup> Further information on HEFCE's review of land-based studies, led by Professor Maggie Gill, is available at [www.hefce.ac.uk/aboutus/sis/land.htm](http://www.hefce.ac.uk/aboutus/sis/land.htm)

## Introduction

### Strategically important subjects: 2005 advisory group

5. On 1 December 2004, the then Secretary of State for Education and Skills wrote to HEFCE requesting the Council's view on 'whether there are any higher education (HE) subjects or courses that are of national strategic importance, where intervention might be appropriate to enable them to be available... and the types of intervention which it believes could be considered'<sup>3</sup>. The Secretary of State's letter included a list of subjects that had been deemed strategically important by the Minister and his Cabinet colleagues.

6. In response, HEFCE set up a Strategically Important Subjects Advisory Group, chaired by Professor Sir Gareth Roberts. The group was charged with advising HEFCE's chief executive on a number of issues, including:

- a. A rationale, process and set of criteria for identifying academic subjects as being of strategic importance, both now and in the future, and for identifying those strategically important subjects that are particularly vulnerable.
- b. The nature of support required by strategically important and vulnerable subjects (SIVS) that the Council or others could appropriately offer.

7. The group was mindful of the steer given by the Minister that 'in framing your advice, I would like you to bear in mind the core principle that higher education institutions are and must remain autonomous, independent bodies, making their own decisions'.

8. The group focused on the following subjects, which it considered to be both strategically important and vulnerable:

- science, technology, engineering and mathematics (STEM) subjects

- area studies and related minority languages, including:
  - Arabic and Turkish language studies and other Middle Eastern area studies, former Soviet Union Caucasus and central Asian area studies
  - Japanese, Chinese, Mandarin and other Far Eastern languages and area studies
  - courses relating to recent EU accession countries, especially those in Eastern Europe and the Baltic region, (including new accession countries such as Bulgaria and Romania scheduled for entry in January 2007)
- modern foreign languages
- land-based studies
- quantitative social science.

9. The group's final report was published in June 2005<sup>4</sup>. In summary, it advised that:

- a. The dynamism of the English HE sector is a great strength and interventions should, as a rule, be kept to a minimum.
- b. Attention should be focused on subjects that are both strategically important and vulnerable. Vulnerability may be measured by a mismatch between supply and demand, or by a concentration of the subject in institutions that may be vulnerable to change. Departmental closures do not of themselves mean vulnerability.

10. The HEFCE Board reconsidered and endorsed this advice at its meeting in June 2006. It also agreed at that time that the policy framework, and HEFCE's funding to support SIVS, should be reviewed in 2008.

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<sup>3</sup> Further detail is available on the HEFCE web-site, [www.hefce.ac.uk](http://www.hefce.ac.uk), under About us/Strategically important subjects.

<sup>4</sup> 'Strategically important and vulnerable subjects: final report of the advisory group' (HEFCE 2005/24) can be read on the HEFCE web-site under Publications.

### **The 2005 review: three years on**

11. The policy framework set by the 2005 advisory group has informed the development of a £350 million programme of work (taken over the period 2005-06 to 2010-11) to support SIVS<sup>5</sup>. The programme comprises a series of individual strands tailored to the problems faced by vulnerable disciplines. HEFCE has:

- invested £15 million to generate interest in chemistry, physics, mathematics and engineering among young people, and to enhance the accessibility of HE courses in these subjects
- provided an additional and time-limited £100 million to sustain very high-cost and vulnerable science provision while this demand-raising activity takes effect
- invested with Research Councils UK to enhance national research capability in strategically important and vulnerable areas of science, social science and languages
- invested with Regional Development Agencies to enhance science capability in places where there are concerns about the vulnerability of specific provision
- conducted a review of land-based studies and started to implement its recommendations
- mitigated the effects of the decision to remove public funding for equivalent and lower qualifications by providing an additional £96 million beyond HEFCE block grant over the years 2008-09 to 2010-11, to support SIVS.

12. Full details of HEFCE investments are available on the HEFCE web-site under About us/Strategically important subjects/'Letter and report to Secretary of State, October 2006'. An evaluation of HEFCE's funding and programme of work is considered later in this report, as is an analysis of trends in each vulnerable subject.

### **Professor Sir Brian Follett's Strategically Important Subjects Advisory Group**

13. HEFCE reconvened its Strategically Important Subjects Advisory Group in May 2007. Chaired by Professor Sir Brian Follett, the group met four times between May 2007 and May 2008. Informed by its terms of reference (see Annex A) and the work of the earlier advisory group, the group identified six key responsibilities:

- reviewing HEFCE's strategically important subjects policy framework
- horizon scanning or trend analysis: considering the data and intelligence at all levels
- evaluating HEFCE's current programme of work to support SIVS against principle and policy
- deciding on the criteria to establish when intervention in individual SIVS is no longer required, that is, when a case for vulnerability can no longer be made
- advising, influencing and working with others: Lord Sainsbury's review of science and innovation policy<sup>6</sup> was identified as having particular importance for the work of the group and wider science and technology policy
- considering the future of a SIVS advisory group.

These headings provide the framework for the discussion that follows in this report.

14. The group's role has been to provide advice and make recommendations to HEFCE's chief executive and Board, and through this means to inform any advice and guidance provided by the chair of HEFCE to the Secretary of State on the matter of strategically important subjects. The group concurs with the 2005 advisory group's view that it should be the Government's role at any given time to designate subjects as being strategically important, and HEFCE's

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<sup>5</sup> A detailed breakdown of this funding is available on the HEFCE web-site under About us/Strategically important subjects/'Letter and report to Secretary of State, October 2006'.

<sup>6</sup> 'The race to the top: a review of Government's science and innovation policies' is available at [www.hm-treasury.gov.uk](http://www.hm-treasury.gov.uk) under Independent Reviews.

role to consider whether such subjects are vulnerable and the interventions necessary to address this.

15. An example of this is the Government's designation of Islamic studies as a strategically important subject. HEFCE is in the process of investigating an appropriate form of intervention to support this discipline, with advice from the Islamic studies community. HEFCE is not treating Islamic studies as vulnerable until the needs of the subject have been fully assessed, an approach the group supports.

### Conclusion 1

The Strategically Important Subjects Advisory Group chaired by Professor Sir Brian Follett concurs with the 2005 advisory group's view that it should be the Government's role at any given time to designate subjects as being strategically important, and HEFCE's role to consider whether such subjects are vulnerable and the interventions necessary to address this.

16. The information and data considered by the group, as part of its analysis and deliberations, include A-level entrants, UCAS applications and Higher Education Statistics Agency (HESA) cost centre data. Other information was considered in developing the group's advice, such as an evaluation of HEFCE's programme of work to support SIVS, international approaches to identifying and supporting subjects of national importance, and papers and views from advisory group members and Government.

### Lord Sainsbury's review of science policy

17. During the course of the group's work Lord Sainsbury's review of science and innovation policy was published. It stresses the importance to our future national prosperity of a world-leading science and innovation system, and of its exploitation. As is indicated later in this report, the Strategically Important Subjects Advisory Group supports the extension of its role to include advice on graduate supply and demand as per recommendation 7.15 of the Sainsbury Review, and it considered some initial data on graduate salaries and choices to begin to inform this work.

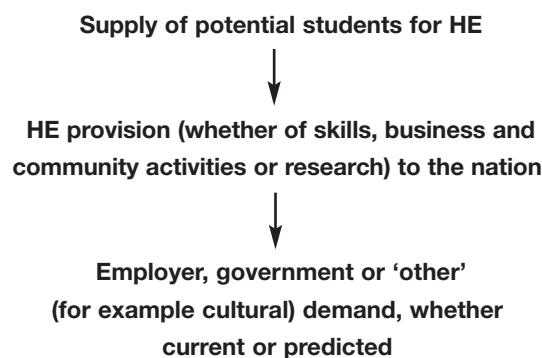
### Criteria for defining subjects as strategically important and/or vulnerable

**'Strategically important'**: subjects may be strategic on economic grounds, for reasons of diplomacy, international relations or on cultural grounds. The criteria for strategic subjects are:

- a. Does the subject currently provide vital research and/or graduates with recognisably specialist knowledge, skills and competencies to the economy or society?
- b. Is there a substantiated prediction that vital research and/or graduates with recognisably specialist knowledge, skills and competencies will be required by the economy, society or Government in future?

**'Strategically important and vulnerable'**: In this context, vulnerable subjects are not those which are simply weak or small; there are two definitions of vulnerability.

- c. The first relates to institutional vulnerability, meaning subjects which are primarily located in small specialist institutions, which may be more susceptible than larger institutions to changes in the external environment.
- d. The second is where there is a vulnerability of the public interest, in that the provision of the subject is misaligned with employer, government or other demand. This mismatch may be identified at national level and/or at regional level. Vulnerable subjects should be defined as those where there is a mismatch between two or more parts of:



## Reviewing HEFCE's strategically important subjects policy framework

18. The group agrees that the principles to guide HEFCE's approach to strategically important subjects, as set by the 2005 advisory group, remain broadly fit for purpose. Tailoring the existing policy framework to today's environment, the group suggests the following principles in relation to SIVS:

- a. The dynamism of the English HE sector is founded on the independence and competitiveness of the institutions within the system. This is a great strength and should be paramount in any policy.
- b. Some interventions may be needed, however, because the system may not always be responsive to the nation's needs. Each SIVS will have its own characteristics and is likely to require a tailor-made solution.
- c. The closure of departments in a strategically important subject does not of itself mean that subject is vulnerable; the availability of provision in vulnerable disciplines is more important than the existence of a named department.
- d. Innovative approaches to disciplines, curricula and modes of delivery will be essential if there is to be an effective response to learner and employer needs. These needs will include subject knowledge, generic and transferable skills, and specific vocational competencies.

19. This final point represents the most important development from the principles identified in 2005. The group stresses the vital importance of a strong supply of skilled labour to the UK economy and the particular importance of STEM subjects in this context. As the Leitch review of skills<sup>7</sup> sets out, we need to compete on value added rather than cost in order to remain prosperous as a nation. Higher-level skills – particularly

in STEM disciplines – are a driving force behind new knowledge and innovations that can be applied by businesses to develop their competitive advantage<sup>8</sup>. What is needed now is a step-change in the level and intensity of HE's engagement with employers in order to meet the challenging agenda set out by Leitch.

20. HEFCE has been addressing this challenge by developing the capability of higher education institutions (HEIs) to respond flexibly to employer needs, for example developing bespoke provision to meet immediate, specific requirements. Employer-responsive HE is not concerned solely with immediate vocational needs. It is also concerned with highly valued subjects, such as those identified as SIVS, and the broader transferable skills and attributes (such as creativity, flexibility, leadership and teamworking skills) associated with graduate status. In the current employment market, jobs change more frequently, so these broader subject and graduate skills are becoming more important. To date, SIVS policy has largely focused on young, full-time undergraduates, but there are subject-specific requirements in the workplace and subject-specific actions needed to address employers' needs. As indicated above, a misalignment between provision and employer needs is itself an indicator of vulnerability. In this context, the group suggests that HEFCE develop a framework for integrating its SIVS and employer engagement strategies and activities.

21. The other notable development from the 2005 policy framework relates to supply-side activity. The 2005 group was concerned that supply-side action should not be used to solve demand-side problems, but this group believes that supply-side activity is appropriate if it is linked to demand-side measures. In areas of the public sector, such as medicine and teaching for example, the Government will remain involved in both the supply of and the demand for trained professionals. There may also be times when it is necessary to sustain supply while demand-side activity is given time to feed through the system. HEFCE's additional and time-limited £100 million to

<sup>7</sup> The Leitch review of skills, 'Prosperity for all in a global economy: world-class skills', is available at [www.hm-treasury.gov.uk](http://www.hm-treasury.gov.uk) under Independent Reviews.

<sup>8</sup> The Department for Innovation, Universities and Skills' recent consultation 'Higher education at work – high skills: high value' outlines the importance of higher-level skills in innovation and sustainable development. It can be read at [www.dius.gov.uk](http://www.dius.gov.uk) under Consultation and Discussion.

support very high-cost science subjects is a good example of this. A further example is the development of courses developed with employers that respond directly to their needs, such as the Information Technology (IT) Management for Business degree developed by a group of universities working with the e-skills Sector Skills Council (SSC)<sup>9</sup>.

### **Conclusion 2**

The group supports the policy framework developed by the 2005 review, while emphasising the importance of skills in the workplace and the need for HEFCE to establish a framework for integrating its activities on SIVS and on employer engagement. The group also highlights the value of measures to address the supply of, as well as demand for, strategically important and vulnerable subjects.

## **Horizon scanning or trend analysis**

### **Considering data and intelligence to identify trends and potential problems in places and subjects**

22. The group reiterates that the sustainability of disciplines in universities depends on the interaction between teaching income, research funding, and other funding streams such as consultancy, continuing professional development and international student recruitment. Demand for subjects varies in response to complex and often unpredictable factors; disciplines change and evolve in response to new knowledge, innovation and market demand, as has been clear in areas as diverse as health and construction. Employer needs also continually evolve as they adapt to a changing competitive environment. This dynamic can have a significant impact on individual departments, particularly in high-cost subjects.

### **Using regional intelligence**

23. The group agrees that a broad range of evidence should be taken into account when building a picture of SIVS. Quantitative data alone will not give a complete picture and the group recommends that a wide range of indicators and measures, including those produced by recognised labour market research centres, should be used to assess trends or potential problems. HEFCE and its regional teams have a close relationship with, and in-depth understanding of, universities and colleges, and are thereby positioned to provide this early intelligence about developments in universities and the regions in which they are based. The group agrees that this should enable HEFCE to stay abreast of, and influence, institutional strategy, behaviour and investment as they affect SIVS.

24. Access to SIVS disciplines for potential entrants from schools, colleges and the workplace may be limited unless suitable SIVS provision is nearby. Access to SIVS provision, from different types of institution, is therefore an important factor, but different solutions may be required in different places and subject areas. The group notes, for example, a tension between the desire of England's regions to maintain the availability of science provision in all disciplines and the sheer cost of sustaining a world-class science base. Alongside this, opportunities are growing for distance learning from the Open University and other providers, and these may be appropriate for young people and employees alike.

25. The availability of suitable local provision is more important in science, which is central to local and regional economies and is a key theme in regional economic strategies, than it is in other SIVS subjects such as modern languages, for which the priority is to sustain national capability. The economic area in which it will be necessary to sustain provision may also vary. In the North and the Midlands, for example, cities are the key functional economic areas and science has been identified as central to their economic development. By contrast, in the East and South East, apart from London there is no dominant city and economic activity straddles

<sup>9</sup> Further details are available at [www.e-skills.com](http://www.e-skills.com) under e-skills UK in colleges and universities/ITMB Degree.

regional boundaries in places such as the Milton Keynes and Thames Gateway growth areas.

26. In this context, the group supports HEFCE's existing approach to department or course closures. HEFCE has asked HEIs (Circular Letter 17/2006) for early and strategic discussions with those that are considering closing capacity in SIVS, and has sought to sustain and develop capacity where it is in the interests of students, employers and institutions. The group advises that HEFCE should adopt a selective approach to sustaining provision in specific places, and that any intervention should be characterised by innovation and collaboration, a strongly evidenced case for vulnerability, and the enhancement of national provision as well as that in the specific locality.

### Conclusion 3

HEFCE should adopt a selective approach to sustaining provision in specific places and any intervention should be characterised by innovation and collaboration, a strongly evidenced case for vulnerability and the enhancement of national provision as well as that in the specific locality.

27. The group supports the principle of HEFCE exercising its judgement – using intelligence from its regional teams and indicators of vulnerability – in order to tailor its response to particular places and disciplines, thereby sustaining a diverse sector that is responsive to national and, where appropriate, sub-national needs. This is exemplified by the way in which HEFCE has not only used its Strategic Development Fund (SDF) to develop capability, but also allocated additional student numbers to increase capacity in SIVS. During the period 2006-2008, for example, 5,273 additional student numbers have been allocated in STEM subjects at a cost of £29 million.

<sup>10</sup> For more information see 'HEFCE secures physics collaboration in South East England' (7 April 2008) on the HEFCE web-site under More news.

### Japanese provision in Oxford Brookes University

Following a review of modern languages provision in 2005-06, Oxford Brookes University identified that Japanese was too small as an academic unit to continue to operate on the current basis. In view of that, HEFCE worked to expand Japanese provision by awarding 30 additional student numbers, at a cost of £110,000 per year, alongside support from the South East England Development Agency and the University of Oxford.

### Modern languages at the University of London

HEFCE awarded 240 additional student numbers, at a cost of £1 million, to the University of London Institute in Paris (the only British university where English-speaking students can study French language and literature in French and in France) as well as the development of modern languages – particularly French – within the University of London. Funded numbers were managed flexibly between constituent colleges of the University of London and the London Institute in Paris to balance demand in London with growth in Paris. New programmes resulted, which contribute to widening participation and improve access to European business communities, supporting planned skills and knowledge transfer developments.

### Physics in the South East

Having considered the position of physics in the South East of England, HEFCE brokered an agreement to collaborate between the region's physics providers. This led to the provision of £12.5 million SDF funding to bring together, promote and sustain physics provision in six universities in the South East so that they can develop and support the regional and national economy. Total additional funding over the period 2008-2015, including resources provided by the universities and partner organisations, will be £27.8 million. The South East Physics Network (SEPNET)<sup>10</sup> seeks to raise demand for physics and support for research collaboration in:

- condensed matter physics
- particle physics
- astrophysics
- radiation and detector instrumentation.

### Trend analysis in subjects

28. The group considered data from four sources to help identify trends and potential problems: UCAS applications; volume of activity in HE via HESA cost centre data; trends in A-level entrants; and information on the early careers of graduates (salary data three-and-a-half years after graduation). HESA data were considered across two timeframes, using the data considered by the 2005 group as a reference point: a longer timeframe of 1999-2000 to 2006-07 and, to provide an indicator of developments since the earlier advisory group, a shorter period of 2003-04 to 2006-07.

### STEM subjects

29. At a high level, home student numbers across all disciplines, three years on from the data and analysis considered by the 2005 advisory group, have risen by four per cent to 924,159 full-time equivalent (FTE) students. While there has been a decrease across STEM<sup>11</sup> subjects – 2 per cent over the period – the trend is much reduced compared to earlier years where, between 1999-2000 and 2002-03, home FTE across STEM subjects fell by more than 5 per cent. In particular, chemistry, physics and mathematics have seen, respectively, a rise of 21 per cent (to 11,532), a fall of 1 per cent (to 8,557) and a rise of 8 per cent (to 17,991). The group welcomes the broad progress of the key indicators in science, finding that:

- a. Chemistry is growing following a period of stabilisation and some earlier decline.
- b. Overall numbers of physics A-level entrants remain a concern, but are stabilising. Applications to university are holding up and this, allied to HEFCE investments such as those outlined above, have helped to sustain physics capacity in higher education.
- c. There is a mixed pattern of trends across the wide-ranging set of disciplines in engineering. Strong international recruitment and a rise in UCAS applications in some engineering disciplines are countered by decreasing numbers in others.

- d. A-level and UCAS data in mathematics suggests that home student numbers will be sustained in the coming years to match a substantial growth in international recruitment.

Although it is too early to attribute these positive trends to the investments that HEFCE has made to increase demand, they provide some justification for the selectivity inherent in the policy framework since 2005.

30. The group agrees with Lord Sainsbury's review that recruitment to strictly defined STEM programmes is not representative of sciences as a whole. A diversity of established and new disciplines draw on core subjects to a great extent, and the number of graduates with substantial STEM competence is growing<sup>12</sup>. It is important, therefore, that stabilising chemistry numbers are considered alongside an increase in pharmacology at national, regional and institutional levels, and that physics numbers are considered alongside increases in oceanography, physical geography and astronomy. The current structure of disciplines, and the overall pattern of provision of SIVS within institutions, must not be viewed as fixed and frozen. A dynamic system that is responsive to the nation's priorities as well as employer and student demand will naturally evolve and change. Trend analysis should, therefore, cover activity within and across the full range of disciplines, rather than exclusively within the core disciplines.

31. The group considers that the broad categories of biosciences, computer science and medicine and related subjects are not vulnerable. The FTE volume of students in biosciences is four times that of physics and shows continued growth over the eight years to 2006-07 to some 39,000 FTE students. Biosciences, therefore, shows no obvious signs of vulnerability, although there may be particular areas that require enhancement to meet employer needs. An example of this is HEFCE's work to provide support to integrative mammalian biology.

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<sup>11</sup> STEM is defined as the following HESA cost centres: chemical engineering; chemistry; civil engineering; earth, marine and environmental sciences; electrical, electronic and computer engineering; general engineering; mathematics; mechanical, aero and production engineering; mineral, metallurgy and materials engineering; and physics.

### **Physics in the East of England**

The Faculty of Science at the University of East Anglia does not have a separate Physics School. Instead, physics is taught in all of the science schools with a range of units available at all undergraduate levels. There are 25 members of staff in the science schools who call themselves 'physicists' and there are also close links with the physicists in the Research Institutes on the Norwich Research Park and at the Norfolk and Norwich University Hospital.

Students can take these physics units as part of their undergraduate degree programme, as either core or optional units depending on the structure of the degree. Students doing the BSc (Hons) in natural sciences can take a physics major as part of the programme.

Research involving physics and physical principles is undertaken across all of the science schools, as well as schools in the Faculty of Health. A Physics Research Centre – COPHIS – which brings together academic and research staff and students from across the University and the Norwich Research Park, has been established.

### **Science-based skills requirements: integrative mammalian biology**

Major pharmaceutical employers (AstraZeneca, GlaxoSmithKline and Pfizer) have identified a shortage of people with in-vivo skills. HEFCE has therefore worked with the Biotechnology and Biological Sciences Research Council, the Medical Research Council, the UK's higher education funding bodies and the pharmaceutical industry to establish an £11 million fund to build research capacity in integrative mammalian biology.

Integrative mammalian biology is the study of how gene products integrate into the function of whole tissues in intact organisms. Understanding gene function in mammalian systems ultimately requires the use of mammalian models. The information generated is central to the development of new therapeutic approaches to tackle human and animal diseases and to help deliver safe and effective medicines.

Capacity Building Awards (CBAs) have been pioneered as a response to concerns that the UK is losing capacity in integrative mammalian biology. The CBA partnership will provide resources to rebuild this capacity to ensure that the UK can capitalise on the wealth of data generated by large-scale genome projects for the development of therapeutic approaches to tackle human and animal diseases and the delivery of safe and effective medicines.

Discussions are ongoing between HEFCE, Government and employers to develop specialist masters courses jointly funded and developed by the UK Research Councils, employers and HEFCE.

32. The 2005 advisory group considered employers' concerns about graduate skills in IT, computing and related disciplines and the Government's designation of e-skills as strategically important, and it found that there was no evidence of vulnerability. The group recommended that HEFCE should continue to work with other stakeholders, including e-skills UK and the Joint Information Systems Committee, to ensure that growing demand in this area is met. HEFCE has addressed this through:

- £9.4 million support for an IT Management for Business (ITMB) degree
- the Revitalise IT programme which aims to raise demand for IT-related degrees and careers
- funding to connect HE to employer demand for continuous professional development for IT professionals.

<sup>12</sup> Table 7.2 of the Sainsbury Report shows that STEM graduates increased as a proportion of total first-degree qualifiers from 40.5 per cent (84,300) in 1995-96 to 43 per cent (114, 000) in 2005-06.

These three initiatives have been developed in partnership with employers, universities and the e-skills SSC.

33. Across IT and computer science subject areas, the volume of home student FTEs has declined by 17 per cent over the eight years to 2006-07 to 43,713 FTE students, but this remains a substantial student population. This trend, alongside the IT-related initiatives above and a 54 per cent growth in international recruitment, informs the group's conclusion that these subject areas should not be considered vulnerable, but should continue to be monitored.

#### The growth of medically related provision and its impact on STEM

34. The 2005 advisory group noted the rapid increase in student numbers in medicine, dentistry and veterinary subjects over the period 1999-2000 to 2003-04. During this period, for example, medically related subjects increased by some 9,700 FTE students compared to a fall over the same period of 2,100 FTE in chemistry, biosciences and physics.

35. In contrast to the picture considered by the 2005 advisory group, STEM numbers are now rising, but the growth of medically-related provision remains stronger. Home FTEs in clinical medicine, for example, have increased by 80 per cent, to 25,315 FTE, over the period 1999-2000 to 2006-07. Dentistry has grown by 46 per cent to 3,659 FTE over the same period; pharmacy and pharmacology by 66 per cent to 9,469 FTE. In comparison, the growth across all disciplines is 16 per cent over the same period. UCAS figures show a similar pattern: students identifying medicine and dentistry as a preferred subject increasing by 28 per cent to 21,393 applicants over the period 2002-03 to 2007-08, compared with 12 per cent growth for all subjects, 14 per cent for physical sciences, minus 18 per cent for mathematical and computer sciences, and 5 per cent growth in engineering.

36. Salary data three-and-a-half years after graduation provides one possible explanation for these student choices. Those studying medicine can expect to earn a mean salary of £42,000<sup>13</sup>, whereas

for chemistry graduates the mean salary at the same point is £22,500. Real and persistent shortages would normally be associated with an increase in salary offers. The group was interested in these figures. But there are other factors informing career choices and a crude subject-by-subject comparison – at a very early point in careers with differing career structures – may mean that we cannot draw entirely reliable conclusions from these data.

37. The 2005 advisory group argued that 'students are not simply shying away from "harder" science subjects... rather, this may be seen as a move to undergraduate degrees offering more obvious vocational output'. This conclusion, given the data available, still stands.

#### Conclusion 4

The group welcomes the progress of the key indicators of demand in STEM subjects and notes the continued impact on STEM demand of the growth of more vocational areas of science such as medicine and pharmacy.

#### Modern languages

38. Specific interventions in support of languages – for example the minority subjects, Chinese studies and former Soviet and East European studies initiatives – predate the 2005 report and the policy framework the group was tasked with reviewing. Although area studies and related minority studies were on the Secretary of State's list of strategically important subjects, modern languages were not. The 2005 advisory group, informed by evidence that highlighted a concentration of provision within institutions and a narrow student class profile, acted to add languages to the list of vulnerable disciplines.

39. Since then, HEFCE has worked in partnership with languages stakeholders and representative groups to understand the problems in languages and how they might be resolved. This resulted in a £4.5 million programme of work to encourage the take-up of language courses in England, called Routes into

<sup>13</sup> See Annex D.

Languages, and a programme of investment with the Arts and Humanities Research Council and Economic and Social Research Council (ESRC) to create a world-class cadre of researchers to enhance the UK's understanding of the Arab world, China and Japan, Eastern Europe and the former Soviet Union. Five new collaborative centres, at a cost of £25 million, were launched in June 2006 to promote these areas of cultural, political and economic importance to the UK.

40. The various modern languages are experiencing different recruitment patterns at A-level, but volumes overall are being sustained in HE. Having considered the evidence and Lord Dearing's review of languages<sup>14</sup>, the group's view is that languages remain vulnerable. Changes to language provision in schools could destabilise languages provision in HE over the next five to 10 years. The group supports the suggestion of Dearing's review that there should be no immediate return to compulsory language study until 16 years of age and that there should be:

- a language entitlement in primary schools
- more ways of recognising languages achievement outside of mainstream qualifications. The National Recognition Scheme, otherwise known as the Language Ladder, will offer an alternative route for language learners from seven year-olds to adults to have their skills recognised and credit-rated
- a broadening of the languages offer, away from mainstream European languages and towards languages needed by business, for example, Arabic and Chinese.

### Conclusion 5

The group notes the sustained volume of modern languages provision in HE and supports the measures recommended by Lord Dearing's review to develop languages at lower levels.

### Land-based studies

41. The group considered a review of land-based studies (LBS)<sup>15</sup> commissioned by HEFCE and overseen by an advisory group chaired by Professor Maggie Gill. Although designated vulnerable by the 2005 advisory group, the review found no widespread evidence of a general threat to the sustainability of LBS provision. However, due to the distinctive nature of the HE provision concentrated within three monotechnics, the sustainability of individual institutions is particularly crucial.

42. The review recommends that HEFCE should 'work with the three monotechnic HEIs to ensure they each have a sustainable strategic plan which is responsive to national and regional LBS needs, and can be afforded on realistic income assumptions. Many of the issues faced by land-based provision are, the review finds, common to a wider spread of higher education provision, and can be addressed by the same good management and strategic planning processes'. The Gill group considered a comprehensive data analysis of land-based provision which is available at Annex B of the review.

43. HEFCE is working closely with each of the institutions to develop and implement strategies to ensure that their distinctive provision becomes sustainable. In this context, the group recommends that LBS should no longer be considered vulnerable, but should continue to be closely monitored for vulnerability. The strategic importance of LBS to the nation remains.

### Conclusion 6

The group recommends that, in light of the Gill Review and the measures being taken by HEFCE to sustain specialist provision, LBS should no longer be considered vulnerable.

<sup>14</sup> 'Languages for all: languages for life, a strategy for England', can be found at [www.teachernet.gov.uk](http://www.teachernet.gov.uk) under Subjects/Modern Foreign Languages/Languages review.

<sup>15</sup> Available on the HEFCE web-site under About us/Strategically important subjects/land-based studies.

## Quantitative social science

44. The 2005 advisory group, building on health of the discipline work undertaken by the ESRC, designated quantitative social science (QSS) strategically important and vulnerable. Since then the UK funding bodies and ESRC have been working in partnership to support the development of advanced quantitative methods in QSS. HEFCE is contributing up to £4 million towards a range of initiatives from developing interest at school level, undergraduate curricula development, support for QSS masters programmes, and supporting high-quality research and methods training throughout the UK. These activities are delivered through a linked network of eight commissioned regional centres of excellence (seven in England and one in Wales) co-ordinated by the National Centre for Research Methods. Given the early stages of this programme, the group recommends that the effectiveness of work to support QSS is evaluated before 2011 so that that year's SIVS review group can consider whether QSS remains vulnerable.

## Evaluating HEFCE's programme of work to support SIVS

45. Drawing upon an independent evaluation of HEFCE's work on SIVS<sup>16</sup>, the group commends HEFCE for the speed with which it has developed its programme of support. Bespoke solutions to the unique problems faced by each vulnerable subject have been developed in response to trends and the available evidence.

46. Different countries, the research finds, have had different policy responses to disciplines designated strategically important by their respective governments<sup>17</sup>. A common requirement, however, is the need for sustainable funding for SIVS disciplines. The group therefore endorses the block grant approach to the majority of HEFCE funding, which provides the freedom and security necessary for universities to innovate and adjust their investments to meet long-term priorities.

47. The evaluation concurs with the positive findings of a HEFCE internal audit in saying that its SIVS investments are being delivered in a professional and thorough way. The sums that HEFCE has deployed are gaining much greater leverage through partnership with other agencies. Perhaps of greater importance than HEFCE investment are innovations by universities developing new market opportunities. The University of Manchester's £20 million investment with other funding partners to develop a new centre for Nuclear Energy Technology is a good example of this<sup>18</sup>.

### Chemistry in Yorkshire and Humber

The University of Huddersfield is celebrating the successful completion of the £500,000 renovation of its chemical engineering laboratory.

The laboratory is designed to help students learn about the scaling-up of chemical processes to industrial quantities by looking at the whole process, including such areas as energy efficiency and safety.

As well as involving the laboratory fixtures, the renovation work has also seen the replacement of large pilot plant with modern, more efficient, smaller equipment, some with state-of-the-art computer control.

The University of Huddersfield has continued to increase its intake on its chemistry courses over the past 10 years. Recognising the success of both teaching and research, the university agreed to the investment in the chemical engineering laboratories.

<sup>16</sup> Available on the HEFCE web-site under Publications/Research & evaluation.

<sup>17</sup> See section 9 'International experience'.

<sup>18</sup> For more information, see [www.dalton.manchester.ac.uk](http://www.dalton.manchester.ac.uk) under About us/News/'£20m funding for new northwest nuclear research centre'.

### **Making Foreign Languages an Option – Manchester Metropolitan University and University of Salford**

Now in its third year, this project aims to increase the take-up of modern foreign languages (MFL) at GCSE and beyond among pupils in Greater Manchester schools. Over 600 pupils a year attend a full day of activity, including lessons in two modern languages, games, quizzes and talks about student life. Specialist teaching material has been developed for the project with the aim of enhancing vocabulary and grammar for Year 8 and Year 9 learners and to give a taste of a second language 'new' to the pupils.

The project has become very popular with schools. Pupils are particularly positive in their feedback, and the impact on take-up at GCSE is encouraging. After the first year of the project, Nicolas Gaido from Withins School in Bolton said:

'The feedback from the pupils has been very positive and we feel it had a direct impact on our GCSE option in Year 10. In September 2004, no GCSE MFL group was opened as an option. But after the International Saturday School, we opened two French groups and one German group. Roughly speaking, we have gone from no students opting for MFL to 45 in the space of one year.'

48. There are, naturally, areas for development. Some of the projects require outcomes that are specified more clearly or targets relating to what might be achieved. This can at least in part be attributed to the uncertainties about the underlying factors causing vulnerability, and to other societal factors which have the potential to alter the impact of SIVS interventions. Although HE solutions to the problem of raising demand in the STEM disciplines may not always be accessible or tailored to the many demands facing schools and colleges, the sector can use academic staff and highly skilled technicians who bring new knowledge and innovation to life.

49. The evaluation of HEFCE's programme of work suggests that each individual STEM demand-raising initiative – notwithstanding their emphasis on widening participation – could be in competition with another for the same students. The group is therefore pleased to see that HEFCE, working with the National STEM programme led by Professor John Holman, is consolidating individual projects into an overall initiative that will raise aspiration and demand across STEM.

### **Conclusion 7**

The group supports HEFCE's programme of support for SIVS, and sees it as being appropriate and proportionate for the issues identified. Outcome and output measures should be in place and regularly monitored in any further funding provided.

### **Deciding when a case for vulnerability can no longer be made**

50. A sub-group was tasked with trying to establish whether there is a framework or set of metrics to enable HEFCE to determine whether a strategically important and vulnerable discipline is no longer vulnerable. The conclusion is that, although there are measures and indicators that can help identify when disciplines are no longer vulnerable, a crude, indicator-based scoring system is simply unrealistic. Vulnerability, furthermore, is not a permanent state. Following appropriate intervention and support the expectation should be that normal funding routes – comprising contributions from Government, students and employers – should sustain strategically important subjects.

51. The sub-group took the 2005 group's definition of vulnerability as its starting point:

- the first definition relates to institutional vulnerability, meaning subjects that are primarily located in small specialist institutions, which may be more susceptible than larger institutions to changes in the external environment

- the second definition is where there is a vulnerability of the public interest, in that the provision of the subject is misaligned with employer, government or other demand. This mismatch may be identified at national level and/or at regional level.
52. It then developed this further into four broad measures that should be considered when forming a judgement about vulnerability:
- a. The volume of HE provision and likely changes in the pattern of provision. Examples here include A-levels, UCAS data, the volume of HE provision and the growth or decline of cognate disciplines.
  - b. Measures of research concentration and quality and their relationship with teaching. Here, among other measures, the group identified the UK Research Councils' health of discipline exercises, postgraduate student and staff numbers.
  - c. Employer demand for higher-level skills. Alongside data from SSCs and salary data there is valuable information available in the Higher Education – Business and Community Interaction Survey (HEFCE 2008/22).
  - d. The structure of the supply of disciplines and cost factors. Cost data, the precise nature of institutions supplying the provision (for example monotechnic, further education college, multi-faculty institution) and the role of non-campus-based providers were among the factors identified in this category.
53. The group recommends that these and other factors should be reviewed periodically to inform a judgement of vulnerability in each strategically important subject.

## Advising, influencing and working with others

### Lord Sainsbury's review of science and innovation and the future of the group

54. The group welcomes the Sainsbury Review, which restates the importance of a sustainable and world-class science base, and widespread scientific literacy, to the future prosperity of the nation.

55. Recommendation 7.15 of the Sainsbury Report is specifically addressed to the Strategically Important Subjects Advisory Group:

‘To address the lack of information on the supply and demand of STEM skills, HEFCE should transform the Strategically Important and Vulnerable Subject Advisory Group into an Advisory Group on Graduate Supply and Demand and extend its remit to include responsibility for publishing an annual report describing: undergraduate subject trends; recent graduate jobs and salaries; and the subjects where employers and government departments believe that there are, or are likely shortly to be, shortages of graduates with key skills.’

56. Paragraph 7.73 of the Sainsbury Report suggests that the SSCs should be able to provide information on graduate demand and other demand-side data. The group notes the difficulty of identifying labour market shortages and the necessity of a dynamic and responsive system, rather than a top-down and highly planned one. As the Royal Society's report ‘A degree of concern? First degrees in science, technology and mathematics’<sup>19</sup> puts it:

‘We emphasise the following [point] about assessing quantitative demand for STM graduates: any attempt at estimating the total number of graduates with particular skills that will be required by the economy on the extended timescales relevant to education policy is fraught with obvious difficulties, not least because of the likely changes to the make-up of the UK economy with the rise of economies elsewhere in the world.’

<sup>19</sup> Available at [www.royalsociety.org](http://www.royalsociety.org) under Policy statements and reports/2006.

57. Given this difficulty, it is important to combine any evidence produced by the relevant SSCs with indicators of graduate demand. Salaries may be the best available proxy for skills shortages, but given the many factors that affect graduate salaries the group recommends that research should be undertaken into wider measures of graduate demand. This will complement salary data and information provided by SSCs and others.

58. To help meet the Sainsbury recommendation, HEFCE has produced a report that considers the early careers of graduates (HEFCE 2008/39)<sup>20</sup>. The report provides a flavour of the information now available from the Destination of Leavers from Higher Education Survey<sup>21</sup>, which can be used alongside other measures to inform understanding of graduate demand in different subjects. A table from the early careers report, considering salaries three-and-a-half years after graduation, is reproduced at Annex D.

59. Terms of reference will be developed for the new group, which will include representatives from discipline groups, employers, and different types of HEI. The group will also work with Research Councils UK on future reviews and health of discipline exercises and notes Professor Bill Wakeham's review of physics research, which sets the scene for the support of physics research over the coming years.

### **Conclusion 8**

An advisory group should be established with a remit to consider graduate supply and demand, and the range of health of disciplines issues arising from indicators of vulnerability; research should be undertaken into salaries and other measures of graduate demand, which will complement information produced by SSCs and others.

## **Next steps**

60. Evidence, rather than lobbying, must be the cornerstone of any rational policy framework. The new Advisory Group on Graduate Supply and Demand will report to HEFCE and Government on an annual basis, but an annual assessment of vulnerability would be unwise given the long-term nature of subject developments and interventions. Disciplines can also see temporary downturns that do not signify long-term vulnerability; one year's data do not make a trend. The group recommends, therefore, that a review of vulnerable subjects should be undertaken every three years, but the new advisory group should monitor trends and potential problems on an annual basis.

61. Indicators currently suggest that SIVS are stabilising after some decline. Vulnerability is not a permanent state; if, based on clear evidence, a discipline can no longer be considered vulnerable, it should be removed from the SIVS list and there should be a managed withdrawal of additional support.

62. HEFCE's review of the cost of teaching using the Transparent Approach to Costing methodology will be a key development, providing evidence of the costs of different subjects to be met by HEFCE, students and employers. This data, which will become available during 2009, will inform a review of the pricing of different subjects within the HEFCE teaching funding model.

63. This report sets out the position at the time of writing. Given the factors that could have an impact on SIVS, such as the 2009 tuition fees review, it is essential that this policy framework remains up to date. The group therefore recommends that a further review be conducted in 2011.

### **Conclusion 9**

A further review of the strategically important and vulnerable subjects policy framework should be carried out in 2011.

<sup>20</sup> Available on the HEFCE web-site under Publications.

<sup>21</sup> Further details about the survey are available from HESA at [www.hesa.ac.uk](http://www.hesa.ac.uk) under Publications and products.

# Annex A

## Membership and terms of reference for HEFCE's Strategically Important Subjects Advisory Group

### Members

Brian Follett (Chair)	Chair of Training and Development Agency and Arts and Humanities Research Council; Department of Zoology, University of Oxford
Mark Beatson	Director of Science and Innovation Analysis, Department for Innovation, Universities and Skills
Jaine Chisholm-Caunt	Director of Stakeholders and Policy, Cogent Sector Skills Council
Judith Howard	Head of Department of Chemistry, Durham University
Maggie Pearson	Sector Skills Development Agency Board member
Peter Saraga	Former Managing Director, Philips Research Labs UK; HEFCE Board member
John Selby	HEFCE Director with responsibility for strategic subjects
Richard Sykes	Rector, Imperial College of Science, Technology and Medicine, HEFCE Board member
Michael Worton	Vice Provost, University College London and Fielden Professor of French Language and Literature

### Secretariat

Paul Hazell	Policy Officer, HEFCE
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### Terms of reference

1. On behalf of the Government and the HEFCE Board, to keep under review the contribution that higher education makes to strategically important and vulnerable subjects (SIVS), focusing in particular on the contribution that higher education makes, through its teaching, research and knowledge transfer activities in science, technology, engineering and mathematics, to the science and innovation system.
    - a. To focus on the sustainability of provision in SIVS within the higher education system, noting that:
    - b. It is for the Government to make judgements on which subjects are strategically important at any given time, including those that may become strategically important in the future.
    - c. Within the list of subjects identified in the Secretary of State's letter of 2004, the Government has a particular concern of science, technology, engineering and mathematics (STEM) subjects within the science and innovation system.
    - d. The Government has asked HEFCE to focus on the sustainability of SIVS provision and to identify areas where current provision is out of step with national need and action is needed.
    - e. To keep under review HEFCE's rationale, process and criteria for identifying academic subjects as being vulnerable taking into account all available evidence.
    - f. To oversee HEFCE's monitoring of provision in SIVS (so called 'horizon scanning') and its programme of work to support SIVS and consider the emerging research evidence for its effectiveness.
    - g. In advising on SIVS, to take account of the needs of the economy and society in relation to both knowledge and skills.
    - h. To consider and advise on the feasibility and implications of taking a UK-wide approach to these issues, recognising developments across the European higher education system.
    - i. To continue to advise on research and information requirements to underpin HEFCE's approach to this issue in the longer term.
- Please note that these terms of reference are similar to Professor Sir Gareth Roberts' 2005 advisory group with the exception of clauses and (f) and (g) above.

# Annex B

## HEFCE spending in support of strategically important and vulnerable subjects

### Outline of spending 2005-2012

1. Over the seven years 2005-06 to 2011-12, HEFCE will have committed in excess of £350 million, over and above core funding for teaching and research, in support of strategically important and vulnerable subjects (SIVS). This comprises:

- £100 million to support very high-cost and vulnerable science
- £29 million for additional student numbers (to date) for STEM subjects
- £76 million for demand-raising and capacity building work in STEM

- £36 million support for languages
- £2 million for land-based studies
- £4 million to enhance quantitative social science
- £2 million to support the Open University delivering SIVS through partner higher education institutions
- £96 million to support SIVS arising from the removal of funding for equivalent and lower qualifications.

2. A detailed breakdown of this funding is available at [www.hefce.ac.uk](http://www.hefce.ac.uk) under About us/Strategically important subjects/Letter and report to Secretary of State.

### Examples of HEFCE interventions in SIVS

#### Supply side and regional capacity building

Subject area	Initiative	HEFCE funding
Physics – building regional capacity	SEPNET (South East Physics Network): Physics collaboration in the South East	£12.5 million out of a total funding package of £27.8 million
Mathematical analysis, renewable energy, chemical engineering at the life sciences interface, quantum coherence and physical organic chemistry	Science and Innovation awards round three Research capacity building	£4 million out of £23 million total with EPSRC and UK funding councils
Physics, chemistry, chemical engineering, minerals, metallurgy and materials engineering	Additional funding for very high-cost and vulnerable STEM subjects	£100 million over four years from 2007-8
Information technology (IT)	'Revitalise IT' initiative with e-skills SSC to support the creation of the IT Management for Business degree	£2.7 million out of a total of £4.1 million over 2007-2009

#### Demand-raising activity

Engineering	London Engineering project: promoting STEM in South London	£2.85 million: £3.4 million funding from partners including the Royal Academy of Engineering and higher education institutions
Languages	Routes Into Languages: nationwide projects to widen and increase participation in language study	£4.5 million with £4 million co-funding from the Department for Children, Schools and Families
Mathematics	More Maths Grads: widening participation in mathematics	£3.3 million: co-funding of £65,000 from Institute of Mathematics and its applications, Royal Statistical Society and London Mathematical Society

# Annex C

## Data and analysis

1. The group considered data from four sources to help identify trends and potential problems: UCAS applications; volume of activity in higher education via Higher Education Statistics Agency (HESA) cost centre data; trends in A-level entrants; and information on the early careers of graduates via salary data three-and-a-half years after graduation (HEFCE 2008/39). The data tables may be found at the end of this annex.

2. With regard to HESA data, it is important to note that the table is based upon student numbers in academic cost centres, not on the subject of an individual's qualification aims. Cost centre is determined by the academic department of the member of staff teaching the activity. So, for example, where a member of the mathematics department teaches a specific module as part of an engineering course, it will be recorded under the mathematics cost centre rather than the engineering cost centre.

3. This analysis therefore tells us something about the overall volume of activity, not just named programmes, at all levels because it includes credits and modules. It therefore helps to understand the overall sustainability of teaching in SIVS disciplines at institutional and national levels. And, because it does not involve HESA subject classifications, it is a more robust time series than data involving these classifications, which were changed between 2001-02 and 2002-03.

4. With this in mind, and to put individual discipline data in context, home student numbers in higher education have grown by 16 per cent, to 924,159 full-time equivalent (FTE) students, over the eight year period from 1999-2000 to 2006-07. Within this, STEM subjects overall have seen a decrease in home student FTEs of 7 per cent. However, the majority of this decline (5 per cent) occurred in the earlier years of this period and, since 2003-04, the decrease has fallen to only 2 per cent. Table 7.2 of the Sainsbury review finds that STEM graduates increased as a proportion of total first-degree qualifiers from 40.5 per cent (84,300) in 1995-96 to 43 per cent (114,000) in 2005-06.

5. Turning to UCAS and A-level data, there were 534,495 applicants across all subject areas at English universities for the academic year 2007-08. This represents 12 per cent growth over the period 2002 to 2007. Within STEM overall, there were 5,000 fewer applicants, a fall from 83,400 to 78,300. There were 720,046 A-level entrants for the academic year ending 2007; 125,730 were applying to study STEM, a fall of some 2 per cent from 1996. Growth across all subject areas over the period 1996-2007 was 16 per cent.

## Chemistry

6. HESA data show that home student numbers stabilised at some 9,531 FTE in 2003-04, and, by 2006-07, have grown to 11,532 FTE. This represents 21 per cent growth over the period 2003-04 to 2006-07. Applications to UCAS to study chemistry as a preferred subject have remained stable over the period 2002-03 to 2004-05 at around 2,800 applicants. There are encouraging signs of interest in chemistry with 32 per cent growth in applications over the period 2002-03 to 2007-08.

7. Going back further in the supply chain, we find that A-level entrants show a 9 per cent increase over the period 2002-03 to 2006-07. Interestingly, the mean salary of chemistry graduates three-and-a-half years after graduation is £22,500, the fifth-lowest salary outcome of the 25 broad subject groupings considered.

8. Chemistry, then, is showing growth across the board following a period of stabilisation and some earlier decline. However, the salary data suggest weak demand signals from employers, which may not sustain growth in the future, and this is a concern.

## Physics

9. For physics, home student numbers in higher education have remained stable over the past six years at some 8,500 FTE, while international numbers have risen by 74 per cent to 518 FTE. UCAS applicants to study physics as a preferred subject have grown 15 per cent to 3,600 applicants over the five years 2002-03 to 2006-07. Taken as a whole, applications to the physical sciences have increased by 14 per cent over the same period.

10. A-level physics entrants, meanwhile, have shown a 16 per cent decrease in numbers, to some 24,000, over the period 1996-07 to 2006-07, although they have stabilised over the past three years. The average salary for physics and astronomy graduates three-and-a-half years after graduation is £24,760.

11. Numbers of physics A-level entrants remain a concern but do show signs of stabilising.

Applications to university are holding up and this, allied to HEFCE investments, has helped to sustain physics capacity in higher education.

## Engineering

12. There has been a 29 per cent increase in home student numbers for civil engineering over the period 1999-2000 to 2006-07 to 8,823 FTE. Taking into account (via UCAS applications) the engineering group of disciplines, we find that there has been a 5 per cent increase in applications for entry over the period 2002-03 to 2007-08 to 22,599 applicants.

13. Home student numbers for mechanical, aeronautical and production engineering have remained stable over the period 2002-03 to 2005-06 at some 15,500 FTE. General engineering and mineral, metallurgy and materials engineering have seen decreases of 17 per cent over the period 1999-2000 to 2006-07 to 12,060 and 2,382 FTE respectively. Decreases in many engineering disciplines, however, have been offset by strong growth (in many cases doubling) of international student numbers. For example, chemical engineering has seen international students rise from 493 FTE to 942 FTE over the period 1999-2000 to 2006-07.

14. The wide-ranging set of disciplines in engineering shows a mixed picture of trends. Employer demand signals, international recruitment and rise in UCAS applications in some engineering disciplines are countered by decreasing numbers in some others.

## Mathematics

15. Home students in this cost centre have increased by 8 per cent over the period 2003-04 to 2006-07 to nearly 18,000 FTE. International students have more than doubled over this period to

3,700 FTE. Applications to study mathematics as a preferred subject have increased by 63 per cent over the period 2002-2007 to 6,100 applicants.

Mathematics and further mathematics entrants at A-level have increased by 21 per cent and by 61 per cent respectively over the period 2002-03 to 2006-07. Graduates can expect, on average, to earn £25,800 three-and-a-half years after graduation.

16. A-level and UCAS data therefore suggest that home student numbers will be sustained in coming years to match growth in international recruitment.

## Languages

17. Home FTEs have increased by 11 per cent over the period 1999-2000 to 2006-07 in the languages cost centre, but this will not necessarily reflect only numbers of people taking language courses. It also includes those taking some language study as part of another course.

18. Applications via UCAS to study European languages and literature have increased by 16 per cent to 4,639 from 2002-03 to 2007-08.

Applications for non-European languages, literature and related studies, in contrast, decreased by 17 per cent over this period. A-level entrants show substantial declines for French and German, offset in part by Spanish and other languages. The 28 per cent decline overall over the period 1996-97 to 2006-07 is due mainly to the high numbers of entrants to French (43 per cent of A-level entrants in 2006-07 who are studying languages are found in this subject area) and the decline observed here. Salaries for languages graduates are the highest of all SIVS at £26,800 at three-and-a-half years after graduation.

19. Overall, different languages are experiencing different recruitment patterns at A-level but volumes overall are being sustained in higher education.

## Data tables

See Excel files available as separate downloads on the HEFCE web-site under Publications with this report.

# Annex D

## Key data from the 'Early careers of graduates' report

### Mean salary of graduates three-and-a-half years after graduation

Strategically important and vulnerable subjects are highlighted in bold.

The full report HEFCE 2008/39 can be downloaded from [www.hefce.ac.uk](http://www.hefce.ac.uk) under Publications.

Subject	Mean salary
Medicine	£40,078
Pharmacy and pharmacology	£28,683
Architecture, building and planning	£26,873
<b>Modern foreign languages</b>	<b>£26,823</b>
<b>Engineering</b>	<b>£26,006</b>
<b>Mathematical sciences</b>	<b>£25,757</b>
ITS and computer software engineering	£25,631
<b>Physics, astronomy</b>	<b>£24,759</b>
Finance and accounting	£24,673
Health studies	£24,357
Humanities and language-based studies	£23,979
Nursing	£23,749
Business and management	£23,552
Sports science	£23,220
Other physical sciences	£23,055
Sociology, social policy, and anthropology	£23,050
Anatomy and physiology	£22,973
Education	£22,963
Combined	£22,912
Geography	£22,667
<b>Chemistry</b>	<b>£22,512</b>
Design and creative arts	£21,788
<b>Land-based studies</b>	<b>£21,615</b>
Psychology	£21,391
Biosciences	£21,382
Media studies	£21,187

# List of abbreviations

<b>CBA</b>	Capacity Building Award
<b>FTE</b>	Full-time equivalent
<b>HE</b>	Higher education
<b>HEFCE</b>	Higher Education Funding Council for England
<b>HEI</b>	Higher education institution
<b>HESA</b>	Higher Education Statistics Agency
<b>IT</b>	Information technology
<b>ITMB</b>	IT Management for Business (degree)
<b>LBS</b>	Land-based studies
<b>MFL</b>	Modern foreign languages
<b>QSS</b>	Quantitative social science
<b>SDF</b>	Strategic Development Fund
<b>SIVS</b>	Strategically important and vulnerable subject(s)
<b>SSC</b>	Sector Skills Council
<b>STEM</b>	Science, technology, engineering and mathematics

**Higher Education Funding Council for England  
Northavon House  
Coldharbour Lane  
BRISTOL  
BS16 1QD**

**tel 0117 931 7317  
fax 0117 931 7203  
[www.hefce.ac.uk](http://www.hefce.ac.uk)**