

HEFCE CHIEF EXECUTIVE

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27 May 2011

Dear Sir Alan

Thank you for your letter outlining HEFCE's plans for strategically important and vulnerable subjects (SIVS), which expanded upon Peter Saraga and Chris Millward's discussion with RCUK Research Group colleagues in March. Your letter identifies four areas of interest where you ask for input from RCUK and I am therefore pleased to provide our input below.

RCUK has very much welcomed the level of engagement on this topic so far and will be pleased to continue via our representation at the seminar HEFCE plans for this summer. We have agreed with Chris Millward that we will provide our nominations separately to this letter.

Yours sincerely

Professor Shearer West
Chair, RCUK Research Group

Arts and Humanities Research Council (AHRC)

Over time a decline in the number of Arts and Humanities PhD subjects is expected but there is no clear indication which areas will be most affected. Languages (particularly Language Based Area Studies) are strategically important areas as are heritage, conservation and archaeology. The number of specialist institutes in the arts (conservatoires, art colleges) should also be monitored.

1. Modern Languages including within Language-based Area Studies

The Worton review, commissioned by HEFCE and published in late 2009, in response to concerns about falling numbers and funding provision, provides an overview of the health of Modern Foreign Languages (MFL). It concluded that continued strategic investment will undoubtedly be essential for the next few years and that it is vital that universities themselves take action to integrate languages more strongly into their future strategies. Broader action was also recommended to promote uptake of language education within society. It noted that modern languages in HE faced a number of challenges, for example, in terms of reductions to QR research funding following the last RAE, declining student numbers and closure or amalgamation of some departments.

The British Academy published a position paper, 'Language matters more and more', earlier this year presented evidence to support its concern that the lack of language learning at all levels (primary, secondary and tertiary), language research, teacher training, and wider intercultural understandings, is damaging the whole education system. It noted that the situation had worsened since its previous report 'Language Matters' in 2009 and made a series of recommendations to Vice-Chancellors.

The AHRC Delivery Plan commits the AHRC to working with the ESRC, Funding Councils, British Academy, HEIs and other parties to build on the success of the Language Based Area Studies (LBAS) Centres (which focus on Eastern Europe, Asia and Middle East) to develop capacity in modern languages. We have also identified the potential to develop capacity in areas of particular strategic importance such as Brazilian Portuguese and South Asian languages.

2. Design

Design is recognised as a strategically important element of a rebalanced, knowledge-based UK economy as noted in a recent paper from Will Hutton for the Design Council 'Design in the knowledge economy 2020'. However research funded by the AHRC at the University of Cambridge (The Design Scoreboard Project <http://www.ifm.eng.cam.ac.uk/dmg/projects/scoreboard.html>, part of the AHRC/EPSRC Designing for the 21st Century Programme) has shown that the UK is facing increasing competition in this area, particularly from East Asia, which may pose challenges to the UK's leading capabilities in this sector.

An AHRC analysis of HESA figures in 2008 indicated that design was a growth area in undergraduate teaching but has a less established research culture, with a relatively small proportion of postgraduate students, many from outside the UK. Its research culture has evolved and developed significantly over recent years due in part to initiatives such as the AHRC/EPSRC Designing for the 21st Century Programme which ended in 2009

3. Heritage Research

The House of Lords Science and Technology Select Committee report on science and heritage in November 2006 concluded that there was a compelling need for a comprehensive national strategy for heritage science. The Science and Heritage Programme, instigated by the AHRC and EPSRC, took forward recommendations from this report to provide research funding opportunities and develop the academic community in this area. The innovative cross-disciplinary nature of the Science and Heritage Programme is unrivalled internationally and has put the UK into an international research leadership position in this emerging area and it will be important to maintain and capitalise on this when the programme comes to an end. As a part of this the AHRC is playing a leading role in the development of a European Joint Programming Initiative (JPI) on Cultural Heritage and Global Change which currently involves 15 countries as partners (plus 8 observers).

A report on Understanding Capacity in the Heritage Science Sector. (<http://www.heritagescience.ac.uk/resources/publications/NHSS3>) (September 2009), prepared as a part of the development of the National Heritage Science Strategy published in March 2010, maps capacity in this emerging and highly cross-disciplinary field. It identifies shortages of skilled people in a number of specific areas but also broader issues for example in finding individuals "with the right mix of analytical and experimental competence with suitable experience and knowledge of heritage issues, and who is prepared to enter a sector with no career structure and lower pay than opportunities open to them elsewhere" It also notes that "Many of the sources of funding for heritage science described in this report, such as government funding and activity resulting from development (i.e. work on archaeological sites and historic buildings) have, and are likely to in the future, come under increased pressure as a result of the recent economic crisis". It concludes by identifying a need for greater co-ordination of activity. The AHRC is supporting the establishment, in 2011, of a National Heritage Science Forum, one of the key recommendations of the Strategy.

4. *Creative and Performing Arts and Practice-Based Research*

Given recent reductions in Higher Education funding and the uncertainty over the impact of the new teaching and tuition fees regime, certain arts subjects, such as music, dance and fine art, may be potentially vulnerable. Some key national capacity in these subjects is in specialist institutions e.g. music conservatoires and art schools, which may have less flexibility and capacity to respond to changing funding regimes and may be subject to increased risk. The emerging research culture of practice-based research in the arts, which the AHRC has helped to develop through a number of targeted schemes which have now reached their conclusion, may also need to be kept under review as its relative newness and also wider distribution across less research intensive institutions may also make it vulnerable in a tight research funding environment.

Biotechnology and Biological Sciences Research Council (BBSRC)

1. *SIVS: Bioscience Areas*

BBSRC undertook a wide consultation on strategically important and vulnerable skills in 2009, and the report, *Strategically Important and Vulnerable Capabilities in UK Bioscience*, is available on our website.¹ The report was based on a survey of the life sciences sector in the UK, covering both academic end-users and users of high-level bioscience skills in the wider economy.

¹ See: <http://www.bbsrc.ac.uk/organisation/policies/reviews/consultations/0905-bioscience-research-skills.aspx>

There are four areas which we would particularly highlight to HEFCE as strategically important and vulnerable:

- Whole Animal Physiology
- Industrial Biotechnologies
- Plant and Agricultural sciences
- Systematics and Taxonomy

2. Evidence of Strategic Importance and Vulnerability

A brief summary of the type of evidence provided by respondents is given in the table below.

Whole Animal Physiology	<i>In vivo</i> skills have been identified by the ABPI in several reports as a crucial area of expertise for the UK pharmaceuticals sector - where recruitment continues to be difficult, and where there is evidence of dramatic decline in the provision of training by universities at undergraduate and postgraduate levels.
Industrial Biotechnologies	This sector is seen as a key growth area for the UK 'green economy', embracing bioenergy and renewable sources for current petro-chemical based products and feedstocks. Graduate and postgraduate numbers are low, and this is creating vulnerability for the UK's expansion in this area.
Plant and Agricultural sciences	The agricultural and food sectors increasingly need high-skilled individuals to address issues in food security. Student interest in this area has declined, but equally the agri-food sector is financially constrained in providing career opportunities for high-skilled scientific staff.
Systematics and Taxonomy	This area continues to be crucial to understanding changes in biodiversity as the UK environment and wider world respond to climate change. Low student interest has led to a loss of teaching staff as retiring experts are replaced by staff working in more popular disciplines.

3. Measures to Address Vulnerability

The reasons for vulnerability vary in each case, and the issues are discussed in BBSRC's Niche Skills report. This means that the measures needed to address vulnerability in the supply of the skills in question also vary.

Information, Student Demand and HEFCE Oversight

The low level of (or reduction in) student demand for subject areas can be a key cause of vulnerability, and would seem to be a strong factor in the issues facing Industrial Biotechnologies, Plant and Agricultural sciences, and Systematics and Taxonomy. Low or reducing student demand can lead to universities to reduce levels of academic staff resource in strategically important subjects for the UK. Student demand in turn is influenced by perceptions of the availability of careers using the scientific skills concerned.

Universities need to be encouraged to strategically manage their staff succession planning in order to avoid subject area expertise being driven purely by student demand, without seeking to modify or encourage demand and take up in strategically important subjects. Special interest groups and professional societies also can play a role in ensuring that universities have up-to-date information on career opportunities and the skills needed.

Where there is evidence that universities are reducing lecturing staff in a strategically important and vulnerable area due to declining interest from undergraduate students, there may be a role for HEFCE or other national skills body. For example, HEFCE may require institutions to provide special justification, or consider special funding in order to maintain national teaching / research capabilities. HEFCE may also have a role in fostering greater co-ordination between universities to ensure that the sector does not 'blindly' lose crucial expertise by incremental loss.

Accreditation and HEFCE Funding for High-cost Provision

BBSRC is supporting the Society of Biology, as the UK's umbrella organisation for scientific societies in the biosciences, in its development of a degree accreditation scheme in specific discipline areas. This is an important development both in promoting student interest and in ensuring degrees provide the R&D skills needed by employers. *In vivo* skills is one of the areas of degree accreditation which is being piloted in 2011, and all accredited biology degrees will place emphasis on the higher levels of mathematical skill now needed by bioscientists.

It will be important for HEFCE to consider how best to recognise and reward the efforts made by universities to ensure that their degrees have appropriate accreditation. This is of particular importance where a university is seeking to provide a particularly high-cost training, such as in animal physiology (i.e. *in vivo* skills). In this regard, we would also draw your attention to the analysis by Evidence Ltd commissioned by HEFCE, which considers the sustainability of this high-cost area of student training.² The report concluded that in this area ongoing targeted Funding Council support will be needed to avoid universities withdrawing provision due to cost reasons.

The recent 'Evaluation of HEFCE's programme of support for Strategically Important and Vulnerable Subjects' (by Curtis+Cartwright Consulting, May 2011) also concludes in connection with high-cost provision such as *in vivo* training: "In cases such as these, where there was a range of pressures on the subject (financial pressures, external social pressures and waning demand from students) the ordinary application of market forces might well lead to an unavoidable decline in provision.

We would encourage HEFCE to consider whether the Society of Biology's accreditation process could be used as the basis for identifying courses which should attract a higher-level of HEFCE subsidy, and therefore as the basis for addressing vulnerabilities in the provision of *in vivo* training by universities due to its extremely high cost.

Engineering and Physical Sciences Research Council (EPSRC)

There are potential conflicts between the RCUK emphasis on quality of PhDs but some disciplines (e.g. engineering) are pushing for volume of quality and because of REF this dichotomy should be explored. EPSRC worked with HEFCE on identifying vulnerable areas while drafting their delivery plan. There is concern about undergraduate maths and some computer science provision with the introduction of fees. EPSRC has no regional agenda as it is a national agency.

EPSRC worked with HEFCE on identifying vulnerable areas while preparing our delivery plans. Our most significant current concern is regarding the flow of students into undergraduate courses as a result of the introduction of fees, which will then in turn impact on postgraduate recruitment. Some areas e.g. computer science, continue to be a concern whilst for other areas e.g. Physics, Mathematics, initiatives over the past few years have

² See: http://www.hefce.ac.uk/pubs/rereports/2008/rd09_08/

helped turn the tide in terms of undergraduate recruitment but there is a risk that this could be affected by fees. In particular, the impact of fees at the highest level of £9k/annum on the number of students pursuing four year undergraduate Masters courses that feed into PhDs in the Engineering and Physical Sciences is a significant threat to the flow of appropriately qualified graduates to meet the needs of academia and business.

Given the substantial investments that have been made in initiatives to increase the numbers in these SIVS in recent years it may be necessary for funding councils to consider interventions designed to protect these subjects/investments and mitigate this risk.

At the post graduate level, there is no shortage of PhD students in the Physical Sciences. Some areas of EPS have shown signs of increased recruitment of postgraduate students, although the situation does vary from discipline to discipline. Within the academic sector, some specific gaps have been identified e.g. statistics, process engineering. It is anticipated that there will also be a continued business/industry need for skilled people in engineering and manufacturing e.g. green technologies, power engineering, environmental goods and services and some specific pharmaceutical skills.

There is a potential conflict between the RCUK emphasis on the *quality* of PhDs with incentives within some REF panels that may encourage large *volumes* of PhD students e.g. Engineering. This dichotomy should be explored.

Economic and Social Research Council (ESRC)

ESRC would welcome continued partnership with HEFCE on quantitative methods in the social sciences where complementary action by ESRC postgraduate and by HEFCE on the undergraduate pipeline is essential. This is increasingly important as an example of joining up across the BIS family where the Research Councils are continuing to develop the large datasets where these skills can be effectively deployed. The ESRC sees language based area studies as another area where working with the Funding Councils and AHRC vital national capacity on Middle East, Asia and selected other areas is both economically important and vital to underpin national security. Social work, education and social science relevant to health and wellbeing, including mental health are areas of concern where recruitment may be threatened by the new funding arrangements and the goal of developing first rate practitioners who can engage with research is threatened.

The content of the response from ESRC is focused on identifying areas where a rise in undergraduate fees will affect the through flow to postgraduate level. Were the level of postgraduate fees also to rise, the response from ESRC regarding perceived threats to subjects or areas highlighted as strategically important or vulnerable, would have to be further considered.

1. Language Based Area Studies

Language based area studies was identified by Sir Gareth Roberts in 2005 as a strategically important and vulnerable subject area. In particular the following area studies and related minority languages were highlighted:

- 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
- Concern regarding area studies was reinforced by the 2005 ESRC Demographic Review of the UK Social Sciences, which indicated that there was an insufficient flow of graduates from undergraduate or postgraduate level, and an insufficient level &

range of the expertise necessary to sustain the nation's research capacity and capability.

In response to these reports, the Language Based Area Studies (LBAS) Centres, funded by ESRC, AHRC, HEFCE, SFC, and HEFCW, were set up in 2006. Following a Mid Term Review carried out by independent consultants, the Centres have been agreed to be a success, in a well-placed area of funding, but with the conclusion that the issues related to language based area studies have not yet been fully addressed. The ESRC views language based area studies as an area where continuing partnership with the Funding Councils and AHRC is vital to build national capacity on the Middle East, Asia and selected other areas. This work is both economically important in terms of competitiveness and vital to underpin national security. This is demonstrated by the UK Interdepartmental Standing Committee on languages establishing the Critical Languages for Government Initiative in 2010 which is seeking to work with a range of stakeholders to address the shortfall in rare, critical language skills and associated areas studies across government.

Funding for the Centres is ceasing in 2011. ESRC highlighted LBAS as a priority area in its 2011-15 Delivery Plan, and will continue to build on its initial investment through £6m funding of postgraduate studentships under the new Postgraduate Training Framework. This work is essential to ensure a through flow of postgraduates. AHRC have confirmed that they are continuing to develop their options for the investment of the additional funding identified in the AHRC 2011-15 Delivery Plan.

The British Academy have indicated that as part of their new programme of funding to strengthen support for Languages and Quantitative Skills (£5m), as announced in December 2010, they are considering a potential steer within the BA Fellowship schemes in the area of Language Based Area Studies (LBAS), to further capitalise on the work of the LBAS Centres.

It is recognised that there cannot be continuation funding of the Centres at the same level. However, to optimise the impact of this continued investment, there is a need to maintain a core underpinning infrastructure as raised with HEFCE in previous correspondence. This will provide an essential mechanism for the leveraging of additional funding.

To summarise, ESRC wish to continue working with HEFCE and other funders on language based area studies, which we consider as an area where fee reduction should take place. This is essential to maintain the through flow from undergraduate to postgraduate level.

2. Quantitative Methods

There is a wide acceptance of a shortfall in quantitative methods, particularly in undergraduate participation, evidenced by the forthcoming joint initiatives between ESRC, Nuffield Foundation and the British Academy.

The 2005 ESRC Demographic Review included a case-study on advanced quantitative methods which revealed that research capacity in quantitative methods remains an issue in specific fields across the social sciences. This was also backed up by the Roberts Report in 2005, particularly as QM often underpinned other social science disciplines.

ESRC published a report in December 2009 by the ESRC Strategic Adviser for QM, Professor John MacInnes, which documented the limited appetite for QM at UG level, the perception of QM as an unattractive subject, and an indication of the low level of undergraduate training provided in quantitative analysis.

Funding streams are shortly to be announced by ESRC (with co-funding from HEFCE and planned co-funding from the British Academy) and the Nuffield Foundation (with co funding from ESRC) in Spring 2011 which have the aim to develop quantitative methods teaching resources, up-skill teachers and work to 'train the trainer' through the ESRC Researcher Development Initiative and to develop centres that will deliver advanced QM training at undergraduate level.

To summarise, ESRC would welcome continued partnership with HEFCE on quantitative methods in the social sciences where complementary action by ESRC and HEFCE on the undergraduate pipeline is essential. This is increasingly important as an example of joining up across the BIS family where the Research Councils are continuing to develop the large datasets where these skills can be effectively deployed. It is important for HEFCE to continue activities under this area, and to monitor quantitative methods subjects closely.

3. Social Work

Social Work is one of the smaller social science disciplines, with those moving into the discipline to carry out practice-linked work and those that are research focussed. The discipline could be considered to have low private returns, but have significant social returns. Other relevant parties will wish to comment on the practice-linked side. ESRC is concerned with the numbers coming through to research focussed work and expertise being at an insufficient level or range.

ESRC published a report in November 2009 by the ESRC Strategic Advisor for Social Work and Social Care, Dr Elaine Sharland, which identified that despite 'pockets of excellence' and signs of growth in social work research, there were significant deficits in the research discipline. Dr Sharland identified priority research themes for research capacity development and engagement. Substantive themes were: Social work and social care perspectives on and responses to: professionalism and service provision in contemporary management, economic and welfare contexts; demographic change and diversity; health and wellbeing inequalities; risk, decision making and choice; promoting social inclusion and engagement; and practice development and innovation. Methodological themes were identified as: using quantitative methodologies; developing and diversifying qualitative methodologies; mixed methods; evaluation research; developing and using measures; large dataset and service data analysis; analysis of costs, cost benefits and cost effectiveness; and systematic and research review.

Given the small size and fragile nature of the discipline, if postgraduate fees rise, we would foresee a particular issue in Social Work, as there is currently an issue ensuring a sufficient or appropriate through flow from undergraduate level and this may result in a disproportionate decrease in postgraduates.

4. Education

The discipline of Education was estimated in the 2005 ESRC Demographic Review to be the second largest social science discipline, with a particularly unusual profile, with senior teaching professionals often recruited from secondary education to take up posts in a number of practice-linked disciplines as second-career researchers Like Social Work, Education features those moving into the discipline to carry out practice-linked work and those that are research focussed.

The Teaching and Learning Research Programme (TRLP) was a £30 million initiative funded by HEFCE, the Department for Educations and Skills (now the Department for Education) the Department for Employment and Learning Northern Ireland, the Scottish Government and the Welsh Assembly. The Programme, which was managed by ESRC on behalf of the

co funders, started in 1999, and ended in 2010, has been considered to be a clear step in right direction in addressing the issues within Education.

One of the aims was to pay particular attention to the development and expansion of research capacity in the field, and whilst the programme is perceived to have effectively addressed aspects of capacity building, it has been acknowledged that further work needs to be done to develop and maintain the future stream of high quality researchers. ESRC would suggest that HEFCE continue to monitoring activities within Education, and should postgraduate fees rise, a particular issue in Education can be foreseen, as there is currently an issue ensuring a sufficient or appropriate through flow from undergraduate level.

Medical Research Council (MRC)

MRC Strategic Skill Priorities and SIVS

MRC's focus is to ensure that the UK's medical science base (including industry) is provided with future research leaders who possess advanced research skills, particularly in areas of unmet national need. MRC's current priorities for strategic skills provision are reviewed regularly (most recently in 2011) through consultation with Research Boards, Panels and external partners. MRC's priorities include:

1. Cross-cutting skills
2. Skills aligned with the MRC Strategic and Delivery Plans
3. Interdisciplinary strategic skills

1. Cross cutting skills:

- a) Advanced *In Vivo* Sciences (See also BBSRC whole animal physiology)
- b) Biomedical Imaging
- c) Mathematics, Statistics and Computation

2. Skills aligned with the MRC Strategic Plan

- a) Regenerative medicine
- b) Stratified Medicine
- c) Systems Medicine: including Mathematics, Statistics and Computation and Whole Human Physiology (See also BBSRC whole animal physiology).
- d) Population Health Sciences and Public Health
- e) Training at the interface of advanced qualitative and quantitative methodologies is a particular priority.

3. Interdisciplinary Strategic Skills.

This selection of interdisciplinary skills priorities have been identified as being critical to sustaining a world-leading UK skills base. Research at the boundaries of MRC's remit may best be supported in partnership, for example with other Research Councils.

- a) Medicinal chemistry
- b) Medical physics
- c) Social Science
- d) "Basic" and clinical
- e) Industry collaborative research

Evidence for strategic importance & vulnerability:

Evidence in support of the above priorities is gathered from a variety of sources including:

- MRC's Training and Careers Overview Group and Research Boards (scientific experts) - who regularly review priorities and feedback to MRC on the state of disciplines
- Management information gathered from returns to JES Student data portal
- Direct experience of the recruitment market (MRC Units and Institutes)
- Reviews, reports including ABPI, NCRI etc

Possible measures to address vulnerability:

At undergraduate level:

- Ensuring the pipeline of undergraduate recruitment to core science subjects is maintained most notably in mathematics (data analysis, computational skills), computing, physics, chemistry and in-vivo sciences
- The possible introduction of a bench mark for lab based subjects to ensure courses provide an appropriate level of research based practical skills training (See also BBSRC comments on accreditation & Society of Biology).
- Lab based subjects may well be disadvantaged because of the inherent higher costs associated with running them. A mechanism whereby the higher costs of such teaching could be supported would be useful (MRC/ BBSRC provide strategic skills awards).

At postgraduate level:

- Studentship portfolio agreements with HEIs to focus shaping of postgraduate student portfolio on areas of strategic importance
- Joint working across RCs on areas of common interest (e.g. in vivo skills with BBSRC - strategic skills awards - a consumables top up of £5 – 10k).

MRC training priority areas can be found at:

http://www.mrc.ac.uk/Fundingopportunities/Studentships/Capacitybuilding/index.htm#P18_1452

Natural Environment Research Council (NERC)
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In 2010 NERC, and partners, undertook an in-depth consultation across the environment sector, including business, government and the research base, of the skills needs in the sector. There was a particular emphasis on the critical skills gaps over the next ten years.

The "Most Wanted" report identifies 15 critical skills in short supply, including hard-edged skills such as numeracy, computer modelling and conducting field research, and softer skills such as translating research into plain language so that it can be understood more easily.

It also explains why such skills are so badly needed - for example, to allow the UK to develop and apply new technologies, respond to the impacts of climate change and extreme weather, and enable better knowledge and understanding of environmental issues

The full report and supporting evidence is available on our website at:

<http://www.nerc.ac.uk/funding/available/postgrad/skillsreview/>.

The table below sets out the 15 critical skills gaps that were headlined by the consultation process:

1.	Modelling
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2.	Multi-disciplinarity
3.	Data Management
4.	Numeracy
5.	Translating Research
6.	Fieldwork
7.	Risk and Uncertainty
8.	Taxonomy and Systematics
9.	Soil Science
10.	Environmental Epidemiology
11.	Sustainability Science and Planning
12.	Microbiology
13.	Food Supply
14.	Energy Supply
15.	Freshwater Science

Based on the extensive consultation, these areas are considered strategically important and vulnerable – not only to NERC but the community more widely.

NERC are looking at ways in which strategic investments can be made to support these areas; in particular, targeted PhDs, specialist short-courses, and more innovative mechanisms e.g. Policy Internship Schemes³. In addition, LWEC partners are also discussing how to work together to fill these critical gaps.

More generally, NERC would welcome training providers (HEIs) to be encouraged to use the information in the “Most Wanted” and similar reports, e.g. to map skills needs against current activities and to generate ideas for new programmes of study, and to foster closer collaborations with employers of people skilled in strategically important and vulnerable subject i.e. to understand needs and develop relevant training.

Science and Technology Facilities Council (STFC)

Maths and analytical skills training is important. Due to the shorter training length new UK PhDs are not easily able to compete with European or US contemporaries.

Nuclear physics is an area where skills are relevant to application areas, and where taught MSc training could be vulnerable

³ Innovative approaches to supporting subjects are particular well received. One alumni of the NERC Policy Internship Scheme (addresses the skills gap ‘translating research’) has emphasised its importance on her career (other examples available):

“Without that secondment, I would not have followed a career in policy analysis. It provided an essential foundation in developing and communicating policy-relevant science. Specifically, it was valuable in the following ways: developing science communication skills, establishing policy networks, understanding the policy-relevance of science, experience and understanding of the policy environment, as well as a whole range of more general transferable skills. The secondment at POST lead directly on to my position at the Stern Review on the Economics of Climate Change, and subsequently supported my other roles, including in the catastrophe risk modelling industry, at Defra, and now doing research on climate change policy at the LSE.”

1. *The 2009 EPSRC/STFC Review of Nuclear Physics and Nuclear Engineering*⁴ made the following recommendations:

Since 2003, 26 PhD graduates in nuclear physics have found employment in the nuclear sector, of which eight are in defence. Whilst it was not clear the highly specialised knowledge gained during a PhD was truly required by industry, it was recognised that the transferable skills gained, such as research skills, team-working and problem solving were highly valuable. It was noted that countries with large-scale nuclear power industries such as France and the US also have relatively large pure nuclear physics research programmes.

Although the panel did not identify a causal connection between the two, it **recommended** that STFC examines whether operating support for nuclear physics research at a level significantly below international OECD norms is strategically justified.

However, the panel felt that the nuclear physics community has a significant contribution to make in counterterrorism, healthcare, nuclear forensics, radiation protection and environmental applications, which are discussed in more detail in the review. Their novel detector development work through projects such as AGATA has already made an impact in these areas and the panel felt there was potential to do more. In addition, the panel noted that in the UK, research in nuclear data relevant to the nuclear industry covering both new reactors and spent fuel management has considerably decreased over the last 20 years due to a reduction in funding. This has resulted in academics moving to fundamental physics research. However, the skills of nuclear physicists in nuclear structure and fission are considered particularly important as a resource for future needs in decommissioning, waste management, new reactor design and safe reactor operation.'

The panel acknowledged that recent funding cuts had damaged the UK's Nuclear Physics community, and that the size of the community now meant that it was extremely vulnerable. It was recognised that financial pressures have an adverse effect on the ability of the Nuclear Physics community to realise its potential in economic impact areas. It was felt that further funding cuts could be terminal, resulting in the loss of an important skill set which would impact the delivery of Masters courses.

However, the panel did feel that there is greater scope for the Nuclear Physics community to capitalise on application areas. Thus, the panel **recommended** that the Nuclear Physics community should:

- seek better research links with the Nuclear Engineering community and the nuclear fission industry
- look to expand research efforts to increase contributions to the healthcare industry as well as homeland security and counterterrorism efforts.

The panel **recommended** that the Research Councils proactively engage with the community to identify the opportunities in these areas and capitalise on them.

The panel recognised that the nuclear physics community had an important role to play in the delivery of existing Masters courses in nuclear science and technology, but noted that their specific expertise covers only a small fraction of the much broader landscape of topics and skills needed for future nuclear build. It was therefore suggested that universities take a coherent, cross-departmental approach to teaching, involving a number of different disciplines. The panel felt that the level of nuclear physics required by an individual going into the nuclear power industry was not necessarily particularly advanced. Whilst the ideal situation would be to have all MSc components taught by specialists, it was considered that

⁴<http://www.epsrc.ac.uk/SiteCollectionDocuments/Publications/reports/NuclearPhysicsAndNuclearEngineeringReview.pdf>

much of the nuclear physics material could probably be taught by non-specialist physicists, and hence universities should not necessarily consider this to be a barrier to establishing more nuclear power related MSc courses or to inclusion of nuclear modules within a wide range of undergraduate science and engineering courses.

2. Support for taught Masters courses in nuclear science and technology

In response to the 2009 review panel's recommendation, EPSRC and STFC brokered a series of discussions with the Office for Nuclear Development (OND) in the Department of Energy and Climate Change (DECC), and the Cogent Skills Sector Council.

The aim was to establish whether there was (i) the possibility of non-Research Council public funding for the courses; (ii) whether any of the parties knew of potential external sources of funding that were available; and (iii) if a viable funding stream could not be identified, how best to support the relevant universities in pursuing alternative sources of funding.

In the present financial climate, there is unfortunately little prospect of obtaining support from central government for these MSc courses. No potential external funding stream has been identified either.

In light of this, it is concluded that the best way to secure the future of the courses is likely to be through continued and deepened engagement with industry. We would therefore expect any support to come through funding agreements with relevant private sector companies. This dialogue will also help ensure that specialist nuclear courses at postgraduate level contain the appropriate content demanded by employers.

With input from Clive Smith of Cogent SSC, EPSRC and STFC have considered whether the current provision of MSc courses matched the present and future needs of industry, both in terms of course content and structure. We had no evidence that the current courses did not match the needs of industry, but we encourage the universities to maintain and strengthen contacts with industry to enable the courses to respond effectively to evolving requirements.

We considered that this would be particularly important in the shorter term, because during the extent and timescale of new nuclear build will become clearer. Engagement with companies likely to be involved in new build is therefore also important. In addition to strengthening links with industry, it was also felt that sustaining and enhancing engagement with relevant institutions such as the Nuclear Institute and the Institute Of Physics was beneficial.

In conclusion, industrial support was the only viable means EPSRC and STFC identified to ensure the longer term future for the MSc courses. We are open to discuss this matter further with the HEIs concerned, and we are happy to offer any support we can in terms of strengthening links with industry.

