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REVIEW AND EVALUATION OF THE SCIENCE AND INNOVATION AWARDS PORTFOLIO

**Science and Innovation Awards: a Strategic Partnership
between EPSRC and the UK Funding Bodies**

Abridged Summary Report June 2011

The Science and Innovation Awards portfolio was funded in a partnership between the Engineering and Physical Sciences Research Council, the Higher Education Funding Council for England, the Scottish Funding Council, the Higher Education Funding Council for Wales and the Department for Employment and Learning, Northern Ireland.



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Foreword by the Panel Chair

The review and evaluation of the Science and Innovation Awards (S&IA) portfolio at an 'Evaluation Theme Day' in February this year turned into a very positive experience for the Panel. We started the day with some significant concerns, having read the reports from the Grant Holders, but rapidly gained a much more positive view from our interactions with the research teams. At the end of the day we were convinced of the quality of the overall programme of work, that we have recruited some current and future research 'stars', and that there are new areas of research, particularly in the emerging and interdisciplinary categories, where the UK is developing a leadership position. The enthusiasm and energy of the research teams we met was impressive, and I would like to take this opportunity to thank them on behalf of all of the Panel members.

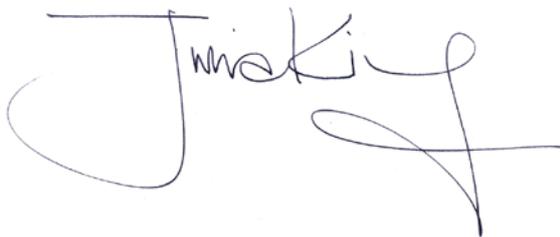
The glow of pride we all acquired from hearing about the exciting developments going on in the UK and funded by the S&IA, did not mean that we were uncritical of the programme. Key concerns, detailed in this report, relate to the absence of earlier review and monitoring processes for the release of large tranches of grant funding, and to demonstrating the sustainability and additionality of these awards in comparison with other existing research grant funding mechanisms.

Leadership was, not surprisingly, a key success factor for the research centres that have been created, and in this context it is very good to see that the EPSRC has this as a priority going forward. Alongside excellence in science and technology, strong leadership, from excellent research leaders, who can nurture and develop people, grow strong networks, develop strategy, and communicate effectively research outcomes and future visions to academics and industrialists, is going to be key to building globally competitive UK research capabilities.

The discussions we had emphasised the importance for successful researchers to understand the wider context of their research – academic, economic and societal – as well as how they fit in within the overall UK research base. Enabling effective collaboration, within organisations, between institutions and with industry and business will remain a critical challenge for the EPSRC in developing its relationship with the research base.

One particularly interesting challenge has been thrown up by the Centres in emerging areas of science and technology. Can we have a sustainable world-leading research capability in areas where we have no major UK industry capable of exploiting the results? If some of this exciting new research is to both remain here and contribute to the economic competitiveness of the UK we need to resolve the issue of developing the research and the industrial base in an integrated manner. Close partnership between Research Councils, the Technology Strategy Board, BIS and UKTI will be needed to ensure that we make the most of some of the ground breaking research we saw at the Evaluation Theme Day.

I hope that the observations and conclusions from this report will assist the UK funding bodies in developing new approaches to building the UK's research capability and will encourage them to continue to experiment with new funding mechanisms and partnerships.

A handwritten signature in black ink, appearing to read 'Julia King'. The signature is fluid and cursive, with a large initial 'J' and a long, sweeping tail.

Professor Julia King, CBE, FEng

Vice Chancellor, Aston University

April 2011

REVIEW AND EVALUATION OF THE JOINT EPSRC/ FUNDING COUNCIL SCIENCE AND INNOVATION AWARDS PORTFOLIO OUTCOMES, 2004 TO 2009

*Report of the Science and Innovation Evaluation Theme Day held at the Birmingham
Hilton Metropole Hotel at the NEC in February 2011*

EXECUTIVE SUMMARY

The £120 million portfolio of Science and Innovation Awards jointly funded by the EPSRC and the UK funding bodies was examined at an Evaluation Theme Day. The focus of the Theme Day was on: progress in recruiting new academic staff to research areas considered to be missing or 'at risk' in the UK; building future sustainability in these topics; examining the prospects for excellent research outcomes and impacts; and finding evidence of strategic support from the grant-holding research organisations. The Evaluation Panel was not primarily concerned about the details of research progress at individual Centres, but nonetheless it also identified a number of 'best practice' examples amongst the funded Centres.

The Panel concluded that:

- ❑ There were many excellent research projects in place, only a small minority were judged to be borderline in terms of their strategic approach and delivery of improved sustainability;*
- ❑ In some cases there was little or no evidence of collaboration between apparently strongly complementary groups in 'at risk' areas. Action is required to make this collaboration happen for the benefit of the UK;*
- ❑ For newly established centres with a low initial visibility, recruitment to fill gaps in the portfolio had proved difficult; whilst this was not particularly surprising given the need to fill gaps or establish a presence in emerging areas, especially in interdisciplinary areas, more innovative and proactive approaches to recruitment could have been beneficial in some cases;*

- ❑ *It was difficult to see how this particular form of award had delivered “additionality” at many Centres. Progress beyond that which might have been achieved through standard support mechanisms and lower cost had not been clearly demonstrated, even though overall, work of high quality in the desired areas of focus had been achieved;*
- ❑ *For EPSRC, a different approach was needed in future to grow capability in future strategic shortage areas, involving identification of good university nuclei for research Centres and building them by specific stepwise investment, with managed review, monitoring and stage-gate processes for the release of subsequent funding commitments;*
- ❑ *For EPSRC, such Centre grants should normally be held by the scientific leader responsible for managing the programmes of research, and not by a senior ‘figurehead’ such as the PVC Research. An alternative approach is needed to ensure high level institutional commitment and support;*
- ❑ *For EPSRC, there was a future need to build robust criteria and ‘success factors’ for identifying new strategic areas in shaping its research portfolio;*
- ❑ *For EPSRC, part of this process should include the assessment of the UK business and industry base and its ability to absorb new technologies from emerging research areas, and whether focussed collaboration with other partners could help ensure a UK base for exploitation of funded research;*
- ❑ *For EPSRC, in retrospect, some opportunities had been lost in the S&IA approach: the ability to ensure that groups in new or ‘at risk’ areas worked collaboratively to increase the impact and visibility for the UK research base; more effective monitoring of research progress and outcomes on these continuing grants; and the flexibility to consider, on a ‘needs’ basis by topic, a variety of academic staff positions outside ‘new lecturer’ posts;*
- ❑ *S&I Grant Holders, especially those working in related topics, should be mandated to use funds from their Awards to network more effectively in order to build capability for the UK rather than focussing locally and regionally for their own and closely related research organisations.*

1. INTRODUCTION AND BACKGROUND

The Science and Innovation Awards (S&IA) programme provided large value, long-term grants in strategically important research areas that were identified as being missing or 'at risk' in the UK. The scheme began in 2004, and EPSRC made five annual rounds of awards starting in 2005. The final fifth round, in particular, looked at emerging research areas where timely investment would have the potential for added value in terms of the UK's future research capacity and international impact (for example, research into the science of graphene, which has attracted the 2010 Nobel Prize for Physics at the University of Manchester).

The scheme was established in response to developing concerns that some areas of engineering and physical sciences research in the UK no longer had the capacity needed for world class research and postgraduate training. These 'at risk' areas might not be able to sustain the research capacity needed for the future, including the production of sufficient well-trained people and the development of new generations of research leaders. The evidence-base for action came from several sources, including statistical studies, International Reviews, and flows of undergraduate and postgraduate students. The issue was also highlighted in the Government's Science and Innovation Investment Framework 2004-2014.

The scheme has been operated in partnership with the Higher Education Funding Council for England (HEFCE), the Scottish Funding Council (SFC), the Higher Education Funding Council for Wales (HEFCW), and the Department for Employment and Learning in Northern Ireland (DELNI). There were 37 individual grants supporting 29 programmes of research activity, with a current value of approximately £120 million. Senior executives from EPSRC, the Funding Councils and DELNI were actively involved in the outline and full proposal assessment panels. Funding details as announced each year from all the public sector partners, and the research areas identified for each cohort of new grants are provided at **Annex 1**.

The grant details, including programme titles and research organisations with awards, are provided at **Annex 2**.

2. PURPOSE OF THE REVIEW AND TERMS OF REFERENCE

The S&IA portfolio of grant outcomes has the potential for a strong alignment to the EPSRC's goals for delivering impact, developing leaders and shaping capability as described in its Delivery Plan ^(EPSRC Reference 1) and can inform the Council about future best practice in developing these goals over the next CSR period from April 2011.

The focus of the Theme Day was on examining:

- recruitment and retention of academics and senior research staff;
- effectiveness of building long-term research sustainability;
- strategic support of programmes by research organisations;
- evidence of new approaches and best practice;
- identification of excellent science and engineering outcomes.

The formal Terms of Reference and membership of the Review Panel is at **Annex 3**.

Prior to the Theme Day itself, the Review Panel considered written progress reports from each of the funded Centres. During the Theme Day the Panel visited research posters provided by Grant Holders, and met representatives from each Centre in order to explore progress and challenges with their awards. In the review, the Panel was particularly keen to investigate the progress in the Centres funded during the first three annual cohorts of awards, since these had the most potential for substantive progress to date, operating five, four and three years beyond their start.

Copies of the research posters have been collected by EPSRC and will form the basis of ongoing publicity of research outcomes and impacts through normal publicity channels in publications, planning documents and the web site.

The Theme Day participant's list for all delegates is provided at **Annex 4**.

3. RECRUITMENT AND RETENTION OF 'STAR' CANDIDATES

Overview

Recruitment had been challenging, especially attracting really outstanding candidates, but the Grant Holders had succeeded in appointing good quality candidates, with a small number of really outstanding ones, i.e. 'stars'. Innovation and persistence in recruitment and use of the prestige of the S&I awards had borne fruit. Particularly where new teams are being built, flexibility to recruit at a range of academic staff levels was important. Gender balance is still a major issue and one which EPSRC should consider further. Visa problems are becoming an increasingly difficult challenge in building academic capability and capacity in UK institutions. Whilst retention levels were acceptable, more focus on support and mentoring of newly appointed academic staff is still needed and should be a requirement for the award of funding.

Grant Holders returned details of 162 individuals (academics and senior researchers), of whom 136 were still in post at the review census point in December 2010 (**Appendix, Tables A to F**). Top-level messages extracted from the submitted information included:

- ❑ 84% of all recruited candidates by research organisations are still in post;
- ❑ 49% of all the recruits have come directly from UK locations. Many of these will have originally come from overseas, and some had come from non-permanent posts, so can be counted as newly contributing to building UK capability in their respective fields;
- ❑ One in five recruited candidates came directly from the EU, and another one in five from the USA;
- ❑ The proportion of recruits retained in their posts are similar (all at over 80%) irrespective of original location (UK, USA, EU, other international);
- ❑ A higher proportion of candidates have been recruited to energy topics from the UK (84%) and to physics topics from the EU (35%);

- ❑ There has been a lower comparative retention of candidates to mathematics topics (73%) and a higher retention to chemistry (96%), physics (90%) and engineering (91%) topics.

The Panel noted that many Centre leaders commented that recruitment had been challenging, particularly in some areas e.g. Energy, and especially for 'star' candidates. Effective use of research organisation and, particularly, individual network links was critical in facilitating the search for good candidates. For newly established Centres and in areas where the UK has low visibility this is not surprising, but emphasises the need for groups to be both proactive and innovative in their approach to recruitment.

Overall the quality of recruits was good, although 'stars' were the exception. However there were some examples of people recruited and in post with the potential to be real stars of the future.

Some of the Centres used the Award's known prestige as a very positive aid to recruitment, and indeed the international nature and reputation of several S&I groups had proved attractive to strong candidates from overseas. The Awards often enabled generous start up funds which aided particularly US recruitment by providing a full start-up package. In some cases, the presence of an S&IA was helping to retain some of the existing staff who might otherwise go elsewhere.

Groups who had been proactive in outreach and communication about their S&IA found that this was very helpful in easing recruitment; there were several examples of heroic quite targeted efforts to fill specific interdisciplinary posts with people with unusual combinations of skills (for example, candidates with combination chemical engineering and biology).

In some instances a strategy for the research organisation for retaining key academic staff for the long term had not been identified. Such a strategy would be a crucial issue in determining the future sustainability of particular centres beyond the period of support provided by EPSRC.

A number of groups commented that the lack of flexibility in the level of recruitment mandated by the awards had frustrated recruitment and the building of groups with a range of levels of experience. The Panel questioned whether it had been a good

policy to recruit predominantly at a junior lecturer level, and whether mixed groups with recruitment at Reader/Professorial level would have been more effective. Evidence from Grant Holders suggested that this could be the case, where the opportunity to use an enhanced university contribution, or to re-negotiate appointment terms with EPSRC to recruit at a higher level had been welcomed by research organisations, and had proved vital in delivering capability in shortage areas.

Several Grant Holders identified the challenge of obtaining visas as becoming a significant inhibitor in recruiting international academics - with the expectation of increasing problems in the future.

Examples of best practice in recruitment:

- Communicating the S&IA prestige to draw recruits to the UK (and to hold recruited staff in the UK), by promoting outreach activities
- Giving consideration to augmenting the junior lecturer salaries provided on S&IA grants with funds from internal sources to recruit at Reader or Professorial level
- Undertaking proactive targeted recruitment for specific skill combinations and persevering to find the right candidate.

In the context of gender diversity, for those candidates whose gender was known from the recruitment statistics for 140-plus submitted posts, 80% were male and 20% were female. This proportion is not significantly different from the general population of staff at Lecturer and Senior Lecturer posts supported by EPSRC through its research grants ^(EPSRC Reference 2). Neither is it very different from the National position by SET subject and gender ^(ECU Reference 3), ranging from 74%/26% for chemistry and 84%/16% for physics. It is disappointing that in building capability for the future it has not been possible to improve the gender balance. EPSRC should give further consideration to how it can facilitate increased participation and progress of women in these areas.

Whilst there was some mention of good support and mentoring for young staff getting started, this was not universal. This is something that should now be embedded in all institutions and EPSRC should consider this an essential requirement for any awards of this type.

4. SUSTAINABILITY OF CENTRES

Overview

The issue of the sustainability of the S&I Award investments was one of particular concern for the Panel. Key issues which emerged were: the importance of a UK industry base, including major companies, to exploit the technology; the quality of industry engagement by some groups; and the urgent need for strategic planning for sustainability by the Grant Holders if the S&IA programme is to meet its objectives of developing long term capability – including diversification of funding.

Concerns about sustainability

A key area of concern for the Panel which came out from discussions with grant holders, especially in emerging technology areas, was the importance of a significant UK industry base capable of exploiting the technology. In some exciting areas the UK capability was only present in small companies, which presented investment challenges. A few grant holders expressed the view that it is likely to be almost impossible to be 'number one' in particular research areas without the presence of a strong UK manufacturing base in the related technologies. This presents a challenge for EPSRC in developing its strategy for new research areas, requiring integration with Technology Strategy Board and BIS/UKTI in developing coordinated initiatives to support investment, including inward investment, in developing and growing the industry base.

In some cases it appeared that sustainability might be dependent on the UK defence sector, and there was an opportunity for closer collaboration with the MoD in identifying critical technologies. In other areas, the panel were concerned by a lack of awareness in research organisations of industrial interests and needs for the research outputs, so sustaining activity at the scale currently achieved going forward at many centres would not be achieved.

A few groups have been too focused on research councils (not just EPSRC) as their main source of funding, and needed to broaden their outlook and scope for the future.

In some areas the lack of collaboration between research teams awarded S&IA grants in closely related topics was disappointing. EPSRC should look at ways to encourage cooperation and help teams find the right balance between cooperation and competition, especially when the purpose of the awards is to build capability for the benefit of the UK, not just individual institutions or teams.

The Panel felt there were potentially new opportunities for EPSRC to consider the establishment (or re-alignment) of its Centres for Doctoral Training (CDTs) in continuing critical gap areas, through gap analysis of its grants portfolio to shape research capability, a priority in the Council's new Strategic Plan. Such an approach could improve the quality of the PhD through cohort training in appropriate key technologies (examples might be in EPSRC global challenges such as manufacturing for the future, energy, digital economy and healthcare technologies).

Best practice to establish sustainability

Grant Holders and the Panel highlighted a number of ways to encourage better sustainability at S&IA Centres

- Being more proactive in identifying appropriate industrial problems which can be addressed by the capability being developed, for example by employing specialists in this 'translational' role;
- Engaging in public acceptability and public understanding debates in new areas of science and technology;
- Exploring the economic issues and possible outcomes surrounding the research problem;
- Using the S&I Award as a springboard for major European programmes;
- Development of MSc modules in undergraduate programmes in specific areas to bring more people trained in the field;
- Recruiting an appropriate industrial advisory board or steering committee and engaging with it effectively and developing industrial clubs;
- Finding innovative ways to encourage interdisciplinary interactions.

In general across the S&I Centres there needs to be more focus on putting in place strategies to deliver medium/long-term sustainability, with less dependence on funding from a single research council, and a stronger intent on finding funding from diverse sources outside the conventional UK public sector. A particularly worrying challenge reported by several Grant Holders was that although many centres now had laboratories with excellent facilities, they will soon have no PhD students in them once the S&I funding stream finishes.

5. EFFECT OF 'ADDITIONALITY' OF THE AWARDS

Overview

Additionality was one of the more difficult areas for the Panel to assess, and did not come out strongly from the written reports. However, the S&IA in many instances had clearly enabled groups to obtain support from their institutions for disciplines that would not otherwise have become a priority, so leveraging institutional funding to support identified areas of national need. The Awards had also acted as catalysts in some cases for exciting institutional and organisational changes, breaking down traditional disciplinary boundaries and supporting new initiatives. Where they had not been so strongly additional was in attracting funds from alternative external sources and building sustainability into the new activities, as indicated in the previous section.

One definition of '**additionality**' is "the extent to which a new input of resources and research funding (the S&IA) adds to the existing activities from the traditional funding routes (instead of replacing any of them) and results in a much greater aggregate activity which delivers more than the sum of the parts", often at a lower cost, because of efficiencies in resource-sharing.

The 'additionality' benefits of holding an S&IA were not always clear from the written progress reports, but came out more strongly in discussions with Grant Holders. This was particularly true where they were building a small current group into an existing larger activity.

An S&IA often accelerated positive change; in some cases catalysed by S&IA; in some cases shaping (or re-shaping) the change over time. In some cases, the known prestige of particular Awards are stimulating excellent visitor programmes and improving PhD recruitment.

6. RESEARCH OUTCOMES

Overview

Overall the Panel felt that there was limited evidence that the S&IA had made a significantly different impact on research outcomes than could have been achieved, probably at lower cost, through other existing funding routes.

The Panel's role had not been primarily to examine research outcomes in any great detail. In examining the posters and discussing research with the S&IA Centres, the Panel gained the impression that the research outcomes ranged from 'business as usual' – i.e. what should be expected from good existing academic groups working together – right through to excellent and innovative.

The S&IA mechanism had enabled some new interdisciplinary interactions to grow, something which is still perceived to be challenging through conventional research grant funding routes and academic department structures.

Examples of excellent research outcomes

- Fixation of carbon dioxide to formic acid started at Cardiff Physical Organic Chemistry and now taken up by the Nottingham DICE project to begin process development
- Plasmonics research and Synthetic Biology research, both at Imperial College
- The Heathrow airport Operational Research scheduling work at Lancaster University and their collaborators (LANCS Consortium)
- The glucose sensor project at Strathclyde and King's College
- The Oxford Quantum Coherence low-cost ion trap research

7. RESEARCH CAPABILITY IMPACT

Overview

A number of the early Centres were now displaying excellence in research capability and potential impact in their scientific outcomes. The Panel had been especially impressed with the DICE Centre at Nottingham which had displayed all the elements of well managed recruitment, high sustainability, high impact science with vibrancy and spark and strong cultural change in the university. Another was the Mathematical Analysis Centre at Oxford which showed promise in terms of excellent recruitment, establishment of a new research hub with an integrated science base, and good links with the private sector. A third example with high research challenges, inspirational leadership and huge potential for interdisciplinary progress was the Sheffield Chemical Engineering/ Life Sciences Interface Centre.

Examples of best practice in capability impact

- ❑ Pure Maths at Oxford University (non-linear partial differential equations): with raised UK visibility in the field, and a remarkable international visitor programme which ensured that outreach of their activities occurred at the highest academic levels around the world
- ❑ Nottingham, linking Chemistry and Chemical Engineering, provided a vehicle for exploitation of key scientific developments to a stage where commercial viability could be assessed. This has begun the process of alleviating a specific UK weakness identified in international reviews and has been welcomed by many companies, large and small, who now see Nottingham as a prime collaborator
- ❑ Sheffield changed the focus of much of their Chemical Engineering activity to work at the interface between chemistry and biology; an area of significant skills and capability shortage. This has allowed advances in the new biology to be exploited more rapidly for applications as diverse as medicine and bio-fuels

8. STRATEGIC SUPPORT FROM HOST ORGANISATIONS

Overview

Although not always evident from the written reports, Grant Holders had often achieved a great deal of additional leverage provided from their institutions to support their Awards. These resources typically included additional academic positions, and part- or full-time Professorial posts to direct or lead the evolving S&IA Centres. Many Centres had acquired studentships, in some cases funded by the university itself and by industry, and from awards diverted to the centres from EPSRC Doctoral Training Grants. The provision of capital equipment and significant laboratory refurbishment also featured strongly. However the sustainability of this funding was a concern, with worries identified by the Centres about the future availability of PhD studentships.

In all cases, the Panel concluded that their discussions with Grant Holder representatives had been valuable in understanding the value of strategic support from the host organisations, especially as this had not always been apparent from the submitted progress reports.

Many Centres had provided additional academic staff positions at Lecturer and Senior lecturer grade from their own resources. Several had augmented the S&IA academic staff heading to bring in more senior people at Professorial grade to take the lead in Centres. At least ten new Professorial positions were identified in the submitted reports, usually to take a key leadership role in establishing new research Centres. By contrast, one institution (with an S&IA in mathematics) had interpreted the need to support its S&IA very meanly, loading an appointed lecturer with considerable other work outside the focus of S&I.

Several of the Mathematical Sciences and Statistics Centres had established vibrant visit and exchange programmes with other academics and PhD students, which in any case hosted large numbers of people addressing practical research problems.

Provision of major research equipment and laboratory refurbishment to bring new teams together in fruitful collaborations was a strong feature of many Centres. Additional capital equipment and refurbishment costs provided by research

organisations together valued at well in excess of £16.4 million had been identified by Grant Holders in the review.

Examples of excellent support from host organisations:

- Support at the Warwick Statistics Centre had changed the research organisational culture at the research organisation
- The Strathclyde Energy Centre had been very well exploited within the university
- The joint Exeter and Bath Universities graphene research programme operated with strong support from the host research organisation

9. CRITICAL SUCCESS FEATURES FOR S&I AWARDS

Overview for the research organisation:

The key success features for these Awards appeared to be: strong institutional support and ownership; strong leadership/ownership and accountability at the Centre level; excellent scientific leadership at project level; understanding of and commitment to the scientific context and ethos of the award; clear additionality; the existence of an engaged industrial user base, linked in through good use of industry boards and clubs; good outreach and visibility; and a strong collaboration ethos. Some of these issues have been highlighted earlier in this report (for example the industry base) and will not be repeated here.

Institutional Ownership and Support: there needs to be strong institutional ownership and support for the project, to ensure leverage and prioritisation at senior management level. However the Panel felt that this was, in general not best achieved by having the Award Holder as PVC level in the institution. Award Holders who actually led their Centres displayed the greatest motivation and engagement.

Centre Leadership: the research leader should have capability to handle collaboration and to stimulate team working and a strong team culture: they should have passion, drive and vision for the field. Heads of research need to be creating an identity for the awarded project, and binding the physical or conceptual identity, stimulating the 'feeling of belonging'. Drive, energy, urgency and a desire to win ('we're going to be the best') are critical attributes. The need for effective leadership emphasises the importance of the EPSRC's focus on developing research leaders in science and engineering with a full range of leadership skills.

Outreach and Visibility: strong outreach activities, developing good visibility for the Centre were very important, in gaining powerful institutional support and leverage, developing collaboration, growing international reputation and attracting and retaining excellent staff.

Advisory Boards: effective use of industry or science advisory boards where it is appropriate for the needs of research programmes; Awards where this had been a strong feature of the management of the project had seen significant benefits from use of external advice.

Flexibility to use funding most effectively: for example flexibility to appoint staff at right level, and make changes when necessary, so the work remains dynamic with time.

Additionality: the Centres should be able to demonstrate that the ‘sum of the parts’ - bringing together much more than the ‘parts’ themselves – provides the required ‘additionality’ and achievement of purpose for the Centre to build effective new capability for the benefit of the UK.

Overview for the EPSRC

EPSRC Contact: for these Awards, in most cases the principal EPSRC contact with the research organisation should be at the scientific leader level, not the PVC, Research (this was indeed true for the first-year awards, where grants were typically made to the notified scientific leader rather than the PVC, Research).

Stage-gate monitoring: for Awards of this size, more active monitoring or stage-gating should have been implemented by EPSRC. An interview as part of the final project selection process should be an essential component (this was indeed true for the fifth-year awards, learning from the experience of the earlier allocation rounds which were paper-based exercises only). An intermediate review (or a series of reviews) would also have added to the effectiveness of the management process by EPSRC.

Partnership: Grant Holders of such strategically valuable grants must also ensure that they respond to requests for interim and progress reports in a timely manner, and there should be an effective partnership between EPSRC and research organisations to ensure the benefits of research outcomes are realised and exploited for the UK.

10. BARRIERS TO EFFECTIVE IMPLEMENTATION IN S&I AWARDS

Overview

Where there were examples of less effective progress the Panel identified a number of common features, often the inverse of the success factors listed above. In particular these included: institutional profile and recognition of the award; continuity of ownership of the award with personnel changes; lack of collaboration between Centres; full recognition of the opportunity of the awards to do new things and in new ways.

There was often a lack of obviously demonstrated accountable ownership of the Awards in the institution. Sometimes there was a lack of continuity of ownership of grants by research organisations, for example as PVCs changed.

In several cases, the Awards were not seen as high profile special strategic opportunities by research organisations, but rather, part of 'business as usual', and operated very much as 'standard' research grants.

Communication and collaboration between individual Centres - and indeed between obvious partners in the UK - was often poor or non-existent, thereby not realising nor maximising capacity building through collaboration at the level of the UK scale.

The stimulation of exciting new innovative approaches and new ways of doing things had not been highly demonstrated by many Awards.

The view was expressed by the Panel that there was still not enough financial incentive operating for research organisations to be able to recruit the very best people from, for example, the very best United States and EU laboratories.

11. CONCLUSIONS OF THE REVIEW

Conclusions about the research progress and outcomes

Overall the Panel was impressed by the quality of the research being carried out; nowhere has the funding been 'wasted' at the supported centres. The projects ranged from adequate to very good from a managerial perspective, but with some currently judged to be 'border-line' in their strategic approach to building and delivering sustainability.

Excellent results and progress had been identified at particular individual research centres. However, the panel identified a lack of obvious collaboration between many apparently natural groups in the UK – there was a need to make this collaboration happen at the UK scale of operation.

The Panel recognised that for new centres with a low visibility recruitment to fill gaps in the portfolio was quite difficult. Filling identified capability gaps was much easier than being able to make really good progress in emerging areas, but of course this was not surprising since the purpose of S&I Awards was to establish a UK presence in these emerging areas.

The effectiveness of multi-site programmes often looked poor on paper, but stood up very well during most interviews with Grant Holder teams. However, the Panel had not been entirely convinced that progress beyond that which could have been achieved through standard support mechanisms (programme grants, platform grants) had been demonstrated by many centres.

Conclusions about the S&IA mechanism:

The Panel acknowledged that the chosen topics for support through S&IAs had been identified from International Reviews and evidence of 'shortage areas' for the UK. However, the Panel concluded that more robust background information was required 'up front' to identify the original intent for both identifying the areas chosen and giving a clearer rationale for desired outcomes. With the benefit of hindsight, it queried whether the key success measures and outcome indicators were articulated clearly enough at the beginning, to identify appropriate expectations for growth during the program in particular topic areas.

There were many outstanding results demonstrated, but the Panel had not been convinced that the S&IA route was especially effective as a mechanism for building capability without a well-described starting baseline – to identify what success would look like after (say) five years support. Capability building was a long term activity, so the real success for even the Centres awarded originally in 2004/5 would not be so measurable for another few years. However, good progress had been made at many Centres to date, at this interim review point.

There was a critical need to identify good university nuclei for research centres and build on them by specific investment, and by developing support mechanisms to link participating groups together in the UK, to build capability and critical mass around topics at centres. This conclusion maps on to EPSRC's strategic approach for delivering impact and shaping capability in its new Delivery plan 2011-2015.

Exploiting and maintaining capital investment and major infrastructure in research organisations needs addressing for the future, perhaps through closer integration with Technology Strategy Board priorities and stronger linkage to business and industry. This key target is one for both the EPSRC and individual institutions to pursue.

Notwithstanding the Panel's criticisms of the S&I funding mechanism, the outcomes from the S&I investment are important and of high quality and should be routinely drawn to the attention of the Department for Business, Innovation and Skills to demonstrate their importance to national needs in the UK.

The Theme Day review process had been instrumental in bringing together for the first time the whole portfolio of Grant Holders, many of whom had not met before, nor necessarily been aware of each others activities to date. The Theme Day had been beneficial in establishing potential new connections between Centres, and certainly for those groups working in closely connected topics, the interactions should now be actively pursued by Grant Holders.

Experience from the S&IA mechanism will inform the way forward into new initiatives as EPSRC changes from being a funder to a sponsor of research, where its investments act as a national resource focused on outcomes for the UK good and where the Council more pro-actively partners with the research it supports. The

sponsorship role will encourage close engagement with the research community, other Research Councils, Government, industry, and other organisations such as the Technology Strategy Board to ensure that the UK gets the most out of the resources available and the research supported ^(EPSRC Reference 1).

12. RECOMMENDATIONS FROM THE REVIEW

In order to develop strategic programmes and packages in shortage areas, EPSRC should be identifying their visions for success into the next Government Forward Look for the period 2011-15, with clarity about longer-term outcomes identified up front at the beginning of the strategic funding period.

The absence of active progress monitoring and evaluation throughout the funding period was a missed opportunity in the case of the S&IA. Principal Grant Holders must be interviewed at the proposal assessment stage and a stronger measure of interim reviews, monitoring and stage-gating for the release of subsequent funding phases is needed.

S&I Grant Holders, particularly those holding grants in related topics, should be now mandated to use funds from their Awards to network more effectively throughout the lifetime of their Awards, to stimulate the building of capability for the UK rather than locally or regionally at single Centres.

EPSRC should consider developing an evidence base around the length of award which would be appropriate to establish capacity building and sustainability projects, recognising that these timescales could be different for different topics and themes in its portfolio.

The staff funding provided in the Awards for new academic posts was typically targeted at three standard lecturing positions, three research assistants and three project studentships. In order to recruit academic staff with the required disciplinary skills for programmes, research organisations could have been permitted more flexibility, within the funds provided (and augmented by their own funds as required), to recruit at more senior levels where necessary.

Centre grants of this type should most normally be held by the scientific leader responsible for managing the programmes of research and not by a 'figurehead' such as the PVC Research, or another senior position in the institution. The anticipated additional benefit of Awards being held by an individual at the level of a PVC Research had not been demonstrated in the Panel's discussions with scientific leaders and PVCs attending the Theme Day discussions at posters. The EPSRC

needs to seek alternative ways to ensure institutional commitment and support to its high profile programmes.

The quality of leadership was critical to speed at which Centres developed, quality of recruitment and strategic planning. The EPSRC should look at developing research leadership training for the next generations of UK research leaders.

Some of the emerging technologies centres in the most exciting areas of new science were finding it difficult to identify a UK industry base to collaborate with. In developing its strategies for new technology areas, the EPSRC should work with BIS/TSB/UKTI and other relevant groups to see how the exploitation of such research in the UK can be facilitated.

Finally, the number of appointments of female academics in the areas of the S&IA was disappointing. EPSRC should work with the academic community to see how this can be improved in future.

REFERENCES

1. EPSRC Delivery Plan 2011-2015, page 2 Executive Summary, Published December 2010.

2. EPSRC Annual Report and Accounts 2009/10, (page 56):

Gender of current award holders as at 1st April 2010 where known

Early Career	Male – 80%	Female – 20%
Grant Holders over 35 years old	Male – 90%	Female – 10%
Senior and Leadership Fellows	Male – 93%	Female – 7%
Average, all categories	Male – 88%	Female – 12%

3. Equality Change Unit, Equality in Higher Education, Statistical Report 2010, (page 23),

Table 1.10:

Academic staff by SET Subject and Gender

Chemical Engineering	Male – 77%	Female – 23%
Chemistry	Male – 74%	Female – 26%
General Engineering	Male – 80%	Female – 20%
Mathematics	Male – 77%	Female – 23%
Physics	Male – 84%	Female – 16%
Average, all categories	Male – 78%	Female – 22%

ACKNOWLEDGEMENTS

The EPSRC acknowledges and thanks the Review Panel under the chairmanship of Professor Julia King for their participation in the review, and the teams of Grant Holders who had provided their written progress reports and the research posters used throughout the Theme Day discussions.

SCIENCE & INNOVATION AWARDS: FINANCIAL SUMMARY

Year	Grant Ref	Centre	Research Topic	EPSRC ££s	FC ££s	Council	Total Fund
1	EP/D001641/1	Cardiff	Physical Organic Chemistry	£2,956,344	£0	HEFCW	£2,956,344
1	EP/D501229/1	Nottingham	Chemical Eng/Chemistry	£2,987,947	£500,000	HEFCE	£3,487,947
1	EP/D002133/1	Strathclyde	Energy (Power Engineering)	£2,742,415	£1,000,000	SFC	£3,742,415
1	EP/D002060/1	Warwick	Statistics	£3,729,604	£386,957	HEFCE	£4,116,561
1	EP/D501288/1	Glasgow	Electronics Design	£3,550,607	£626,232	SFC	£4,176,839
Year 1				£15,966,917	£2,513,189		£18,480,106
2	EP/D063485/1	Bristol	Statistics	£3,429,962	£75,000	HEFCE	£3,504,962
2	EP/D063191/1	Warwick	Maths/Comp	£3,428,455	£387,299	HEFCE	£3,815,754
2	EP/D062985/1	Cambridge	Statistics	£2,230,044	£70,000	HEFCE	£2,300,044
2	EP/D062837/1	Warwick	Plasma Physics	£4,438,202	£618,000	HEFCE	£5,056,202
2	EP/D06337X/1	Queens Belfast	Plasma Physics	£2,520,873	£710,000	DEL	£3,230,873
2	EP/D063329/1 EP/D063604/1	Imperial UCL	Nanometrology	£4,791,192	£759,262	HEFCE	£5,550,454
2	EP/D062861/1	Strathclyde	Nanometrology	£2,794,634	£1,473,400	SFC	£4,268,034
Year 2				£23,633,362	£4,092,961		£27,726,323
3	EP/E035027/1	Oxford	Mathematics	£2,530,151	£250,000	HEFCE	£2,780,151
3	EP/E036066/1 EP/E036112/1 EP/E036236/1	Oxford Imperial Cambridge	Quantum Physics	£2,657,305	£2,700,000	HEFCE	£5,357,305
3	EP/E036333/1 EP/E03635X/1	Edinburgh Heriot-Watt	Mathematics	£2,693,361	£105,178	SFC	£2,798,539
3	EP/E036473/1	Nottingham	Quantum Physics	£4,864,768	£420,000	HEFCE	£5,284,768
3	EP/E036252/1	Sheffield	Chemistry/Life Sciences	£3,637,663	£0	HEFCE	£3,637,663
3	EP/E036503/1	Cardiff	Energy	£2,765,924	£500,000	HEFCW	£3,265,924
3	EP/E036244/1	Strathclyde	Physical Organic Chemistry	£2,722,055	£1,065,000	SFC	£3,787,055
Year 3				£21,871,227	£5,040,178		£26,911,116
4	EP/F034520/1 EP/F034482/1	Edinburgh Heriot-Watt	Energy	£4,671,708	£420,000	SFC	£5,089,708
4	EP/F033613/1 EP/F033214/1 EP/F033338/1 EP/F033982/1	Lancaster Nottingham Cardiff Southampton	Operational Research	£5,328,605	£100,000	HEFCW	£5,428,605
4	EP/F034210/1	Warwick	Analytical Science	£3,047,900	£650,000	HEFCE	£3,697,900
4	EP/F033605/1	Imperial	Structural Ceramics	£4,999,255	£500,000	HEFCE	£5,499,255
4	EP/F034296/1	Southampton	Tribology	£2,898,363	£370,000	HEFCE	£3,268,363
4	EP/F034350/1	Cambridge	Energy	£2,862,119	£0		£2,862,119
Year 4				£23,807,950	£2,040,000		£25,845,950
5	EP/G036004/1	Imperial/ LSE	Synthetic Biology	£4,884,695			£4,884,695
5	EP/G035954/1	Manchester Lancaster	Graphene	£4,100,353	£1,312,654	HEFCE	£5,413,007
5	EP/G036136/1	Edinburgh Heriot-Watt Strathclyde	High End Computing	£4,740,170	£290,000	SFC	£4,740,170
5	EP/G036101/1	Exeter Bath	Graphene	£4,247,464	£789,851	HEFCE	£5,037,314
Year 5				£17,972,681	2,392,505		20,075,186
Grand Total =				£103,252,137	£16,078,833		£119,330,971

GRANT DETAILS INCLUDING PROGRAMME TITLES AND RESEARCH ORGANISATIONS HOLDING S&I AWARDS, BY YEAR OF AWARD

Round 5 – December 2008

Edinburgh, Heriot-Watt and Strathclyde: Numerical Algorithms and Intelligent Software for the evolving HPC Platform

University of Exeter and University of Bath: Graphene: Fundamental Research and Applications in Nano-electronics, Photonics and Bio-Sciences

Imperial College London and London School of Economics: Centre for Synthetic Biology and Innovation at Imperial College

University of Manchester and Lancaster University: Centre for Innovation Through Materials Science, Chemistry and Engineering

Fourth Round – December 2007

University of Edinburgh and Heriot-Watt University: To establish a centre for Carbon Capture addressing some of the issues relating to fossil fuels.

Lancaster University, University of Nottingham, Cardiff University and University of Southampton: To establish The LANCS initiative in Foundational Operational Research.

University of Warwick: To create a centre for Analytical Science

Imperial College London: To create a world-leading, multidisciplinary, UK Structural Ceramics Centre to underpin research and development of these highly complex materials.

The University of Southampton: To develop a centre for advanced Tribology at the University of Southampton.

University of Cambridge: To develop a centre for investigating energy efficient cities

Third Round - December 2006

University of Oxford: To establish a forward-looking world-class research centre in the analysis of nonlinear partial differential equations

University of Edinburgh and Heriot-Watt University: To develop a centre for analysis and nonlinear partial differential equations

Cardiff University: To create the Centre for Integrated Renewable Energy Generation and Supply

University of Sheffield: To build a new centre of excellence, ChELSI, where chemical engineers work collaboratively with biologists at the life science interface

University of Strathclyde and the University of Glasgow: To catalyse and sustain a new dimension in the UK's research capability in physical organic chemistry

Universities of Cambridge and Oxford and Imperial College London: To create a new collaboration of complementary expertise in the area of quantum coherence

Universities of Birmingham and Nottingham: To establish the Midlands Ultracold Atom Research Centre

Second Round - March 2006

University of Warwick: To create a new centre of excellence in fusion plasma physics

Queen's University, Belfast: To complement and strengthen the current experimental activity in high- and low-temperature plasma physics with theoretical and computational expertise

University of Cambridge: To develop the Cambridge Statistics Initiative

University of Bristol: To develop SuSTaln - Statistics underpinning Science, Technology and Industry

University of Warwick: To set up the Centre for Discrete Mathematics and its Applications

Imperial College London and University College London: To develop new tools for nanoscale characterisation and metrology

University of Strathclyde and King's College London: To advance the emerging field of nanometrology, for applications in molecular science, medicine and manufacture

First Round - May 2005

Cardiff University: To develop a centre for physical organic chemistry

University of Glasgow: To establish an electronics design centre for heterogeneous systems

University of Nottingham: To establish DICE – Driving innovation in chemistry and chemical engineering research in the UK

University of Strathclyde: Integrated energy initiative – innovative power networks, demand/supply side integration and nuclear engineering

University of Warwick: To establish a centre for research in statistical methodology (CRISM)

TERMS OF REFERENCE AND MEMBERSHIP OF THE EVALUATION PANEL

A. The **terms of reference** for the Review Panel were to:

- Evaluate the EPSRC/ Funding Council's portfolio of Science and Innovation Awards with regard to the extent to which they have built and/or grown new UK research capability in the identified research areas supported by the S&I grant route;
- Evaluate the extent to which the 29 funded centres have made unique research advances in the field (consistent with the length of time each of the centres have operated) which would not have been possible without support from the awarded S&I grants, including case studies;
- Identify best practice in the attraction, recruitment and retention of new academic staff (star recruits) moving from overseas to UK research organisations for their career advancement;
- Make recommendations to EPSRC about how to commission new shortage areas, to build more effective UK research capability and to stimulate the development of leaders in its strategically important areas.

B. The Panel Membership was:

Professor Julia King CBE FREng, Aston University, Chair
Professor David Arrowsmith, Queen Mary, University of London
Dr Colin Harrison CBE, industrialist, Chemistry Innovation
Professor David Hogg, University of Leeds
Professor Kevin Lomas CEng, Loughborough University
Mr Martin Sadler, HP Systems
Mr Peter Saraga OBE, formerly Philips Research Laboratories UK
Dr Sarah Thompson, University of York
Professor P Rhodri Williams CEng, Swansea University

EVALUATION THEME DAY - LIST OF DELEGATES

TITLE	NAME	SURNAME	RESEARCH ORGANISATION
*Professor	David	Arrowsmith	Queen Mary, University of London
Dr	John	Aston	University of Warwick
Dr	Metete	Atature	University of Cambridge
Professor	Robin	Ball	University of Warwick
Professor Sir	John	Ball	University of Oxford
Professor	Bill	Barnes	University of Exeter
Professor	Simon	Bending	University of Exeter
Professor	David	Birch	University of Strathclyde
Dr	Pieter	Blue	University of Edinburgh
Professor	Kia	Bongs	University of Birmingham
Professor	Marco	Borghesi	Queen's University Belfast
Professor	Phil	Bowen	Cardiff University
Professor	Nigel	Brown	University of Edinburgh
Professor	Edmund	Burke	University of Nottingham
Dr	Niklass	Buurma	University of Cardiff
Professor	Barry	Carpenter	University of Cardiff
Professor	Sandra	Chapman	University of Warwick
Professor	Bo	Chen	University of Warwick
Dr	Yu	Chen	University of Strathclyde
Professor	Gui-Qiang	Chen	University of Oxford
Dr	Ruchi	Choudhary	University of Cambridge
Dr	Graeme	Cooke	University of Glasgow
Professor	Patrick	Corbett	Heriot-Watt University
Professor	David	Cumming	University of Glasgow
Dr	Neil	Curson	University College London
Professor	Artur	Czumaj	University of Warwick
Professor	Philip	Dawid	University of Cambridge
Professor Dame	Ann	Dowling	University of Cambridge
Dr	Timothy	Drysdale	University of Glasgow
Professor	Dugald	Duncan	Heriot-Watt University
*Dr	Paula	Duxbury	EPSRC
Dr	Ozgur	Ergul	University of Strathclyde
Professor	Vladimir	Falko	Lancaster University
Dr	Solveig	Felton	Imperial College London
Dr	Maria-Chiara	Ferrari	University of Edinburgh
Professor	Alastair	Florence	University of Strathclyde
Professor	Paul	Freemont	Imperial College London
Professor	Mark	Fromhold	University of Nottingham
Dr	Timo	Gans	Queen's University Belfast

Dr	Dirk	Gericke	University of Warwick
Dr	Finn	Giuliani	Imperial College London
Professor	Kevin	Glazebrook	Lancaster University
Professor	Duncan	Graham	University of Strathclyde
Professor	Bill	Graham	Queen's University Belfast
Professor	Peter	Green	University of Bristol
Professor	Jeff	Griffiths	Cardiff University
Dr	Irina	Grigorieva	University of Manchester
Professor	Mike	Gunn	University of Birmingham
Dr	Zoran	Habzibabic	University of Cambridge
Professor	Manu	Haddad	Cardiff University
Dr	Alex	Hagen-Zanker	University of Cambridge
*Dr	Colin	Harrison CBE	Consultant
Dr	Ernie	Hill	University of Manchester
Dr	Cyrus	Hirjibehedin	University College London
*Professor	David	Hogg	University of Leeds
Professor	Karen	Holford	Cardiff University
Dr	David	Horsell	University of Exeter
*Mr	Paul	Hubbard	HEFCE
Professor	Martin	Hyland	University of Cambridge
*Professor	Julia	King CBE	Aston University
Professor	Sam	Kingman	University of Nottingham
Professor	Richard	Kitney	Imperial College London
Professor	Peter	Knowles	University of Cardiff
Professor	Peter	Krüger	University of Nottingham
Professor	Bill	Lee	Imperial College London
Professor	Adam	Letchford	Lancaster University
Dr	Peter	Licence	University of Nottingham
Dr	Georges	Limbert	University of Southampton
*Professor	Kevin	Lomas	Loughborough University
Dr	David	Lucas	University of Oxford
Professor	Stefan	Maier	Imperial College London
Professor	Jon	Marangos	Imperial College London
Professor	John	Marsh	University of Glasgow
Professor	Steven	McArther	University of Strathclyde
Professor	David	McComb	Imperial College London
Professor	James	McDonald	University of Strathclyde
*Dr	Steve	Milsom	EPSRC
Professor	John	Murphy	University of Strathclyde
Dr	Vijay	Nagarajan	University of Edinburgh
Dr	Pawel	Naiwazas	University of Strathclyde
Professor	Guy	Nason	University of Bristol
Dr	Josselin	Noirel	University of Sheffield
*Ms	Dolly	Parkinson	EPSRC
Professor	Mike	Paterson	University of Warwick

Professor	John	Pickup	Kings College London
Professor	Martyn	Poliakoff	University of Nottingham
*Ms	Katarzyna	Rachuta	EPSRC
Dr	Fabio	Rigat	University of Warwick
Professor	Gareth	Roberts	University of Warwick
Professor	Nikolas	Rose	London School of Economics
*Mr	Martin	Sadler	Hewlett Packard plc
Professor	Eduardo	Saiz	Imperial College London
Dr	Richard	Samworth	University of Cambridge
*Professor	Peter	Saraga OBE	Consultant
Dr	Tania	Saxi	Kings College London
Dr	Simon	Shackley	University of Edinburgh
Professor	Mark	Smith	University of Warwick
Professor	Mark	Steel	University of Warwick
Professor	Endre	Süli	University of Oxford
*Dr	Lesley	Thompson	EPSRC
*Dr	Sarah	Thompson	University of York
Dr	Paul	Tuohy	University of Strathclyde
Dr	Tell	Tuttle	University of Strathclyde
Professor	Patrick	Unwin	University of Warwick
Dr	Aravind	Vijayaraghaven	University of Manchester
Professor	James	Vikers	University of Southampton
Dr	Emma	Waters	University of Oxford
Dr	Julian	Wharton	University of Southampton
Dr	Nick	Whiteley	University of Bristol
Dr	Steve	Wilkinson	University of Sheffield
*Professor	Rhodi	Williams	University of Wales Swansea
*Dr	Maggie	Wilson	EPSRC
Professor	Robert	Wood	University of Southampton
Professor	Phillip	Wright	University of Sheffield
Dr	Zheng-liang	Zhi	Kings College London

(* Denotes Evaluation Panel Members and EPSRC staff

APPENDIX TO S&I AWARDS REPORT

DATA FROM RESEARCH ORGANISATION PROGRESS REPORTS

A. STAFF IN POST BY RESEARCH ORGANISATION

Count of Recruited staff	Still in post?			
Institution	Yes	No	n/a	Total
Oxford	14	2	1	17
Warwick	10	4	1	15
Cardiff	12	1		13
Nottingham	12			12
Cambridge	5	4	2	11
Southampton	11			11
Strathclyde	7	1		8
Edinburgh	7	1		8
Edinburgh, Heriot-Watt & Strathclyde	8			8
Imperial	6	1		7
UCL & Imperial	5	1		6
Birmingham & Nottingham	6			6
Bristol	4	2		6
Exeter and Bath	6			6
Glasgow	3	2		5
Manchester	5			5
Heriot-Watt	3	1	1	5
Sheffield	3	1		4
Strathclyde & Glasgow	3			3
Lancaster	3			3
Queen's Belfast	3			3
Total numbers	136	21	5	162
Total percent	84%	13%	3%	100%

B. STAFF IN POST BY RESEARCH ORGANISATION AND PREVIOUS EMPLOYMENT LOCATION

Count of Recruited staff	Previous Location					
Institution	UK	USA	EU	n/a	Other	Total
Warwick	6	4	3	1	1	15
Glasgow	4				1	5
Strathclyde	7	1				8
Cambridge	6	3	1		1	11
UCL & Imperial	2	3			1	6
Nottingham	9		2		1	12
Oxford	3	5	5	2	2	17
Strathclyde & Glasgow	1		2			3
Sheffield	4					4
Cardiff	8	2	1		2	13
Imperial	2	3	2			7
Lancaster	1				2	3
Southampton	6	2			3	11
Manchester	2	1	2			5
Heriot-Watt	3	1	1			5
Edinburgh, Heriot-Watt & Strathclyde	4	1	3			8
Edinburgh	4	2	1		1	8
Queen's Belfast			3			3
Birmingham & Nottingham	1	1	4			6
Bristol	3	3				6
Exeter and Bath	3	1	1		1	6
Total	79	33	31	3	16	162

C. STAFF RETENTION BY PREVIOUS EMPLOYMENT LOCATION

Count of Recruited Staff	Previous Location					
Still in Post?	UK	USA	EU	Other	n/a	Total
Yes	69	27	26	14		136
No	8	5	5	2	1	21
n/a	2	1			2	5
Total	79	33	31	16	3	162

n/a = not yet appointed

% of Recruited Staff	Previous Location					
Still in Post?	UK	USA	EU	Other	n/a	Total
Yes	87%	82%	84%	88%		84%
No	10%	15%	16%	13%	33%	13%
n/a	3%	3%			67%	3%
Total	100%	100%	100%	100%	100%	100%

n/a = not yet appointed

D. DISCIPLINARY TOPIC OF AWARD BY PREVIOUS EMPLOYMENT LOCATION

Count of Recruited Staff	Previous Location					
Broad Subject Area	UK	USA	EU	Other	n/a	Total
Chemistry	14	4	5			23
Energy	16	2		1		19
Engineering	17	6	6	4		33
Mathematical Sciences	22	15	9	8	2	56
Physics	10	6	11	3	1	31
Total	79	33	31	16	3	162

% of Recruited Staff	Previous Location					
Broad Subject Area	UK	USA	EU	Other	n/a	Total
Chemistry	61%	17%	22%			100%
Energy	84%	11%		5%		100%
Engineering	52%	18%	18%	12%		100%
Mathematical Sciences	39%	27%	16%	14%	4%	100%
Physics	32%	19%	35%	10%	4%	100%
Total	49%	20%	19%	10%	2%	100%

E. STAFF RETENTION BY DISCIPLINARY TOPIC OF AWARD OVERALL

Count of Recruited Staff	Still in Post?			
Broad Subject Area	Yes	No	n/a	Total
Chemistry	22	1		23
Energy	15	2	2	19
Engineering	30	3		33
Mathematical Sciences	41	13	2	56
Physics	28	2	1	31
Total	136	21	5	162

% of Recruited Staff	Still in Post?			
Broad Subject Area	Yes	No	n/a	Total
Chemistry	96%	4%		100%
Energy	79%	11%	11%	100%
Engineering	91%	9%		100%
Mathematical Sciences	73%	23%	4%	100%
Physics	90%	6%	3%	100%
Total	84%	13%	3%	100%

F. STAFF RETENTION BY TOPIC AND BY PREVIOUS EMPLOYMENT LOCATION

Count of Recruited Staff	Still in Post?			
Broad Subject Area and Previous Location	Yes	No	n/a	Total
Chemistry				
UK	13	1		14
USA	4			4
EU	5			5
Energy				
UK	13	2	1	16
USA	1		1	2
Other	1			1
Engineering				
UK	16	1		17
USA	5	1		6
EU	6			6
Other	3	1		4
Mathematical Sciences				
UK	18	3	1	22
USA	11	4		15
EU	5	4		9
Other	7	1		8
n/a		1	1	2
Physics				
UK	9	1		10
USA	6			6
EU	10	1		11
Other	3			3
n/a			1	1
Total	136	21	5	162

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