

Enterprise & Business Committee Scrutiny Session – Science, Research and Horizon 2020 Welsh Government

Purpose

To provide the Enterprise and Business Committee with evidence relating to its planned scrutiny session on Wednesday 25 November 2015 with Professor Julie Williams, the Chief Scientific Adviser for Wales (CSAW).

Science for Wales Annual Progress

Progress with the overall strategy is positive. The Innovation section of the strategy was effectively completed by the production of a separate Innovation plan with its own oversight. There have been major developments in the world of STEM education and the Welsh Government's contribution to improving Wales' research capacity is all in place or coming into place over the next year or so. An annual report has been published on the Science pages of the Welsh Government website for each year of the Strategy.

Sêr Cymru

Research Chairs – Sêr Cymru I

The four 'star' Research Chairs are in different stages of development with their research programmes and research teams. Professor Barde (Life Sciences at Cardiff University) and Professor Durrant (Materials science for renewable energy applications at Swansea University) are the most developed while the third, Professor Barron (Energy systems resilience) is still completing his transition from Rice University, Houston, Texas, to Swansea University now that their Science and Innovation Campus research facilities are ready for use. The most recent Research Chair appointment (awarded in the summer of 2015), Professor Diana Huffaker, has started her transition to Cardiff University from UCLA, California and will take up full time residency in January 2016 working on compound semiconductors. Already, she is preparing plans for spin-out commercial activity in Wales, based on research already completed.

National Research Networks – Sêr Cymru I

These have all been set up and are now at a critical point in their development after approximately two years of operation. In all three networks there are many areas where their research is excellent and achieving international recognition We are working with the networks to build strength around these areas. They have committed most of the monetary resources and now the focus needs to shift to the generation of significant external research income (EU/Research Council/Industry).

We are closely monitoring the Life Sciences Network (led by Cardiff University), and the Advanced Engineering and Materials Network (led by Swansea University) since there are sickness and resignation issues (through moving to other posts) among the senior management of both. Professor Bonet, Director for the Advanced Materials and Engineering Network is moving to become a Deputy Vice-Chancellor in London. The third Network, Low Carbon, Energy and Environment (led by Bangor University) has the most robust leadership. We are engaging positively with all networks, highlighting areas of success and working closely where development is needed.

The three Networks have made good progress with the recruitment of Ph.D. research studentships and appointment of Post-doctoral Research Associate posts (PDRAs) and Research Fellow posts. Collectively, they have appointed 74 Ph.D. studentships and 67 Fellows and PDRAs. Although there are a small number more to appoint, the main emphasis now for the three Networks is the move towards delivery of their research strategies and building the collaborative research activities within the Networks which will enable them to deliver their research outputs and targets.

Research income reported to date for all 3 networks currently stands at approximately £22 million with 3 years left to run. The networks are increasingly providing a source of expert information and access to leading researchers for policy officials, scientific advice has been provided to the WG on fisheries, marine renewable energy and genetic research.

Rationale for Sêr Cymru II

In February 2015 the Leadership Foundation for Higher Education produced 'The Case for Growing STEM Research Capacity in Wales' by Professor Peter Halligan and Dr Louise Bright. This shows universities in Wales winning a smaller proportion of UK research funding than Wales' share of the population would suggest, for many years past. Successive attempts to strengthen research, made since the 1990s, have seen the proportion stay stubbornly low. They note this is particularly in the science, technology, engineering, mathematics and medicine (STEMM) disciplines. Achieving this elusive increase they attribute to Wales' historic shortfall in STEMM research capacity.

Analysing Higher Education Statistics Agency data they showed our universities have 4.1 per cent of total UK academic staff in the STEMM disciplines, compared to Wales' 4.8 per cent share of the UK population. We need 646 more researchers to be at Wales' population equivalent share of UK STEMM researchers. Scotland has 12.3 per cent of total UK academic staff in the STEMM disciplines for only 8.3 per cent of UK population. They showed the largest staff deficits in Wales' HEIs were noted in clinical medicine; biosciences; physics; electrical and computer engineering; mechanical, aero and production engineering, and maths, which happen to be largely disciplines covered by the highest-spending UK research councils – the MRC and EPSRC. Their report welcomed our Sêr Cymru I investment into Wales' research capacity but said more was needed for critical mass - 621 Full-time equivalent researchers in STEMM-related researchers (96 per cent of their identified shortfall). If these were in post we could expect to see Wales competitively-awarded grant capture rising significantly. They do also point out that over-emphasising our universities not capturing a notional 5 per cent of UK research funding does mislead. Wales' true research performance, in many respects, is very strong.

Sêr Cymru II

Responding to this evidence of the need for yet more effort to boost research capacity, the Welsh Government designed a series of elements, collectively called Sêr Cymru II, to be its contribution to bridging this gap. Each element is reported on separately here:

[EU Marie Skłodowska Curie Actions COFUND Research Fellowships \(Horizon2020 & match-funding\)](#)

These Research Fellowships are aimed at stellar candidates, typically three to five years on from their PhD coming from anywhere - outside the UK - to work in Wales. We aim to support approximately 90 fellowships of approximately three years each in duration. The total value of this grant is €24.1 million (with €9.5 million coming from the European

Commission). The official start date for this programme was 1 September 2015 and it was launched by the Minister for Economy Science and Transport in the Senedd on 9 September 2015. The first call went live on 7 October 2015 with the first deadline for applications on 1 March 2016.

Sêr Cymru II Fellowships

The Chief Scientific Adviser's Division had prepared a business case, very recently agreed by WEFO, for Structural Funds support for the rest of the Sêr Cymru II programme, described below. This proposal has been described as a 'backbone' project for WEFO, with a total value of £39 million (of which £23 million is from Structural Funds). A launch event took place in Brussels only on 17 November. The elements of the programme are:

- 'Rising Star' fellowships (ERDF & match-funding)

'Rising Star' fellowships will be very prestigious and highly competitive positions, designed to attract the very best 'rising stars' of academic research. The plan is for approximately 26 five-year rising star fellowship packages each funded at £0.2 million per annum to be awarded.

- 'Welsh Fellowships' scheme (ERDF & match funding)

These research fellowships will be aimed, like COFUND, at stellar candidates, typically three to five years on from their PhD coming from anywhere in the world - including the UK - to work in Wales. We aim to support about 30 fellowships of approximately three years in duration.

- Recapturing Research Talent (ERDF & match funding)

This strand is designed to provide support for researchers returning to work following a career break. The programme will support in the region of 12 fellows. We know that there is a 'brain-drain' of researchers, many of them women, who take career breaks for childcare or otherwise and find it difficult to break back into active research careers. We need to recapture that talent.

- Welsh Strategic Awards for Capital Equipment (Welsh Government funding only)

In April 2015, Universities in Wales were invited to bid for capital funding to purchase equipment for research in the academic disciplines of STEMM (Science, Technology, Engineering, Mathematics and Medicine). Applications could be made for single pieces of equipment and/or multiple smaller items with a coherent plan for use, but the total request for funding had to be between £50K and £500K. The total fund available was £1.7 million. 42 applications were received for a total value of £7.78 million. They were reviewed by our newly appointed Independent Evaluation Panel (see below). We were able to fund 7 proposals, with six awards made to a variety of researchers and research groups in Cardiff University and 1 to Swansea University, with another award pending.

The Research Excellence Framework 2014

Through the objective audit exercise of REF, our universities have demonstrated the real quality of much of their research and the equally pleasing 'impact' that we have seen from a wide range of departments. This impact (a new measure) shows how research helps the economy; society and culture in Wales in many ways. Approaching 50 per cent of our impact case studies were judged as of the highest quality level (4★) and 86 per cent was judged to be in the top two quality levels (4★ and 3★ combined). The outcome for Wales' leading research-intensive universities was very pleasing. Wales' results for

Wales' confirmed the positive findings which we saw in Elsevier's 'International Comparative Performance of the Welsh Research Base 2013' report, which the Welsh Government commissioned with Universities Wales and HEFCW. REF provides more useful and encouraging evidence.

The proportion of world-leading quality research (4★) in Wales more than doubled since RAE in 2008 and the proportion of 3★ also increased considerably, as shown in this summary table from the latest Annual report on *Science for Wales*.

	4★	3★	2★	1★	Unclassified
Wales 2014	30%	47%	20%	3%	0%
UK 2014	30%	46%	20%	3%	1%
Wales 2008	14%	35%	36%	14%	1%
UK 2008	17%	37%	33%	11%	1%

Table2: REF(2014) & RAE (2008) quality profiles, Wales & UK comparison (p. 9)

Particularly pleasing was the strength shown in STEM subjects, given the importance of these to our economy and civil society. Another table drawn from this year's Annual Report on *Science for Wales* shows this strength in science and related units of assessment (here showing 'top ten' rankings UK-wide). Ranking the institutions on the basis of their grade point average or GPA – here using the THES rankings, for the research quality profiles showed Cardiff University as sixth and Swansea University 26th in the UK.

UK Ranking	Unit of Assessment	University
1	Civil & construction engineering	Cardiff
2	Allied health professions, dentistry, nursing & pharmacy	Swansea
2	Psychology, psychiatry and neuroscience	Cardiff
3	Sociology	Cardiff
=4	Allied health professions, dentistry, nursing & pharmacy	Cardiff
=5	Education	Cardiff
6	Physics	Cardiff
=7	General engineering	Cardiff
=7	Sports & exercise sciences, leisure & tourism	Cardiff Met. & Bangor
8	Clinical medicine	Cardiff
8	Earth systems and environmental sciences	Swansea
9	Chemistry	Cardiff

Table 4: UK GPA ranking in REF research outputs by unit of assessment. (p. 10)

Importantly for the economic and social benefits enjoyed by Wales from research submitted, a number of the units of assessment (i.e. areas of research) were scored very highly across the UK, as set out in this table:

Impact in Wales: 49% rated 4*; 86% 3 or 4* (above UK average)

UK Ranking	Category	Universities
1	Psychology, psychiatry & neuroscience	Swansea joint 1 st
1	Civil & construction engineering	Cardiff 1 st
1	General engineering	Cardiff joint 1 st
1	Architecture, built environment & planning	Cardiff joint 1 st
2	Allied health professions	Cardiff
2	Sociology	Cardiff
2	Modern languages and linguistics	Bangor
4	Chemistry	Cardiff joint 4 th
5	Physics	Cardiff
5	Sport & exercise science, Leisure & tourism	Swansea
6	Psychology, psychiatry & neuroscience	Cardiff
6	Agriculture, veterinary & food science	Aberystwyth / Bangor joint submission
6	Sport & exercise sciences, leisure & tourism	Cardiff Met./ Bangor joint submission
7	Clinical medicine	Cardiff
7	General engineering	Swansea
8	Biological sciences	Cardiff
8	Geography, environmental studies & archaeology	Swansea
9	Biological sciences	Bangor joint 9 th
9	Geography, environmental studies & archaeology	Aberystwyth
9	Education	Cardiff

STEM Engagement & Education

The National Science Academy

In July 2015 the NSA had completed a strategic review of its previous two rounds of funding and, informed by this, a short Strategy for its future activities in STEM Enrichment through to 2018 was published with it, in time to be used by applicants for its current grant round which is nearing completion. This says that NSA will:

- favour projects proposed for funding which target children aged 7-14 and their parents/guardians (the ages when they are considering and deciding whether to study science subjects, with parents and guardians forming a very significant influence on such choice).
- favour projects breaking down barriers to studying STEM subjects, especially subjects where girls are underrepresented.
- provide long-term stability/certainty for programmes seen to be performing best to maximise continued delivery.

In parallel to the latest funding applications, and in keeping with its strategy, NSA has already funded these proven high-performing programmes, with £1.1 million of funding:

- a) Bangor University -GCSE & AS Science Revision
- b) BSA - CREST for Wales, for all
- c) Cardiff University - Universe in the Classroom 2.0
- d) Institute of Physics – ‘Lab in a Lorry Cymru’ 2015-2017
- e) RSC – SIAS
- f) National Eisteddfod -STEM Activities
- g) Science Made Simple - AstroCymru 2015-2018
- h) Swansea University -Technocamps:Playground Computing, Technoteach
- i) Engineering Education Scheme Wales (EESW)
- j) See Science Ltd – Science Enrichment Experiment (See)

The call for applicants was, unsurprisingly, very heavily oversubscribed with 55 bids received seeking £6.8 million total funding. From these, after a rigorous selection process, with independent expert review, nine have been identified as fit for funding.

In March 2014, NSA held a STEM engagement stakeholder event. This proved very useful and popular, allowing a very diverse sector, who are, often one in competition with each other, to meet to discuss matters of mutual concern. The NSA is happy to provide this forum for discussion.

The NSA’s Hub model has been broadened to include this wider stakeholder community. The Hub organisations continue to engage in discussion of STEM engagement in Wales through events such as this, which is appreciated, given their status as some of the larger providers of this engagement in Wales.

STEM in Education Group

As CSAW, I chair the STEM in Education Group, an internal vehicle for collaboration and information sharing with Education and Economy, Science and Transport officials: on curriculum, qualifications, teacher professional development, careers, schools marketing and NSA, meeting quarterly. Now it is the formal internal overseer of the STEM Education Delivery Plan whose publication is imminent. It also receives updates on the ongoing *Qualified for Life: Focus on Science* engagement campaign for teachers, pupils and their parents/guardians, which is Education-led.

The Committee had sight of the draft STEM in Education Delivery Plan in the spring, and that is now being updated to reflect developments with the NSA strategy and how we are taking *Successful Futures* forward. On 22 October the Minister for Education and Skills launched *A Curriculum for Wales, a curriculum for life*, the plan for taking forward Professor Donaldson’s recommendations. Since then work has moved swiftly, with the announcement of the first tranche of Pioneer Schools for the New Deal for the education workforce, and curriculum design and development. STEM enrichment activities are essential in helping bring STEM alive for young people. However, the strength of the curriculum and teacher support arrangements is critical to ensuring the flow of future STEM skills. I am encouraged by these developments, and will be following this work closely over the coming years.

I am also encouraged that the Minister for Education and Skills was able to agree to extend the Institute of Physics (IoP) and Techniquet’s pilot programme earlier this year from 12 to up to 50 schools. From this September, secondary schools across Wales are benefitting from teacher mentoring through the IoP’s successful Stimulating Physics Network programme, alongside girls in those schools accessing specific enrichment activity to encourage their progression to A-level physics. It is early days, but initial

signs are positive, and I will be looking for increased girls progression in physics as this work moves forward.

Women in Science Report

Earlier in the year I set up a group, led by two of our Pro Vice-Chancellors - Professors Karen Holford of Cardiff University and Hilary Lappin-Scott of Swansea University. It has been looking at the role of women in science, technology, engineering and maths or STEM based careers in Wales. It will recommend steps to help recruitment, retention and promotion of women in these fields – vital to the economy of Wales. Publication of this report is expected in January 2016.

Skills Policy, including Higher Level Skills

The Welsh Government published its Policy Statement on Skills in January 2014. There is a strong alignment between the Policy Statement on Skills and the development of STEM skills in Wales. This is most notably in terms of the focus on raising overall skills levels and developing higher levels of skills, the approach to regional skills delivery, and the recognition that employers and government must co-invest in the skills of the workforce.

In developing its skills policy the Welsh Government has appreciated the changing demand for skills in Wales, particularly the need for higher level skills, given the profile of future jobs. Qualification levels in Wales increased in 2014, continuing the general increase in previous years. 58 per cent of working age adults in Wales were qualified to the level 3 threshold compared with 56 per cent in 2013. The proportion holding degree-level qualifications (NQF levels 4 or above) was 36 per cent compared with 33 per cent in 2013.

We also support the work of the Regional Skills Partnerships (RSPs) in linking skills provision to the needs of the labour markets across the three regions: North, South West and Central, and South East. The work with Regional Skills Partnerships will potentially enhance and exploit the demand for STEM skills amongst employers. It will enable close working with those sectors in Wales with a high demand for STEM subject areas. Positively, the RSPs are considering the regional skills requirements from major infrastructure and investment projects, such as the Swansea Tidal Lagoon, a number of which have a strong foundation in STEM subject areas.

The Welsh Government's Framework for Co-investment in Skills provides added weight to the development of STEM skills in Wales. This is specifically in terms of the commitment to support and prioritise Higher Apprenticeships, given that a number of STEM subject areas are associated with this form of vocational learning. The engagement in Higher Apprenticeships continues to improve with 5,355 unique learners undertaking Higher Apprenticeships in 2013/14, compared to 2,720 in 2012/13, and this is consistent with apprenticeship delivery as a whole.

EU Funding in support of building research capacity – especially Horizon 2020

It is early to try and attribute improvement in Wales' research performance to elements of the Sêr Cymru programme. Figures for Sêr Cymru I elements are reported above but Sêr Cymru II has only just started to move. Horizon 2020 is administered centrally by the EU and we would be pleased to see more activity from Welsh HEIs taking active steps to access more of this funding themselves, perhaps using Welsh Government funding already provided under Sêr Cymru or ERDF funding from WEFO.

Our success in gaining Marie Skłodowska Curie COFUND funding for SIRCIW ('Strengthening International Research Capacity in Wales') is very positive – we were successful against really stiff competition from right across Europe. It is worth noting that other successful applicants included CERN in Geneva and the UK's Science and Technology Facilities Council for work at its prestigious campuses, such as Daresbury and Harwell. We are hopeful that negotiations with WEFO will see us able to deliver a lot more Fellowship activity across Wales but the procedures we have to go through are not quite completed at the time of writing.

It should be emphasised that gaining the COFUND award, which was secured by staff in my team, was a considerable achievement. The prospective figures for the programme are reported above. We are not presently considering further applications as the chance of winning further funding, on top of this major sum, is slim. We will continue to monitor the situation and remain alert to opportunities but feel, presently, that we have already secured a lot and need to make the smooth delivery of the programme in Wales our priority now. COFUND sits alongside a prospective ERDF funding bid from WEFO – an effective use of complementary funding sources to deliver the differing elements of a cohesive programme to drive up research capacity in Wales. The EU are interested in this alignment of funding sources to achieve larger programmes with requests to use Welsh examples of best practice already made.

I understand that there were ultimately no awards to Welsh Universities in gaining FP7 European Research Council Chairs, despite at least two very strong bids which came close to being successful.

Two of our National Research Networks work in the research fields of low carbon, energy and environment and advanced engineering and materials. Both have research interests in the maritime sphere and will continue to be supportive of existing economic activity, in fields such as tidal energy.

Horizon 2020

While early in the programme period, so we cannot confirm statistical trends, it is clear that Horizon 2020 is more competitive than its predecessor FP7 - many programme areas are heavily oversubscribed. Against this, Welsh organisations' performance has been encouraging in many areas. Data, from 17.7.2015, shows 44 Welsh participants were selected for funding, involving EU funds of €17.6 million. This doesn't reflect recent successes such as COFUND. Welsh businesses have made several successful bids. These will be announced in the Autumn.

Higher Education continues to perform well. Cardiff University won funding of some €15.8m. There is an increased focus on innovation in Horizon 2020, compared to FP7 - a new challenges for the sector. The Welsh Government seeks to help them address this challenge.

CM International did a Horizon 2020 Scoping Study, examining how best to support Welsh organisations to access the funding. It endorsed the Welsh Government's Horizon 2020 Unit approach, of working closely with key stakeholders in Wales, the UK and Europe to co-ordinate and facilitate actions to maximise the Horizon 2020 opportunities for Welsh organisations. The unit is taking study recommendations forward under five key objectives. Notable progress has already been made.

Research for the study looked at comparator regions and countries: Catalonia (Spain) Skåne (Sweden) and Ireland, Scotland and Northern Ireland. The Horizon 2020 Unit regularly shares best practice with similar units in Ireland, Scotland and Northern Ireland and works with the Welsh Government's and Welsh Higher Education's Brussels office. The unit's work with stakeholders is focussing

The Unit is impacting on stakeholders in Wales' approach to Horizon 2020. Integrated investments, targeted support and common objectives with stakeholders will give a long term sustainable increase in Welsh organisations winning Horizon 2020 funds.

The work of the EU Ambassadors is also helping to build the networks needed to maximise the opportunities for Welsh organisations looking to access Horizon 2020. As Chief Scientific Adviser for Wales I have recently engaged with the EU Ambassador for Horizon 2020, Interreg and R&D funds (Dr Grahame Guilford).

A number of capacity building investments have already been made, including the £35 million (including £20 million of European Regional Development Fund (ERDF) support) for the Aberystwyth Innovation and Enterprise Campus and the £44 million (including £4.5 million ERDF) for the Cardiff University Brain Research Imaging Centre.

With the three SMART schemes (SMART Innovation, SMART Cymru and SMART Expertise) we have put in place an integrated suite of interventions that will drive the innovative behaviour we need in Wales in order to access funding such as Horizon 2020

You have heard from the Minister for Finance and Government Business recently on the potential Welsh uses there could be for monies from the European Fund for Structural Investment and European Investment Bank. I would echo her evidence – Swansea University has already used EIB funding for its ambitious second campus development and I am sure there are other investments which our Universities could consider making, backed by these funds.