Agenda Supplement – Economy, Infrastructure and Skills Committee

Meeting Venue:
Committee Room 1 – Senedd
Meeting date: 13 October 2016
Meeting time: 09.30

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Please note the documents below are in addition to those published in the main Agenda and Reports pack for this Meeting

– Revised paper

3 Chief Scientific Adviser for Wales – Scrutiny session

(11:00 – 12:00) (Pages 1 – 6)

Professor Julie Williams, Chief Scientific Adviser for Wales

Attached Documents:
Research brief
EIS(5)-06-16 (p1) Chief Scientific Adviser for Wales
EIS(5)-06-16 (p1) Chief Scientific Adviser for Wales – Revised paper (Amended figures in para 3)

PAPER FOR THE ECONOMY, INFRASTRUCTURE AND SKILLS COMMITTEE

Since publication of *Science for Wales* in March 2012, Welsh Government policy has focused on boosting research capacity in Wales' universities, especially research in science, technology, engineering, maths (and medicine) or STEM(M) subjects. Wales has not won its population share of UK competitively-awarded research funding for several decades. There is substantial evidence that a strong research base underpins a thriving economy, supports better health and social care and showcases Wales as a modern, vibrant, innovative nation - so steps to strengthen our research are important.

'Sêr Cymru', our initial plan to expand Wales' research strength, runs from early 2013 to the end of financial year 2017-18. Four world-class academics now hold Sêr Cymru Research Chairs and have brought together many significant industrial and international research collaborations. All three research networks - Life Sciences; Advanced Engineering & Materials and Low Carbon, Energy & Environment are more than halfway through their period of support, with almost all of the funding now allocated to research programmes. Within these three, targeted scientific research is being funded for over 140 PhD students and over 150 Postdoctoral Researchers & Fellowships. On 15 September 2016 the networks held their inaugural postgraduate conference on the new Swansea University Bay Campus, most of their students taking part.

Collectively, the Sêr Cymru scheme has already brought £37 million of competitively-won and verified research funding into Wales, for £16 million of Welsh Government spend, (including financial contribution from HEFCW). This is equivalent to £1 of Welsh Government investment into the Sêr Cymru scheme having brought in over £2.30 of extra research investment to Wales.

Because 2015 commissioned research and the 2014 Research Excellence Framework (REF) produced evidence that the main issue for Welsh higher education was a long-standing lack of research capacity, especially in STEMM subjects, a second phase of Sêr Cymru was established. This is now helping to fill this 'gap' with high quality researchers; expand successful research teams and build the successful research teams of the future. Welsh Government, with business and higher education partners, won one of the largest grants yet from the EU's Horizon 2020 Marie Skłodowska-Curie COFUND scheme – some €9.5 million (close to €24.1 million with match-funding). Welsh Government-led partners also secured £23 million ERDF funding from WEFO Structural Funds for the remaining Sêr Cymru 2 programme (£39 million with match funding).

Vetted in all cases by a dedicated independent panel, **Sêr Cymru 2** has four strands:

★ COFUND and ERDF funded research fellowships – some 120 fellowships (90 COFUND and 30 ERDF) for candidates of truly exceptional quality. Typically three to five years on from their PhD, they can come to work in Welsh Universities, funded for three years.

★ Recapturing Research Talent – a strand supporting up to 12 researchers returning to work following a career break.

★ Rising Star Fellowships and Research Chairs – prestigious and highly competitive awards to attract the very best future 'stars' of academic research.

★ Welsh Strategic Awards for Capital Equipment – a one-off call against £1.7 million of Welsh Government capital funding that supported 9 bids for research equipment in STEM academic disciplines, assessed and awarded in mid to late 2015.

The first round of Sêr Cymru 2 ultimately received 64 applications. Most of these have been put forward for funding to commence in the autumn of 2016. Letters have been issued to a number of the successful applicants and we await their acceptance. Pleasingly,

the next round of applications, closing on 4 October 2016, has also experienced high levels of interest and applications.

The COFUND element of Sêr Cymru 2 will end in August 2020. Remaining fellowships (partly funded by EU Structural funds) will end in 2022. Assurances have been received that the UK Treasury will underwrite the payments of such awards, even when specific projects continue beyond the UK's departure from the EU.

Erasmus+ is a consolidated EU programme more designed to modernise education, training, youth work and sport across Europe. It is not research-focused and so of lesser focus for me but I understand that students with a funding offer will have it honoured and there are already ways for non-EU students to participate in Erasmus which we might access in future.

A potentially important element for boosting research capacity and exploiting research outcomes are two **Catapult Centres** (world-leading centres designed to transform the UK's capacity to innovate in specific areas and drive economic growth). Innovate UK has awarded a regional centre of excellence in Precision Medicine, to be based in Cardiff and Swansea. The UK Government also recently announced a Compound Semi-conductor Catapult, where Wales will lead. Putting these in place is in the early stages at present.

The UK Government's 2015 White Paper 'Fulfilling Our Potential: Teaching Excellence, Social Mobility and Student Choice', now embodied in the current Higher Education and Research Bill, required us to respond to radical proposals to change the mechanisms used for allocating competitively-awarded research funding. The current dual-funding system for research in HEIs will continue but Quality-related Research or QR would go to a new single body (Research and Innovation UK) with all of the UK Research Councils' and Innovate UK's funding. There is a risk of blurring QR for England and wider-UK research council monies. With our Hazelkorn Review proposing a new Tertiary Education Authority in Wales and the Stern review of REF (used to allocate Quality-related Research or QR funding) suggesting adjustments to the system used in 2014, we must defend our interests and formulate a mechanism to target funding most effectively to support and deliver research outcomes in our Universities.

The Chief Scientific Adviser's Division has undertaken a study of research capacity deployable to support our steel industry. We are considering further support, once a final decision is made on the ownership and future of the steel industry, particularly at Port Talbot and other plants in South Wales.

As part the of the Welsh Government's **Wylfa Newydd** Nuclear Programme, we are considering seeking the creation of a UK National Research facility in North Wales, as a major legacy activity of the Programme. Discussions are being held between Welsh Government officials and the UK Government's Department of Business, Energy and Industrial Strategy (BEIS). A funding call for scoping research in this area is expected soon. It is likely that Bangor University, in collaboration with Imperial College London, will make a bid. If successful, this should lead to a major UK nuclear research facility being sited on Anglesey.

STEM Education

I chair the STEM in Education working group within Welsh Government, which oversees the implementation of the '**STEM in Education and Training Delivery Plan**' with quarterly meetings ensuring substantial progress is being made in key areas. As signalled in the plan, Ministers will make available a formal update on progress on the development of STEM skills in the spring.

One of the key building blocks within the STEM plan is the development of an engaging and inspirational STEM curriculum, fit for the 21st century. The new *Curriculum for Wales* will play a crucial part in improving education in Wales, following an independent Review of Curriculum and Assessment arrangements by Professor Graham Donaldson. Details can be found in his report 'Successful Futures'.

The four purposes, as articulated in 'Successful Futures', will be at the heart of the design of the new curriculum and expresses what children and young people should become and achieve, through their school education. The four purposes state that children should become:-

- Ambitious, capable learners, ready to learn throughout their lives;
- Enterprising, creative contributors, ready to play a full part in life and work;
- Ethical, informed citizens of Wales and the world; and
- Healthy, confident individuals, ready to lead fulfilling lives as valued members of society.

The design of the **new curriculum** is being taken forward by a network of Pioneer Schools working together as a national network to co-design, consult, inform, support and build capacity in schools across Wales. They do this by working as an all-Wales partnership including Welsh Government, Estyn, Higher Education, business and other key partners. During the development process there will be opportunities for the Pioneer Schools to consider the content and structure of the six Areas of Learning Experience (AoLEs), including Science and Technology, Mathematics and Numeracy. It is the Welsh Government's ambition that the new curriculum will be available from September 2018 and will be used to support learning and teaching in schools from September 2021.

From September this year, the professional learning, digital and curriculum pioneer strands will merge to establish a single national network of Pioneer Schools, to start to develop the context across Wales and so ensure the new curriculum will thrive. As set out in the STEM plan, Welsh Government is also discussing with key organisations, such as the learned societies and Association for Science Education, how they can best support this fundamental reform process.

The **Digital Competence Framework** (DCF) was made available to schools and settings in Wales on 1 September 2016. Initially, schools and settings are encouraged to familiarise themselves with it and plan for its adoption, with the rest of the new curriculum. The DCF is a cross-curricular framework and so will influence the teaching of STEM subjects. The DCF includes classroom task ideas for teachers and practitioners and these will be added to and refined over time. A national Professional Learning Offer to support practitioners in implementing the framework will be developed in collaboration with the Pioneer Schools Network for 2017. Teaching resources are also being developed.

A significant work strand for the professional learning pioneers will focus on designing, developing and delivering a **national professional learning offe**r in partnership with regional consortia specifically linked to Career Development Pathway milestones. Immediate fast track work strands include shaping the new Professional Teaching Standards, supporting the implementation of the Digital Competence Framework, and further support for the development of mathematics teaching and learning - taking forward actions set out in the Mathematics Task and Finish Group report of December 2015. I understand the Cabinet Secretary for Education will be making further announcements on the development of professional learning support for education practitioners shortly. In addition, the Education Workforce Council (EWC) has made available the Learning Exchange as a subject specific continuous personal development information portal for STEM teachers, learning support assistants, school technicians and teachers in further

education. This is now live on the EWC's website, so practitioners can better access the STEM support.

With regard to **STEM qualifications** in schools, a suite of new science GCSEs has now been introduced for first teaching in schools from this September. This follows two new mathematics GCSEs introduced in 2015, to be first assessed later this year. The introduction of new GCSEs in schools and colleges is being supported through £3.25m of Welsh Government funding to Consortia this financial year. Other STEM-related qualifications are being revised by Qualifications Wales, the independent regulator.

In line with the STEM in Education Delivery Plan (STEM plan) the Government continues to take forward actions and deliver key messages, including the **importance of girls studying STEM subjects**, through its *Focus on Science* campaign. I am keen to develop closer working with and between STEM providers such as Techniquest and Techniquest Glyndŵr, STEMNET, EESW, Technocamps, the science learned societies and many others, with renewed emphasis on the importance of STEM study, progression and careers for girls. The STEM Ambassadors network is growing in Wales. They already provide a body of real life role models for girls in STEM. As a further example, Government continues to fund the Institute of Physics to deliver the Stimulating Physics Network programme of non-specialist physics teacher mentoring to address the issue of girls' progression and up-skill our teaching workforce in this key STEM subject.

STEM engagement

Support for **STEM engagement** activities, to encourage and inspire young people about science, technology, engineering and mathematics (complementing the formal school curriculum) is encouraged by our **National Science Academy** (NSA). Its 2015 strategic review identified three strategic priorities:

- favouring projects proposed for funding which target children aged 7-14 and their parents/guardians,
- breaking down barriers to studying STEM subjects, especially subjects where girls are underrepresented,
- provide long-term stability/certainty for programmes seen to be preforming best to maximise continued delivery.

Using these, after an open competitive grant call and external expert assessment, NSA has a portfolio of some 20 projects including some strategic projects outside the competitive grant call (often prior successful ones). Projected figures to March 2018, should achieve 870 STEM enrichment events for over 186,000 pupils/students and 462 CPD (continuous professional development) events for over 2,800 teachers. With recent support for the British Science Festival and Swansea Science Festival and brokering a second event for STEM engagement providers in Wales, NSA has committed 75 per cent of its budget of £2.2m over the 3 years to March 2018.

On Friday 9 September the NSA arranged a second successful workshop for a wide range of STEM engagement providers in Wales, linked to the British Science Festival, which this year was hosted by Swansea University and financially assisted by the NSA. These popular workshops allow providers to showcase their work, discuss best practice and issues of common concern and network.

The Minister for Skills and Science will be responding in greater detail soon to the welcome independent report of the '**Women in Science**' task and finish group –'Talented Women for a Successful Wales'(March 2016). Its recommendations for action in the fields of education, recruitment, retention and promotion of women in STEM-related careers are made to a number of bodies, with only a few directly for Welsh Government. Officials in my team have spoken to stakeholders over the summer to draw up a more

detailed response and secured input from colleagues in the appropriate departments too, on how particular recommendations can be taken forward.

STEM skills and the Welsh economy

The UK Commission for Employment and Skills (UKCES), in their 2015 review into UK higher level STEM skill requirements, state why action on STEM skills is important. They point out that there is an association between hourly pay and the use of STEM skills in the workplace, suggesting these skills are a factor in increased earnings and productivity. They also note that employment in STEM occupations is projected to grow (2012-22) in almost all broad sectors but that service-based activities, rather than manufacturing, offer the best prospects for future job growth. The evidence also suggests an undersupply of qualified individuals for high level STEM roles does not exist overall but there are acute shortages in specific occupational areas.

Looking at Welsh data, there has been growth in a number of occupations linked to STEM, which is projected to continue into the future. For example, 'Working Futures' shows that, in Wales, the number of people working as science, research, engineering and technology professionals increased by 24 per cent between 2004 and 2014 (from 37,000 to 46,000) and is projected to increase by around 10 per cent between 2014 and 2024 (to 50,000).

Three **Regional Skills Partnerships** (RSPs) were announced in October 2014 by the then Deputy Minister for Skills and Technology. Welsh Government works in partnership with each RSP, providing funding to commission regional employment and skills plans. RSPs are now well-established and recognised as key influencers with positive and productive relationships with Welsh Government and with employers and stakeholders across Wales. Each RSP has highlighted STEM as a key area of importance in their annual employment and skills plan and RSPs will be developing solutions to improve STEM-related activities in their regions.

An example of work already underway is the 'Act on STEM' project, developed by the Skills and Employment Work-stream of the North Wales Economic Ambition Board (which acts as the RSP for North Wales). The RSP has undertaken an audit to examine activities to date and inform the addressing of gaps in STEM provision. In tandem, they have been working with private employers and public sector providers to develop on-line resources for Year 5 and 6 pupils, parents and practitioners. This was launched across all schools in North Wales over the summer. Work is also progressing to promote STEM subject areas to support the needs of employers across the regional priority sectors.

An **Equality** Impact Assessment of the **Advanced Materials & Manufacturing** (AM&M) sector revealed very few women employed in manufacturing / STEM related industry. They accounted for just 19 per cent of the workforce and the majority of these roles are in administration and HR roles. There are, therefore, very few role models to inspire the next generation of potential female engineers. The sector developed a key equality and diversity objective to work with Anchor Companies, RICS and other significant AM&M businesses to support initiatives that encourage girls to consider careers in engineering and STEM related industry. This also supports the Programme for Government key action to encourage young people into science & engineering and to advance equality and tackle discrimination.

To date, the Welsh Government's Advanced Manufacturing and Materials has supported three programmes, which have proved beneficial to girls and young women considering careers in scientific and engineering-related careers:

- Ford Saturday Club, Bridgend, where a number of girls have graduated to bronze or silver CREST awards after the programme.
- Airbus Industrial Cadets, , which has had three all-girl cohorts supported by AM&M.

- Raytheon Quadcopter Challenge – held at Broughton, a new programme for boys and girls schools in North Wales to build and fly quadcoptors.

Further, Wales Rally GB 2016 features 35 Wales-based companies in an exhibition promoting the use of STEM in manufacturing to boys and girls in year 8 and 9.

In the **Life Science Sector**, there is a range of support from Welsh businesses for STEM related activity. In May 2015, Bangor University and Siemens Healthcare Diagnostics, based in Llanberis, signed a formal Memorandum of Understanding, enabling both to work more closely together in future, including students benefitting from both work placements and study placements at the Siemens site. Both parties are also keen to work together on educational outreach activities, particularly to promote awareness of science, technology, engineering and maths amongst young people.

Sony UK Technology Centre (Medical Technology), Pencoed, Bridgend host regular school visits hosting over 2000 children, as well as regular visits from colleges and universities across the UK. They also support the Ospreys Schools Programme by allowing pupils to learn about local engineering prospects and see the latest technology as it is built.

The **Engineering Education Scheme Wales** (EESW), a non-profit, educational charity benefitting from some NSA funding, runs programmes across Wales to inspire and motivate young people to choose a career in STEM. Their programme is one of a number of educational programmes which Sony UK TEC supports, with the aim of introducing the manufacturing and technology industry to young people.

The wider **STEM Ambassador Programme** has recently been promoted to Life Sciences businesses via the Business Development Team as part of their on-going relationship with the companies. Life Science companies already involved and active participants in the Programme include: GE Heathcare; Ipsen Biopharm; Quotient; PCI (Penn Pharmaceuticals); Quay Pharmaceuticals.

Professor Julie Williams
Chief Scientific Adviser for Wales
30 September 2016