Economy, Infrastructure and Skills Committee

Professor Peter Halligan – Chief Scientific Adviser for Wales (CSAW)
Welsh Government

Purpose

1.The CSAW Prof Peter Halligan took up his post in March 2018. This paper provides the EIS Committee with background material and a brief progress update ahead of the planned scrutiny session on Wednesday 17 October 2018. This includes a description of his cross-portfolio role and supporting office (recently agreed with Cabinet), brief updates on previous/ongoing CSAW-related programmes, and future plans to use the role as part of a wider outward-facing promotion of science (science diplomacy) designed to enhance Wales competitive image, challenge potential negative associations, foster greater international collaboration and recognition of Wales's science and research profile.

Introduction

2. The importance of growing a knowledge-based economy built upon science, skills and innovation is widely regarded as essential for global competitiveness. It is a key element of most governments' strategies, intent on sustainable economic and social improvement. The volume of scientific information and evidence, however, has grown exponentially and many governments have appointed science advisers to help inform policy and decision making, believing an accurate, unbiased synthesis of relevant science evidence is one of the most valuable contributions a research community can offer to democratic decision-makers. Public attitude surveys confirm strong support for the use of scientific advice as part of government policy making.

3. Different models of science advice reflect different political cultures. In the UK, the position of **Chief Scientific Adviser (CSA)** is well established, with similar roles adopted by several countries, such as Australia; Canada; Cuba; the Czech Republic; India, Ireland; Malaysia and New Zealand. The UK science advice to government system is well-regarded, with each government department having a Chief Scientific Adviser and the Government Chief Scientific Adviser (GCSA) reporting directly to the UK Prime Minister. In 2006, Scotland appointed its first Chief Scientific Adviser, with Ireland following in 2007. In 2010, First Minister Carwyn Jones appointed Professor John Harries as the first CSAW (2010-13). In March 2018, Professor Halligan began as the new Chief Scientific Adviser for Wales (CSAW) succeeding Professor Julie Williams, who stepped down in the Autumn of 2017 to take up a leadership role in the newly-created Dementia Research Institute.

4. At its most reductionist level, science advice is the exercise of harnessing and synthesising scientific knowledge, with policy being the set of principles that guide actions in order to achieve a particular outcome. While science advice is valuable and essential, it remains one of several factors for policy makers and one of several considerations for decision makers.

5. With a view to learning from best practice and establishing relevant links, Prof Halligan has engaged extensively since taking up his role in March with the research, business and policy community both inside and outside Wales, and in particular has developed productive links with counterparts in Canada; Scotland; Ireland; Quebec and Europe together with the recently-appointed UK GCSA, senior members of the Department for Business, Energy and Industrial Strategy(BEIS); UK Research and Innovation(UKRI); research organisations (HEFCW, Universities Wales, National Physical Laboratory); Universities and businesses (Airbus, IQE).

6. Supported by the officials in the new **Welsh Government Office for Science** (**WGOS**), the key elements of the role of the CSAW include:

- ensuring that government policies and decisions makers are informed by the best scientific evidence in support of public decision-making;
- championing the role of science in Government and promoting Wales intellectual, innovative and cultural achievements nationally and internationally;
- representing and acting as an advocate for Welsh science in Wales, Whitehall and Europe;
- Inspiring the next generation of scientists and encouraging diversity in STEM;
- Managing Sêr Cymru programme delivery and departmental research budgets

7. In providing advice on cross-cutting policy problems, the CSAW secures evidence from all sciences including the natural and physical sciences; mathematics; engineering; technology; social science and the humanities. The arts, humanities and social sciences are vital for a thriving economy, vibrant culture and cohesive society. They help deliver the skills which are crucial to the services sector, which makes up 80 per cent of the UK economy and over 70 per cent of the Welsh economy.

8. From discussions with counterparts in the UK Government, Canada, Scotland, Ireland, Quebec and other European countries, structured advice can sometimes require a formal report, involving lengthy consultation and input from advisory panels or academies. However, informal methods typically play a role in the everyday business of policymaking and many CSAs find that much of their time is spent contributing or offering advice informally at the earliest (and opportune) stages of policy development.

9. The current areas of CSAW responsibility, recently agreed with Cabinet, can be summarised under five pillars:

- **Science Advice for Policy**
- **Promotion & Communications**
- **Programme Management & Delivery;**
- **Science Capability & Skills**
- **Analytics on Research funding & performance**

Science Advice for Policy

10. Providing scientific advice to the 'First Minister, Cabinet and administration' is a key element of the CSAW role – designed to ensure government policies and decisions are informed by scientific evidence and strategic long-term thinking. This means leading and co-ordinating scientific efforts within Welsh Government and engagement with the wider scientific community in Wales and beyond.

11. To support this broad advisory role, effective advisory systems, in and outside government, are required, including accessing existing networks of leading scientists and contacts in different fields, across the UK and internationally. Professor Halligan has already met his Scottish and Irish counterparts, the new Canadian CSA and several European CSAs. The CSAW also meets regularly with the UK GCSA and attends (where possible) weekly CSA network meetings of UK Departmental and Agency CSAs, where collective expertise and good practice is shared. Such meetings are a vehicle to highlight and promote Wales' research excellence and explore synergies and opportunities in the wider UK.

12. Refreshing the previous Science Advisory Council for Wales, the CSAW has convened a new independent 'Wales Science and Innovation Advisory Council' (WSIAC). In addition to being co-chair for this group of distinguished members of the UK Science, Business and Innovation community, he also chairs the internal Science

Strategy Network (SSN), designed to tap into the reservoir of multidisciplinary, cross-portfolio staff and facilitate scientists making links across Welsh Government.

Promotion and Communications

13. The profile of a country's research, intellectual vitality and innovation is one of its most valuable soft power assets. It shows intrinsic quality and future innovation potential for engagement and inward investment from the wider world. A country's reputation strongly correlates with people's willingness to visit, work, study, invest and buy products and services from it. Strong reputation leads to higher levels of expectation but also graduate interest, staff affinity, philanthropy and employee advocacy.

14.While small in scale, the Welsh research base is both productive and efficient. It is one of Wales' few indigenous engines capable of returning innovation competitiveness and generating future inward investment. Wales produces a disproportionately high share of the world's published academic articles and highly-cited articles but awareness and recognition of research and innovation is not sufficiently well known.

15. To remedy this, communication will form a key part of the CSAW's work, with plans being worked up to develop new materials, events and opportunities to better market Wales science and broader research contribution. It will be important to project a consistent, holistic brand, including highlighting Wales' current and historical intellectual vitality - its research and innovation achievements, alongside existing tourism and business promotion. This aligns with the first recommendation from the Reid Review of Government Funded Research and Innovation in Wales (Reid 2018) – to set up a Welsh Research and Innovation London Office (WRILO), to increase Wales profile in the UK Capital; pursue funding opportunities; draw in talent and investment and represent the Welsh Government.

16. 'Science diplomacy' refers both to the role scientific research activities can play in fostering positive international relations and to the use of diplomacy to support international science. Growing Wales Science diplomacy will be an important tool for generating awareness and recognition essential for growing future international strategic collaboration. This includes activities where science can help facilitate and foster more international collaboration and promotion of national interests. With global grand challenges, such as climate change, ageing populations and infectious diseases - strategic international scientific engagement and collaboration is critical. The CSAW has already had meetings with scientists from the Canadian Province of Quebec; the Basque Region and Ireland and presented on behalf of Wales at leading EU Science advisory conferences in Bulgaria and Estonia. Wales already has a strong record of collaboration across Europe through EU, pan-European and other multilateral and bilateral initiatives. It is important that we seek agreement to continue to collaborate with European partners on major science, research and technology initiatives, after BrExit. Wales currently has the highest international collaboration share of UK countries with co-authors from outside Wales.

Programme Management & Delivery

The Sêr Cymru Programme

17. Building a strong and successful scientific community was one of the Welsh Government's core aims when it launched *Science for Wales* 6 years ago. A key driver behind this strategy was the addressing a recognised investment gap with other parts of the UK and the need to grow research capacity in Wales to support the wider economic and national development of Wales.

18. With this in mind, Professor John Harries, the first CSAW, established a number of programmes under the 'Sêr Cymru' *('*Stars Wales') brand to help begin create a globally-

competitive science and technology research base in Wales. Launched in late 2012, the first phase of Sêr Cymru was directed at attracting a small number of the brightest and best scientific researchers and their teams from across the world to Wales but also at supporting indigenous talent by developing three national research networks in each of three 'Grand Challenge' areas: *Life Sciences and Health; Low Carbon, Energy, and Environment;* and *Advanced Engineering and Materials* capable of funding large scale doctoral training schemes. The initiative paved the way for the Welsh Government and universities to work together to support research chairs in each of these 'Grand Challenge' areas. To boost capacity further, all the research-active Welsh universities have also been investing heavily in infrastructure, such as new buildings and equipment.

19. A second programme phase of Sêr Cymru (II) followed in 2015, again focusing on capacity-building but this time securing promising early-stage researchers involving significant EU structural and Horizon 2020 funding. With more than £30m coming from the European Commission, through Horizon 2020 and Structural Funds, Wales is the first country to have used both these European Funding sources in a synergistic manner to support research.

20. An report has been produced annually, detailing the progress of this programme over the past 5 years and Professor Julie Williams (as previous CSAW) had the opportunity in October 2016 to update this committee on Sêr Cymru I & II.

21. The first phase of the Sêr Cymru programme draws to a close this year and, while too early to draw definitive conclusions, as elements are still operating, a recent commissioned independent report (to be published late in November) found that, overall, the two strands of Sêr Cymru I had performed well - exceeding original output targets and securing close to £75m of net additional research income.

22. To date, the Sêr Cymru I and II programme elements have successfully supported 3 National Research Networks, 12 Research Chairs, 9 Rising stars (future research team leaders), 115 research fellowships (including those supporting researchers returning to academia following a career break) and more than 340 PhD students and postdoctoral researchers.

23. The programme has attracted considerable international and UK interest. The influence of Sêr Cymru can be seen in the recent UK funding calls, openly based on this programme: Universities UK International (UUKi) Rutherford Fund Strategic Partner Grants and the UK Research and Innovation Future Leaders Fellowships (FLF). Given the experience in seeking new talent internationally, it is encouraging that Wales had secured, to date, 14 per cent of the 100 Rutherford Fellowships, more than twice the national share predicated by national population of 4.8 per cent.

24. Since the launch of *Science for Wales back in 2012*, the UK and Wales have experienced significant changes, in the both economic and higher education / research policy landscape. In addition , Wales now benefits from having a much more robust evidence base charting our international performance, including the *International Comparative Performance of the Welsh Research Base* (Elsevier, 2013 & 2016), *The Case for Growing STEMM Research in Wales* – (Halligan & Bright, 2016) and the last Research Excellence Framework outcomes. Although the primary driver behind Welsh Government policy remains: 'the building of a strong and dynamic science base that supports the economic and national development of Wales' the *Science for Wales* strategy has now been overtaken by UK developments, Welsh Government reviews and a series of Welsh government legislation and policies including the *Well-being of Future Generations Act* 2015, *Prosperity for All* (2017) and the *Economic Action Plan* (*EAP,*Nov. 2017), rather than which has been overtaken by the developments. To inform and reflect this, the final *Science for Wales 2017* report provided a review of progress over the

previous 5 years as well as highlighting the changing science landscape in both Wales, and the UK, in the prodromal period before BrExit.

25. To build on the success and of the positive brand of the programme, the CSAW is currently working on plans to progress a new phase of this programme, **'Sêr Cymru III'**, which will ramp up, as the financial costs of the earlier phases ramp down, maintaining affordability and retaining the brand at a time of straitened budgets. The aim here is to extend the previous programmes in collaboration with interested stakeholders, seeking a 'shared partnership' so that new R&I programme elements continue to harness public, academic and private sector collaborative working, as effectively as possible.

26. In line with this new programme, a new Sêr Cymru Research Chair has just been awarded to Aberystwyth University in the field of Bovine TB, funded by £2m from WEFO and £0.6m match-funding from the university. A further £1.1m has been guaranteed by the Chief Veterinary Officer for Wales, evidencing her support for this important area of research, combatting the huge and costly problem that Bovine TB represents for parts of Wales. This is a good demonstration of how inter-divisional collaboration can be facilitated through funding mechanisms such as Sêr Cymru.

27. In addition to new UK funding policy initiatives (such as the UK Industrial Strategy and UKRI) existing and forthcoming influences likely to impact science and research policy in Wales, include **Ellen Hazelkorn's** 2016 Post-compulsory education review, the Welsh Government's *Economic Action Plan* (*EAP*) and the more recent Graeme **Reid**, review, alluded to above.

28. Hazelkorn recommendations for the establishment of a future **Tertiary Education and Research Commission for Wales (TERCW)** are being taken forward, where responsibility for higher and further education, work-based learning and Welsh Government funded research and innovation will be brought together. The plan is for Research and Innovation Wales (RIW) to be incorporated as a statutory committee and the reference point in TERCW where it can engage with Research England and UK Research and Innovation (UKRI). The establishment of RIW is actively designed to promote the exploitation of research and innovation knowledge, by driving integration of the links between pure and applied research, innovation, skills and education, industry, business, public bodies and local authorities and other key stakeholders.

29. In 2017, the *EAP* confirmed the ambition to secure a more competitive and fair economy, by growing productivity to help generate income that could deliver high quality public services and well-being for Wales. To help create a prosperous and fair society, the *EAP* identified the 'engine' of this prosperity as growing research, innovation and development of the right skills base. Innovation, in particular, involves the development of new or improved products, processes or thinking, which can lead to an improved quality of life.

30 In his review Reid (2018) noted that while '*the research and innovation ecosystem in Wales is strong and includes strikingly successful examples of university-business collaboration and research impact*' …'*the research base does not have the scale needed to deliver its full potential to the people of Wales*.' Reid also noted that European Structural Funds have played an important role in Wales, in addressing the shortfall in both UK research and innovation funding in Wales, by comparison with other UK regions. Since 2000, the investment of EU funds has helped mitigate the decline in Wales' economic performance. Investment in research and development has more than doubled since 2000, from £351m to £716m, driven by increased private sector investment and keeping pace with UK averages. Universities in Wales have received a significant amount of funding from European Structural Funds and this continues to provide vital

investment and funding for projects and infrastructure that contribute towards economic and social growth in Wales.

31.Reid's review also noted that the '*long-standing structural weaknesses in the research and innovation ecosystem'* in Wales had been masked by the availability of EU structural funds and their withdrawal could render Wales at a disadvantage to other parts of the UK in securing access to the new large, competitive funding increases, announced by UK Research and Innovation (UKRI). As such, Welsh universities could be disproportionately disadvantaged by the loss of the Structural Funding, given the longstanding high levels of historical dependency.

32. Finally, Reidpointed out that the growing UKRI budget now presents major opportunities for Welsh businesses and universities to win sizeable amounts of additional funding. This can help ensure Wales increases its competitiveness in the research and innovation sector given that BrExit will bring a major shift away from EU WEFO funding towards this UKRI competitive-awarded funding. In his review, however, Reid suggests that unless the current low levels of un-hypothecated funding, relative to the rest of the UK are addressed, Wales will not have a research and innovation ecosystem fit for competition. Reid indicates that the degree to which this weakness is addressed will have a major influence on Welsh performance, in the increasingly competitive UK-wide landscape for funding from UKRI, businesses and research charities.

Science Capability & Skills

33. **STEM in Education** - *Science for Wales* called for a more engaging and relevant science curriculum and for more robust and respected science qualifications, both of which are being implemented and are bedding-in through 2018 and beyond. Pioneer schools and practitioners are working with Welsh Government on the new curriculum, including new science and maths areas. It is understood that the results of their collaborative work will be published in the new year for further scrutiny. Pupils took the new GCSE science qualifications this year, with reassuring results. More young people taking up the option of studying science, especially the three single sciences is to be warmly welcomed.

34. Historically, about two thirds of the cohort took GCSE Science qualifications, with one third taking a range of vocational alternatives, often Level 2 BTEC - which precluded further science study at A Level. The Cabinet Secretary for Education has clearly indicated she expects that by 2021 every pupil will sit a science GCSE. Already, in this summer's results, nearly all Year 11 students sat at least one of our new GCSE science qualifications – the first time these have been formally taken by candidates. Entries for individual sciences (chiefly pupils taking triple science) rose pleasingly: Biology up 12 per cent; Chemistry up 11 per cent and Physics up 10 per cent. The A*-C pass remained stable at 9 in 10 achieving those grades but, reassuringly, more students took individual sciences (within a 50 per cent increase in pupils taking some combination of GCSE sciences). A higher proportion gained the top A* - A grades and, at A Level, Biology, Chemistry and Physics A*-C grades also went up this summer.

35. **The National Science Academy (NSA)** - First set up in 2010, the NSA has supported outreach activities, through grants to organisations engaging children, young people, teachers, parents and guardians, aiming to increase our future workforce of scientists and engineers.

36. In 2015 the NSA undertook a high-level strategic review of its previous two rounds of funding. The strategic priorities were subsequently defined to:

- 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 preforming best to maximise continued delivery.

37. Since April 2015 NSA funded over 20 STEM enrichment projects – an investment of over £2.7m. It is forecast to deliver 870 STEM enrichment events for over 186,000 pupils/students (most aged 11-14 years) together with 462 CPD (continuous professional development) events for over 2,800 teachers.

38. Recently, the NSA secured funding from WEFO to run an innovative £8.2 m STEM enrichment proposal. It will be led by NSA, in partnership with Cardiff, Swansea, Aberystwyth and Bangor Universities and the Institute of Physics. It seeks to establish and increase 'Science Capital' capacity, through a targeted suite of intensive STEM enrichment interventions (such as interactive 'hands-on' experiments; STEM related inquiry-based activities; roadshows; STEM-related career awareness; demonstrations, STEM-related virtual and augmented reality technologies; exhibits; etc.). The proposal will target cohorts of participants, aged 11-14 years (over 5,000 pupils), sourced from up to 30 schools in the West Wales and Valleys, over a three year period. It is forecast to deliver over 140,000 hours of activities. We particularly want to encourage the taking of GCSE triple sciences (Physics, Chemistry, Biology) by more pupils than at present.

39. The overall scheme will be underpinned a ground-breaking longitudinal cohort evaluation, featuring a critical and unique impact evaluation, assessing how effective the STEM enrichment interventions are, related to pupil uptake of GCSE science subjects (from a mandatory single science through to a maximum choice of triple science subjects).

40. **Women in Science** - The Women in STEM Board, which is Ministerial-chaired, was set up to monitor and oversee implementation of the recommendations of the 2016 '*Talented Women for a Successful Wales*' report. Several members agreed to establish a separate Task and Finish Group to focus on several of the external-facing recommendations from the report, such as promoting and developing work on cross-sector outreach, engagement and mentoring networks across Wales.

41. Science-related business and research are crucial to Wales' success. Women are underrepresented in this workforce and Wales cannot afford to lose half of its potential scientists and technologists. This under-representation of women in STEM is a UK long-standing and a more global phenomenon – representing a waste of knowledge and talent.

42. Many of the NSA's funded programmes have been directed in whole or part to stimulating girls' interest in science and particular STEM subjects. NSA funding has also enabled professional learning (communicating research) training for over 57 researchers - 41 of them being women, to provide valuable female role models.

43. Finally, the CSAW acts as **Head of Profession** for **Science and Technical staff**. Maintaining a strong cadre of scientists and engineers in government is essential to managing and using science and engineering effectively. This carries a remit to ensure the scientific skills and training of staff and officials in agencies, such as Natural Resources Wales (NRW). The CSAW also undertakes some development activities and dissemination events and communications, from the UK-wide Government Science & Engineering or GSE network.

Analytics on Wales' Research Funding & Performance

44. A key function of WGOS is to provide access to relevant research intelligence on Wales performance, by benchmarking research and innovation performance and comparing this with high quality external competitor regions and nations. This information can be used to inform strategic information-based decisions, that will allow Welsh Government to identify national strengths and providing a basis for facilitating engagement across the UK and beyond. In identifying such trends WGOS plan to help improve outcomes and demonstrate operationally efficient performance which in turn can inform success stories that can be used to promote Wales as a place on the way to an even more prosperous future. Comparisons with with similar regions and nations assist with new and strengthened collaborations.

45. The UK Charter for Science and Society calls for public policy and debate to be enhanced by more extensive and purposeful engagement with all sectors of society, with the views of the public being considered, alongside evidence from scientists and engineers. The WGOS is currently planning a study to assess the awareness, understanding and attitudes towards science and research amongst the general public in Wales. The proposed study, ‘Science in Wales Barometer: Public Views on the Value of Science’, will be the first of its kind in Wales. It will be specifically designed to understand the public’s attitudes, understanding of and engagement with, science and science-related matters.