

Innovation strategy for Wales

Q1. Which stakeholder group would you consider yourself to represent:

third sector

Q2: What would you like the Innovation Strategy to achieve in the short (1 year) term in relation to: economic growth skills development social equity climate and environment other

The Welsh Innovation Strategy should recognise deep tech innovation as a driver of economic growth. Innovation in chemistry underpins achieving transformational breakthroughs in a range of areas, including: energy and climate change; medicine and healthcare; pollution control and environmental technologies; and more. The discipline has wide applicability, with chemistry-based companies (and particularly SMEs) active across sectors and technologies throughout the UK economy. Many companies using chemistry fit in the category of “deep tech”, i.e. have R&D as fundamental to their business and the potential to introduce disruptive, novel technologies and/or products to the market. Royal Society of Chemistry research into these companies, published in Igniting Innovation, has revealed specific requirements to enable innovation: typically, capital investment that allows for an uncertain timeline of research and development, and access to suitable laboratory and scale-up facilities.[1] 39% of chemistry-intensive SMEs invest in R&D, compared to 20% across the whole SME landscape.

Future actions taken under the guidance of the Strategy should be evidence-informed, so the early period should include evidence review, and data collection and analysis, focusing on the innovative SME sector. Royal Society of Chemistry research has identified key barriers to deep tech SME growth that could inform areas for analysis in Wales. First, SMEs often struggle to find appropriate premises and R&D facilities/equipment, particularly as they grow. The Welsh Government should analyse facilities and resources available in Wales for starting up and growing deep-tech SMEs and create a plan and/or incentives programme to grow and enhance these facilities. Second, SME and spinout founders often excel in research but lack the business and leadership skills to drive the company. The Welsh Government should analyse the sector for skills gaps detrimental to growth and plan for targeted skills development as part of the Innovation Strategy.[2] The first year should also see action to support robust data collection and analysis on equality, diversity and inclusion in the sector.

Some elements of the Strategy need immediate action. For the Strategy to build a healthy innovation ecosystem, current challenges must be addressed. SMEs are affected by the increasing cost of living and current economic pressures, manifesting in increased costs (particularly for energy), difficulties in attracting and retaining talent, and reduced risk appetite among investors. The Welsh Government should closely monitor the impacts of these issues, particularly those that persist after UK-wide support schemes have been implemented, and listen to innovative SMEs on further Wales-specific help that may be needed. Further, some of the critical R&D areas identified in the draft Strategy should also see immediate impact in the first year, e.g. the Welsh Government should start to implement plans as written on climate change priorities, and determine how public procurement can drive positive climate action.

[1] Igniting Innovation, Royal Society of Chemistry 2022, <https://www.rsc.org/new-perspectives/discovery/the-case-for-supporting-uk-deep-tech-chemistry/>

[2] Ibid

Q3. What would you like the Innovation Strategy to achieve in the medium (2 to 5 years) term in relation to: economic growth skills development social equity climate and environment other

Priorities in the medium term should be informed by the data collection and analysis we recommend in the initial phase of the Strategy. Based on RSC evidence,[3] we expect that one of the key areas that will result from such analysis will be closing skills gaps and achieving improved technical, business and leadership skills across new and existing innovative SMEs.

Innovation should be embedded in all Welsh Government thinking. Policy decisions can generate an innovation "pull" for key technologies for Welsh growth and prosperity. This is described in the draft Strategy in relation to health and care goals, but there is no reason why the principle cannot be extended to other sectors with positive results.

The Strategy should function to boost innovation funding and allow a more sustainable, long-term funding picture. Over this two-to-five-year timeframe we would hope to see improvements to the innovation ecosystem in Wales coming from greater access to funding (from public and private sources). This should catalyse science and tech cluster formation and growth, with the effect of concentrating facilities and skills, and the Strategy should encourage this. The success of deep tech SMEs in Wales depends on an investment ecosystem providing funding to these companies, spreading funding further than the traditionally dominant London and South East of England area. The Strategy should encourage home-grown investors as well as attracting external funding. Investment in deep tech SMEs requires a financial sector that understands the prospects of deep tech R&D and has the patience to accept longer horizons before returns will be seen. The Strategy should be formulated to help promote this approach to investment.

Data collection should be an ongoing aspect of innovation development throughout the life of the Strategy. Understanding how the Strategy is affecting innovation activities and the workforce in Wales will allow ongoing strategic development and better outcomes for the country. This should also track structural inequalities that are present in science academia and industry, which currently lack representation of women and people of minoritised ethnic backgrounds to represent the communities they operate in.[4]

[3] Igniting Innovation, Royal Society of Chemistry 2022, <https://www.rsc.org/new-perspectives/discovery/the-case-for-supporting-uk-deep-tech-chemistry/>

[4] Breaking the Barriers, Royal Society of Chemistry, 2018, https://www.rsc.org/globalassets/02-about-us/our-strategy/inclusion-diversity/womens-progression/media-pack/v18_vo_inclusion-and-diversity-womans-progression_report-web-.pdf

Q4. What would you like the Innovation Strategy to achieve in the long (5+ years) term in relation to: economic growth skills development social equity climate and environment other

The long-term impacts of the Innovation Strategy should form a healthy SME innovation landscape. Welsh Government action can boost innovative SMEs, particularly when tailored to their business stage, from foundation to scale-up and commercialisation. There should be an established roadmap of SME growth in Wales. Success stories from these companies should be attracting skilled workers to Wales.

The key sectors identified in the Strategy should be seeing demonstrable progress, with positive impacts for Wales; a pipeline of new climate solutions being installed across Wales, advances in health and care, and benefits to food and agriculture. Adoption of these solutions should have extended beyond Wales, demonstrating Wales's position as a leading nation in fostering innovation for global improvement. There are already examples of this, such as the Swansea University-led Sunrise Network that works to address global energy poverty,[5] and the Innovation Strategy should result in growing this portfolio of broader impacts.

The Strategy should be evaluated to understand its impacts, successes and next steps. This should examine not only the companies and sectors that have seen progress over the course of the Strategy, but also the range of people who have participated in and benefitted from innovation activities. Key metrics will include gender and ethnicity representation, and pay gaps in science and tech-driven sectors.

[5] <https://www.rsc.org/news-events/profiles/2022/jun/satish-patil-profile/>

Q5. We set out some high-level objectives that underpin our vision in the draft strategy. We recognise that Wales cannot be a global leader of innovation in all areas. Is there a specific mission or missions, linked to economic sectors or areas of social outcome where you think activity and resources should be concentrated?

Wales already has an existing innovation ecosystem with strength and expertise in the chemical sciences, particularly in advanced manufacturing. Royal Society of Chemistry data on our members and journal authors shows a particular concentration of chemistry strength in the Cardiff and Vale of Glamorgan region.[6] Building on this will strengthen many sectors that are dependent on chemical technologies, including those critical to the UK economy and to solving global challenges. These include sectors specifically highlighted in the draft Strategy including green technologies, sustainable energy generation and storage, life sciences and pharmaceuticals, and food security among many others. Wales also has local advantages that could be further exploited to incentivise chemistry clusters such as significant renewable energy resources. Adding facilities needed to grow existing deep tech companies, such as scale-up laboratories, can be expected to bring additional investment and expertise.

[6] RSC analysis of chemistry strengths in the UK, based on data collected by the RSC (not available online)

Q6: What impact, positive or negative, do you think the innovation strategy will have on Wales?

Potential positive impacts of the Strategy include an increase to the R&D funding flowing into Wales, improving its share to be proportional to its population within the UK. An increase in UK government funding is likely to leverage additional private investment, injecting vitality into the innovative SME sector in Wales. The increasing health of the sector should develop in conjunction with equality, diversity and inclusion improvements that show more high-skilled individuals from a variety of backgrounds are coming to Wales to work in the sector and contribute their different perspectives to the innovation ecosystem.

Further, if the draft Strategy's expressed priorities are pursued, Wales could develop its position as a leader within the UK on sustainable energy and climate change mitigation, as well as the emerging circular economy. The chemical sciences are underpinning technological advances in these areas and will continue to be a critical component of green RDI (Research, Development and Innovation).

Achieving these positive impacts will require careful development of the Strategy, with regard to the effectiveness of its scope, implementation, and ongoing evaluation.

Q8: Which aspects of the innovation strategy should remain the same?

We are encouraged by many aspects of the draft Innovation Strategy, including:

- The Welsh Government's ambition to increase resource efficiency and transition to a circular economy. In keeping with the UK Government's ambition to support action beyond recycling, innovation has to prioritise design of products and processes that enables reuse and refurbishment, and that maximises the recovery of valuable materials so they can serve as secondary resources. The transboundary nature of manufacturing, supply chains and waste management means there are significant benefits in coordination across the UK of circular economy, resource and waste legislation and investment, as well as harmonisation of these with key UK markets (such as the EU).
- Proposed efforts to work towards greater resilience while protecting the natural environment. An innovation ecosystem that has a strategic focus on net zero, a circular economy and enhanced resource and waste management will play a vital role in this.
- The intention to adapt and decarbonise agriculture. This is a key source of carbon emissions and other contributors to climate change (e.g. methane) for Wales and will be a critical topic in net zero planning.
- The ambition to use public sector procurement to further innovation. Public procurement can be used as a driver of innovation through the adoption of novel solutions promising transformative capabilities. The Welsh Government should create ambitious tenders designed and structured to attract innovative proposals, allowing an enhanced risk appetite to encourage innovation solutions including those from research-driven deep tech SMEs. Efforts to minimise the bureaucracy involved in submitting proposals may increase accessibility for SMEs with lower resources and/or little experience in submitting proposals to government (though due diligence remains important, as well as reporting to impact measures for the Strategy). Procurement processes may also want to consider UN sustainable development goals and the SMEs working to further them.[7]

[7] <https://sdgs.un.org/goals>

Q9: What are the main challenges and barriers to innovation in Wales? What needs to be done to overcome these barriers?

The draft Strategy document details several commendable outcomes but is light on plans to achieve them. The Welsh Government needs to work with experts, SMEs and central government to develop a detailed roadmap of actions for the initial years of the Strategy. Potential barriers to innovation that should be acknowledged in the Strategy include:

- Loss of EU funding and support must be offset. As the draft Strategy acknowledges, the shortfall on EU Structural Funding received by Wales after Brexit will leave resources constrained for implementing SME investment to bolster innovation.

- Overlap with existing UK-wide schemes is a potential complicating factor for innovative businesses in Wales. The intention detailed in the draft Strategy to build on existing sources of innovation support (e.g. Wales Innovation Network, Development Bank of Wales etc) is positive, but would benefit from being developed further to ensure complementarity to nationally available innovation support from bodies including Innovate UK and the British Business Bank. This should help businesses have clarity on which support/investment schemes are most appropriate for them.

- Fundamental research is also key to innovation. The recommendations from 'Scoping the Future' point to more commercially oriented research and mission-based innovation; while these are important, this must not be to the exclusion of all fundamental research with a knowledge acquisition agenda. Traditionally in the UK this research is the preserve of the academic sector, but this often leads to university spin-outs, making it an important part of the innovation pipeline. Support for basic research is a foundation that needs to be preserved to ensure the long-term success of the research and innovation sector and its ability to drive prosperity and deliver benefits for all.

- A lack of people entering the STEM education pipeline. STEM-educated people are needed to occupy future high-skilled roles doing innovative work. The Innovation Strategy should ensure that young people from all backgrounds have the opportunity to study STEM subjects and feel like they "belong" in that cohort: social and economic inequalities may be limiting the aspirations and career choices of some young people and affecting progression to further study or employment in chemistry.[8] Chemistry should be included as part of the core, compulsory curriculum for all learners up to the age of 16, as part of a balanced offering in the sciences alongside biology and physics.

- Making choices available to students who want to continue STEM studies. The Welsh Government should ensure that a range of post-compulsory study routes – vocational, technical and academic – are available beyond the age of 16 to equip students with specific knowledge and skills that will enable them to enter career paths in the chemical sciences.

[8] ASPIRES 2: Young people's science and career aspirations, age 10-19, Archer, L., Moote, J., MacLeod, E., Francis, B., & DeWitt, J., 2020. See https://discovery.ucl.ac.uk/id/eprint/10092041/15/Moote_9538%20UCL%20Aspires%202%20report%20full%20online%20version.pdf

Q10. The Innovation Strategy aims to achieve a more prosperous Wales through introducing new products and services, job creation, spend in the Welsh economy and productivity. An ecosystem where innovation becomes everyone's responsibility.

a. Do you believe the proposed Innovation Strategy has set out clear objectives to achieve this outcome? If not, what is missing?

Wales needs to use STEM, and chemistry in particular, to drive prosperity gains. The chemistry sector is a key economic contributor across the UK. Chemistry-using professionals contributed an average of £83 billion to UK GDP over the years 2013-2019. This shows that chemistry is an impactful and valuable sector. Figures from Wales show the number of chemistry-using professionals (excluding academic staff and teachers) has fluctuated over this period, with a high of 17,040 in 2015 but a most recent figure of 10,885 in 2019.[9] Support for the sector to reverse this trend could bring a productivity benefit to Wales, as our research shows strong links between high-skilled work, innovation and productivity.[10]

[9] Chemistry's Contribution, Royal Society of Chemistry 2020, <https://www.rsc.org/new-perspectives/talent/chemistrys-contribution-workforce-trends-and-economic-impact/>

[10] Ibid

Q11. The Strategy aims to grow a more Resilient Wales which aims to improve a healthy natural environment, adopt circular economy principles and increase our capacity and capability in adapting to change.

Do you believe the proposed Innovation Strategy has set out clear objectives to achieve these outcomes? If not, what is missing?

In the context of achieving proposed outcomes, we would recommend the following refinements to the draft Strategy:

- Resilience depends on a Life Cycle approach to products and systems. We support the aspects of the Strategy relating to resilience, circular economy and climate change. Hardwiring low-carbon and resource efficiency thinking into innovation approaches is an important step towards building a more sustainable economy. However, it will be crucial to ensure that in these efforts the whole life cycle of products, processes and systems is considered - aided, for example, by tools such as Life Cycle Assessment[11] - so that unintended displacement of environmental impacts (e.g. increasing water or land use as a result of trying to decrease a product's carbon footprint) can be minimised.
- Future resilience will require skilled workers coming into green jobs. Our recent Green Shoots report showed that while young people are interested in future careers or study relating to sustainability, only 38% felt that studying chemistry can lead to jobs in sustainability and climate change.[12] We call on the Welsh Government to ensure young people have the skills and careers information needed to progress into green jobs, including in the chemical sciences, and contribute to the future green economy through this Strategy.

[11] Life Cycle Assessment explainer, Royal Society of Chemistry, 2021, <https://www.rsc.org/globalassets/22-new-perspectives/sustainability/progressive-plastics/explainers/progressive-plastics-explainer-8---life-cycle-assessment.pdf>

[12] Green shoots: A sustainable chemistry curriculum for a sustainable planet, Royal Society of Chemistry, 2021, <https://www.rsc.org/globalassets/22-new-perspectives/sustainability/sustainability-curriculum/green-shoots-a-sustainable-chemistry-curriculum-for-a-sustainable-planet.pdf>

Q12. An equal Wales is an objective of the Innovation Strategy. This proposes a transparent innovation ecosystem that ensures inclusivity in all research, development and innovation activity and a fairer distribution of investment where all regions in Wales feel the benefit from increased innovation activities.

a. Do you believe the proposed Innovation Strategy has set out clear objectives to achieve these outcomes? If not, what is missing?

The draft Strategy tackles inclusivity in research, development and innovation well. We would make the following suggestions for further detail, based on research into equality, diversity and inclusion (EDI) in the chemical sciences:

- Measurement of EDI metrics should be broad and thorough. We support the equality and diversity goals set out in the Strategy, and commend the explicit intention to collect data on progress in this regard. Inequalities persist in science, research and innovation set in academia and industry,[13] and funding systems present structural barriers for underrepresented groups. The RSC has conducted research and has developed a number of suggested actions for funding bodies, with broader applicability in some cases; a key example is the need to review and expand definitions and measures of success and excellence in STEM.[14] There is additionally a need for intersectional data, in order to understand the challenges faced by those belonging to multiple underrepresented groups and how these may differ in nature and/or extent.
- Publication of this data should be timely and transparent. Access to high-quality data and evidence is essential to improving the diversity of the STEM workforce. To ensure talented people thrive and progress in the chemical sciences, we need greater transparency in reporting the data that gives us insight into the barriers people face and the ways in which we can remove them.
- It does not only fall to the Welsh Government to publish data on EDI in STEM. Funding bodies and institutions have a key role to play in fostering this environment of trust and should also consider how they might increase transparency such as through the systematic provision of diversity data in reference to funding awarding. Funding bodies, institutions, organisations and companies should also share evidence of improvements achieved, so that models of best practice can be utilised by the community. Government action may be needed to overcome reluctance or bureaucracy in making this data available.

[13] Diversity landscape of the chemical sciences, Royal Society of Chemistry, 2018, https://www.rsc.org/globalassets/02-about-us/our-strategy/inclusion-diversity/cm-044-17_a4-diversity-landscape-of-the-chemical-sciences-report_web-2.pdf

[14] Breaking the barriers, Royal Society of Chemistry, 2018, <https://www.rsc.org/new-perspectives/talent/breaking-the-barriers/>

Q13. The Innovation Strategy aims to promote a globally responsible Wales through decision making processes that take account of the impact of our innovation activities on global wellbeing, as well as a collaborative approach to working in partnerships internationally to share knowledge, skills and undertake projects with a social purpose.

Do you believe the proposed Innovation Strategy has set out clear objectives to achieve these outcomes? If not, what is missing?

Wales can be a leader and testbed for globally important innovative solutions. The draft Innovation Strategy has chosen important areas to direct efforts, including net zero, resilience, and health and wellbeing. Focusing on innovation in these areas will result in technological development that could spread worldwide.

Q15. The new Innovation Strategy wants to achieve a healthier Wales through a more coherent and aligned innovation ecosystem that targets new and different ways of working, supports recovery strategies from the pandemic and enables greater adoption of innovation.

This will be underpinned by a health and social care system that collaborates across industry, academia and the third sector to deliver improved healthcare value by developing, sharing, procuring and adopting innovative practice and technology.

Do you believe the strategy will support this ambition? If not, what additional activities need to be included?

The Strategy has a well-developed approach to healthcare, which should be extended to other sectors. Innovation is key to improvements in healthcare and the relevant section in the Strategy is comprehensive. Indeed, this section mentions principles that also apply more widely. Life sciences and health are not unique in delivering social benefits through business growth - engineering, physical sciences and efforts tackling Sustainable Development Goals also meet this objective. Elements from the health and care section of the Strategy that should be extended to other sections include: detailed plans on measuring progress, generating more of a "demand pull" for innovation, improving horizon scanning functions, and integrating innovation approaches throughout policy delivery mechanisms.

b. Do you feel that you have the opportunity to participate in innovation? Please explain why you feel that you are able / unable to participate in innovation?

N/A

Q18. Do you think this Innovation Strategy would positively impact you? If not, how could this be changed?

N/A

Q19. Alongside the final strategy we plan to publish an action plan which will address resourcing and implementation of the strategy. The Commission for Tertiary Education and Research will have a leading role to play in the implementation of the strategy, as will the Welsh Government and other bodies and partners. Wales currently does not have one lead body responsible for the coordination and delivery of our innovation system. Turning to implementation, how would you like to see this strategy implemented?

Any implementation plan must be accompanied by robust data collection designed-in from the inception, looking at both economic and social metrics to understand the success of the Strategy. A well-designed collection process should minimise the administrative burden on companies and individuals while ensuring the Welsh Government is effectively informed on all important parameters.

About you

Q20. Gender

Male

Q21. Are you trans or non-binary?

No

Q22. Are you currently pregnant or have been pregnant/ taken maternity leave in the past year?

No

Q23. Age

30 to 34

Q24. How would you describe your national identity?

British or Mixed British

Q25. What is your ethnicity?

White - Welsh, English, Scottish, Northern Irish, British

Q26. What is your sexual orientation?

Heterosexual, straight

Q27. What is your religion or belief?

Atheist

Q28. The Welsh Government recognises that disabled people are not disabled by their impairment or health condition or by using British Sign Language but by policies, processes and environments which may not be accessible to them. We are committed to taking action to remove those barriers.

The Equality Act 2010 defines disability as:

'A physical or mental impairment which has a substantial and long term adverse effect on a person's ability to carry out normal day-to-day activities.'

For diversity monitoring purposes, do you consider yourself to meet either the social definition of disability which the Welsh Government uses and/or the definition in the Equality Act 2010?

No

Q31: We have asked a number of specific questions. If you have any related issues which we have not specifically addressed, please use this space to report them:

Links to UK government policy are important but do not need to mirror all initiatives/decisions. The Welsh innovation system will not be working in a vacuum, so it is positive that it has been written with regard to UK government and Innovate UK priorities. The ideal outcome is a combination of synergy with central UK policy and complementarity to create unique successes in Wales.

Leveraging private investment depends on attractive government investment at the right time. Driving innovation to the fullest possible extent is not feasible through government action alone - inclusion of the private sector will be critical, but should not be assumed as an automatic outcome of the Strategy. Plans should be oriented to leverage private funding through early support and demonstrating successes. Early signs of support for a new deep tech SME can act to reassure potential private investors as to the viability of the company. Similarly, supporting a deep tech SME to reach a proof-of-concept stage means they can then provide the evidence behind their technology that may bring in future private investment.[15] Early-stage support needs to be at a level where the company has the freedom to proceed without spending all its effort on securing the next slice of funding. The administrative burden attached to receiving early support must be proportional and not overbearing. Funding must not be tied to an expectation of quick returns, as the early R&D stages of deep tech development can have a very uncertain timeline, and setbacks are not uncommon. However, due to the disruptive nature of deep tech R&D, the eventual rewards can be significant.

[15] What Works for Innovation, Enterprise Research Centre, 2021,
https://www.enterpriseresearch.ac.uk/wp-content/uploads/2022/03/3973-WWFI-Report_WEB.pdf

Submit your response

Do you live in Wales?

No

Do you have a business interest in Wales?

No answer

Please provide the first part of your home postcode e.g. CF10

W1J

You are about to submit your response. Please ensure you are satisfied with the answers you have provided before sending.

Name Henry Lovett

Organisation (if applicable) Royal Society of Chemistry

If you want to receive a receipt of your response, please provide an email address.

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lovetth@rsc.org