

IOP response to the Welsh Government's consultation on the draft innovation strategy (28 September 2022)

Q1. 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**

These challenges are unlikely to be tackled in the short-term; all have affected Wales for decades. What can be achieved in a one-year-timeframe is expedited use of existing powers, regulations and funding streams already at the Welsh Government's disposal. The immediate priority should be full implementation of the recommendations of Professor Graeme Reid's review of government-funded research and innovation.¹

The Reid review actions are 'off the shelf' and have strong support amongst the research, development and innovation (RDI) community in Wales. The current shortfall has been identified as being in the range of £60m per annum.² To note, Reid's calculations came before the cost-of-living crisis and the IOP believes RDI funding streams should reflect inflation and current cost pressures.³

Q2. 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**

The IOP and the Centre for Economics and Business Research have found physics is worth £7.3bn GVA to the Welsh economy and supports 113,138 jobs; equivalent to 10% of both GDP and full-time employment.⁴ Physics-based businesses in Wales had a combined turnover of £26.7bn in 2019, a 36% increase in a decade – the fastest rise of the four UK nations and well above the UK figure of 24%. The decade also saw 41% growth in employee pay – again, the largest increase in the UK.

Continued improvement of these measurements should be evident within the medium term. Associated benefits would be increased public investment (which leverages private investment); even higher level of job creation, earnings and labour productivity; and inward investment from across the UK, EU and beyond.

Similarly, the Reid uplifts to Welsh Government sources for RDI should continue to rise and keep pace with costs. An increased number of RDI-active companies in Wales would be a desirable target, as would an improved rate of UK Research and Innovation (UKRI) grant capture. With regards to skills, an increase in the uptake of physics (and wider STEM) at post-16 level. In particular, the diversity of the cohort should be improved—the current underrepresentation in terms of gender, ethnicity and socio-economic background is holding back participation rates. Concomitantly, the shortage of STEM teachers should be improved to boost the potential for future innovators; as stands, just 41% of those teaching the subject in Wales were trained in physics.⁵

¹ Reid, G. 2018. *Review of Government Funded Research and Innovation in Wales*. Cardiff: Welsh Government.

² Cardiff University. 2021. *Economy, Trade, and Rural Affairs Committee Priorities for the Sixth Senedd*. Cardiff: Senedd Cymru.

³ Institute of Physics. 2022. *Physics: investing in our future*. London: Institute of Physics.

⁴ Centre for Economic and Business Research. 2021. *Physics and the Economy: Measuring the value of physics-based industries in Wales*. London: Centre for Economic and Business Research.

⁵ Education Workforce Council. 2022. *Annual Education Workforce Statistics for Wales 2021*. Cardiff: Education Workforce Council.

An uplift, especially in technical apprenticeships, is required to meet the identified shortfall of skills needed by physics- and RDI-driven companies in Wales.⁶ For example, the south Wales compound semiconductor cluster has stated that “planned and expected growth within the cluster could potentially exhaust the local supply of physics candidates”, so “the region is investing in education and outreach programmes to widen potential recruitment”.⁷ It would be beneficial if the strategy could help more (and a more diverse cohort of) young people from Wales to fill these kinds of physics-driven RDI roles.

Q3. 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**

Long-term benefits will extend well beyond five years and, indeed, will be difficult to predict; one of the characteristics of a successful innovation system is a high tolerance for risk and acceptance of failure. The rationale, and support for, the creation of the Advanced Research and Invention Agency is instructive.⁸

However, generalised benefits on a longer time horizon should become clear via a range of measures. Some are established via the national indicators and milestones mandated by the Well-being of Future Generations (Wales) Act 2015, which has a suitable range of metrics that span productivity, health, sustainability, language and wellbeing.⁹As above (see Q2), figures found by the IOP and the Centre for Economics and Business Research regarding physics’ impact on the Welsh economy should continue to increase (with growth having been the trend established in the last decade). Associated benefits would be increased public investment (which leverages private investment); even higher level of job creation, earnings and labour productivity; and inward investment from across the UK, EU and beyond.

The more pressing matter is to give the strategy sharper focus, which will then allow for the appropriate indicators and milestones to be selected. In addition, any monitoring for long-term benefits should be long-term in its analysis e.g., innovation’s contribution to GVA should not be judged on an annual basis or in a way that could lead to knee-jerk reactions. This was the basis of the famous ‘Sowlow paradox’ that the computer age was not apparent in late 80s national productivity statistics.

Q4. 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?

In terms of current sectors in the Welsh economy, the compound semiconductor cluster should continue to be a priority and treated as a key national asset. Other growth opportunities exist in renewables, data and cyber security. Prospects may arise for nuclear, especially in north Wales, if the Welsh Government decides to pursue the project for a medical radioisotope reactor at Trawsfynydd.

The UK Government is unequivocal in how it views innovation, what it believes the benefits to be and how it intends to achieve its targets. It is emphasising technological change, growth and a high-risk, high-reward culture.¹⁰ It is also pursuing a range of ambitious reforms in aid of its strategy.

⁶ Emsi Burning Glass. 2022. *Physics in Demand: The labour market for physics skills in the UK and Ireland*. London: Institute of Physics.

⁷ Ibid.

⁸ House of Commons Science and Technology Committee. 2021. *A new UK research funding agency: Third Report of Session 2019–21*. London: UK Parliament.

⁹ Welsh Government. 2021. *National indicators and national milestones for Wales*. Cardiff: Welsh Government.

¹⁰ Department for Business, Energy & Industrial Strategy. 2021. *UK Innovation Strategy: leading the future by creating it*. London: UK Government.

Wales should not be compelled to copy the agenda and should tailor its programme accordingly, but it is concerning that the strategy has no agreed definition for innovation within the Welsh Government. If the Welsh Government settles on a definition of innovation broader than the one used by the UK Government, or if the Welsh Government puts more emphasis on 'social innovation', it is important that physics and STEM is not sacrificed.

Social benefits are an end rather than a means, and science has as much of a role to play in social equity as it does in productivity growth. Cardiff University's data institute works simultaneously on reducing waiting times in the Aneurin Bevan Health Board and detecting dark matter and gravitational waves. Physics delivers benefits in a multitude of ways, not solely relating to the advance of knowledge or increased productivity.

Regarding future economic sectors, the next breakthrough will be difficult to predict. However, the Welsh Government's own review of digital innovation cautioned against pitting STEM and non-STEM against one another.¹¹ Nesta has also counselled that placing academic subjects in opposition to one another is inimical to the needs of the future economy, while also noting that STEM-related skills and attributes are as complementary to conventional STEM occupations as to some non-STEM occupations.¹²

Q5: What impact, positive or negative, do you think the innovation strategy will have on Wales?

As stands, the document requires more actions and targets for a judgement on potential impact to be possible.

Q6: What new actions are needed from the Innovation Strategy?

In 2021, the IOP commissioned the CBI to conduct research into physics innovators across the UK.¹³ The research showed physics innovators in Wales (more so than UK counterparts) felt direct costs are the most substantial challenge to undertaking RDI, with labour the most significant contributor to the cost pressure. Wales's physics innovators were also more likely than UK counterparts to cite the costs of lab and workshops, as well as insufficient access to testing equipment and simulation or demonstration facilities.

In line with the rest of the UK, skills shortages were also cited as a significant obstacle to RDI, with 79% of respondents saying skills shortages led to RDI activity being suspended or delayed in the past five years and 43% saying activity had to be sub-contracted or outsourced. Roles with a combination of technical and commercial skills were hardest to fill, with shortages particularly acute at the large-scale prototype stage of the innovation pipeline. Concerningly, just 5% of physics innovators said they faced no difficulties recruiting.

Welsh innovators were also more dependent on public support, relying on financial support from the Welsh and UK government and the EU more than UK colleagues did. It was noteworthy that Wales innovators in the sample were much less likely to report that access to financing was a significant barrier than the UK, perhaps in keeping with a trend of limited venture-capital and angel investment in Wales.¹⁴

The analysis also found the COVID-19 pandemic had a more disruptive impact on physics-based RDI in Wales compared with the total UK, but these innovators were optimistic their spending on RDI will increase in the next five years compared to the previous five years.

The strategy includes a range of possible success metrics (RDI spend, employment gain, UKRI grant capture, GVA) but there are not quantities. The Welsh Government could be much bolder and open about where it wishes to take innovation. Clear actions required are:

- Full implementation of the Reid review recommendations (see Q1).

¹¹ Brown, P. 2019. [Wales 4.0: Delivering Economic Transformation for a Better Future of Work](#). Cardiff: Welsh Government.

¹² Bakhshi, H. et al. 2017. [The Future of Skills: Employment in 2030](#). London: Pearson and Nesta.

¹³ CBI. 2022. [Paradigm shift: Unlocking the power of physics innovation for a new industrial era](#). London: Institute of Physics.

¹⁴ British Business Bank. 2021. [The UK Business Angel Market 2020](#). Sheffield: British Business Bank.

- Further uplift to QR to compensate for the below inflation allocations in the last decade (see Q1 and Q18).¹⁵
- Increasing the proportion of full economic costs (FEC) recovered on all publicly-funded research grants (an absence of FEC is known to create additional pressures in regions already lagging for RDI activity).^{16 17}
- Adding science, research and innovation (especially funding) as a standing item to at least one of the Interministerial Standing Committees and Groups established via the 2022 review of intergovernmental relations.^{18 19} This would allow the Welsh Government to track more regularly the rate of grant capture in Wales and, in turn, allow the UK Government to see progress against its target of increasing R&D funding beyond the Golden Triangle (see Q11e).
- Longer-term commitments to STEM outreach programmes, including the Physics Mentoring Project and the Stimulating Physics Network. Such projects should be funded on a multi-annual basis; the challenges they are tackling will not be fixed in a single year (see Q7).
- Mechanisms to encourage early-career academics to seek posts within UKRI's constituent councils; despite representations from the IOP and others, Sir David Grant's recent review of UKRI rejected stronger rules for devolved representation within UKRI (Wales will need to make this happen without any mandatory representation).²⁰
- Supporting businesses to navigate the complex RDI landscape, in particular financing routes, intellectual property protection, and access to external expertise and facilities, building on existing support provided by Innovate UK EDGE and the IOP's Business Innovation and Growth group.
- Upskilling small and/or new businesses in developing successful business cases when seeking private investment, as well as fostering greater confidence among private investors in physics-based and other highly innovative businesses by showcasing successes and demonstrating the typical timescales to generate return on investment
- Promoting best practice across technology transfer offices to boost skills at a broader range of universities.
- Ensuring progression and promotion frameworks employ a holistic approach to recognising skills, building on the Royal Society's Resume for Researchers and UKRI's Resume for Research and Innovation.^{21 22}

Q7: Which aspects of the innovation strategy should remain the same?

The commitment to new STEM outreach programmes is welcome. Enhancement of existing, and creation of new, STEM activity is vital if Wales is to be as innovative a nation as possible. No matter the definition or application of innovation (social, economic, health etc.), there will be a need for a substantial increase in skills predominant in STEM.

The IOP and Welsh Government work together on the Stimulating Physics Network Wales and associated whole-school equity and inclusion project. Reference to the projects in the strategy and associated action plan would be appropriate. The IOP would also point to the Physics Mentoring Project and Our Space Our Future as two initiatives that should be included in any action plan.^{23 24} Such projects should also be funded on a multi-annual basis, allowing for better planning and consistency of delivery.

The strategy includes reference to the new Curriculum for Wales, but this should play a larger role. Pre-16 education is an area wholly devolved to the Welsh Government, giving it far greater scope to influence

¹⁵ Institute of Physics. 2022. [Physics: investing in our future](#). London: Institute of Physics.

¹⁶ Institute of Physics. 2022. [IOP Response to the Nurse Review](#). London: Institute of Physics.

¹⁷ Chaytor, S., Gottlieb, G. and Reid, G. 2021. [Regional policy and R&D: evidence, experiments and expectations](#). Oxford: Higher Education Policy Institute.

¹⁸ Cabinet Office and Department for Levelling Up, Housing and Communities. 2022. [The review of intergovernmental relations](#). London: UK Government.

¹⁹ Drakeford, M. 2022. [Written Statement: Review of Intergovernmental Relations](#). Cardiff: Welsh Government.

²⁰ Department for Business, Energy & Industrial Strategy. 2022. [Independent review of UK Research and Innovation \(UKRI\): final report and recommendations](#). London: UK Government.

²¹ Royal Society. 2021. [Résumé for Researchers](#). London: Royal Society.

²² UKRI. 2021. [UKRI introduces new Resume for Research and Innovation](#). London: UKRI.

²³ Physics Mentoring Project. 2022. [Our Aims](#). Cardiff: Physics Mentoring Project.

²⁴ Our Space Our Future. 2022. [The project](#). Cardiff: Our Space Our Future.

innovation than other policy portfolios. Similarly, great effort has been made to pass legislation to establish the new Commission for Tertiary Education and Research. Far greater co-ordination between RDI and skills should be within the strategy; skills is what will drive the capacity and underlying infrastructure that allows for a resilient innovation system (and for funding to be absorbed by a region).²⁵

Q8: What are the main challenges and barriers to innovation in Wales? What needs to be done to overcome these barriers?

In 2021, the IOP commissioned the CBI to conduct research into physics innovators across the UK.²⁶ The research showed physics innovators in Wales (more so than UK counterparts) felt direct costs are the most substantial challenge to undertaking RDI, with labour the most significant contributor to the cost pressure. Wales's physics innovators were also more likely than UK counterparts to cite the costs of lab and workshops, as well as insufficient access to testing equipment and simulation or demonstration facilities.

In line with the rest of the UK, skills shortages were also cited as a significant obstacle to RDI, with 79% of respondents saying skills shortages led to RDI activity being suspended or delayed in the past five years and 43% saying activity had to be sub-contracted or outsourced. Roles with a combination of technical and commercial skills were hardest to fill, with shortages particularly acute at the large-scale prototype stage of the innovation pipeline. Concerningly, just 5% of physics innovators said they faced no difficulties recruiting.

Welsh innovators were also more dependent on public support, relying on financial support from the Welsh and UK government and the EU more than UK colleagues did. It was noteworthy that Wales innovators in the sample were much less likely to report that access to financing was a significant barrier than the UK, perhaps in keeping with a trend of limited venture-capital and angel investment in Wales.²⁷

The analysis also found the COVID-19 pandemic had a more disruptive impact on physics-based RDI in Wales compared with the total UK, but these innovators were optimistic their spending on RDI will increase in the next five years compared to the previous five years.

In terms of policy solutions, a greater proportion of Wales innovators than UK saw easier navigation of existing support as a key enabler for RDI. A focus on long-term funding schemes was the most popular option, while a majority of Wales innovators also believed greater access to direct funding for early-stage R&D and late-stage development could help increase spending in the next five years.

In meeting these challenges and delivering the solutions, the innovation strategy should recognise that the Welsh Government does not control most of the public funding for RDI; UKRI is reserved to Westminster and the strategy should be more open about that fact. As stands, the strategy lists in detail what the Welsh Government wants UKRI recipients to do with grant funding but, if the money is from UKRI, then UKRI and the UK Government will decide what happens with it. If the Welsh Government wants its own deliverables in Wales, then it will need to institute its own funding, increase existing streams and incentivise UKRI grant capture. As above, the Reid review discussed these issues.

As noted by Wales's physics innovators, the EU funding schemes were a significant aid to EDI in Wales and the form of replacement is not propitious for RDI in future; the IOP has made this case in public and to the Senedd's Finance Committee.²⁸ However, it is important to recognise that the Reid review proposed two set of funding allocations: one if the Welsh Government controlled replacement funds and one if it did not. As stands, the Welsh Government has still fallen short of the latter.

²⁵ Royal Society. 2022. [Regional absorptive capacity: The skills dimension](#). London: Royal Society.

²⁶ CBI. 2022. [Paradigm shift: Unlocking the power of physics innovation for a new industrial era](#). London: Institute of Physics.

²⁷ British Business Bank. 2021. [The UK Business Angel Market 2020](#). Sheffield: British Business Bank.

²⁸ Institute of Physics. 2022. [Response to the Senedd Finance Committee's inquiry into post-EU funding \(13 May 2022\)](#). London: Institute of Physics.

There are additional barriers, which are longer-term and structural. Weak R&D intensity – especially in the private sector – is a well-known issue.^{29 30 31 32} The latest data from the Office for National Statistics (ONS) show Wales’s productivity per hour worked is consistently far below the UK average.^{33 34} Data also show Wales with the lowest level of R&D spending per head.^{35 36}

The private sector’s RDI activity is lower in Wales compared to the rest of the UK; across the last 20 years, the share of private R&D in Wales has never matched the UK level—it is in the high 50% range in Wales, but the high 60% range for the UK.³⁷ Wales is also known to suffer from a lack of ‘home-grown’ or ‘Wales-based’ companies active in RDI, with multinationals rarely locating high-value RDI in Wales. One of the best success stories is, in fact, physics-led: IQE.

As a counterpoint to the weak private RDI intensity, Wales’s physics innovators collaborate more regularly with key knowledge institutions (e.g., universities), business partners and peer networks/associations than in the UK as a whole. With 54% of Wales innovators saying improved opportunities to collaborate were a key driver of their plans to increase investment (vs 35% in the UK as a whole), these partnerships may be central to realising R&D/innovation goals. Again, the Reid recommendations will be instructive.

As above (Q7), the alignment of RDI and skills policy is essential. Barriers between education and economy portfolios should not be created and/or remain. The new curriculum and post-16 regulator should be used to remove such barriers and provide a cohesive landscape for innovation. The inclusion of careers and work-related experiences as a cross-cutting theme in the new curriculum is the kind of strong skills-based approach that can be advanced. More reference to how the strategy will support the curriculum would be welcome.

Q9. 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?

As stands, no. Clearer actions and targets are required.

b. What impact, positive or negative, do you think innovation can have on helping improve the economic prospects and well-being of the people of Wales?

There is substantial evidence of the benefits that RDI brings to economies. This has been well-established over the long-term and the amount of relevant literature is exhaustive.

Specific to physics innovation and Wales, the IOP and the Centre for Economics and Business Research have found physics is worth £7.3bn GVA to the Welsh economy and supports 113,138 jobs; equivalent to 10% of both GDP and full-time employment.³⁸ Physics-based businesses in Wales had a combined turnover of £26.7bn in 2019, a 36% increase in a decade – the fastest rise of the four UK nations and well above the UK figure of 24%. The decade also saw 41% growth in employee pay – again, the largest increase in the UK.

Physics innovators undertaking RDI activity in Wales see innovation as central to their business purpose, with 95% agreeing it is a strategic priority.³⁹ Across Wales, physics innovators are motivated to invest for a

²⁹ Henley, A. 2021. [Wales’ Productivity Challenge: Exploring the issues](#). Manchester: Productivity Institute.

³⁰ Wales Productivity Forum. 2021. [The Wales Productivity Challenge: Insight paper](#). Manchester: Productivity Institute.

³¹ Morgan, K. et al. 2017. [Growing the Value of University-Business Interactions in Wales](#). London: National Centre for Universities and Business.

³² Tilby, E. 2021. [Research and Innovation in Wales: Research Briefing](#). Cardiff: Senedd Cymru.

³³ BBC News. 2021. [Wales one of the least productive parts of the UK](#). London: BBC.

³⁴ Office for National Statistics. 2021. [Annual regional labour productivity](#). Newport: Office for National Statistics.

³⁵ Office for National Statistics. 2021. [Gross domestic expenditure on research and development, by region, UK](#). Newport: Office for National Statistics.

³⁶ Hutton, G. 2021. [Research Briefing: Research and development spending](#). London: UK Parliament.

³⁷ StatsWales. 2021. [Research and development expenditure in Wales by expenditure type and year](#). Cardiff: Welsh Government.

³⁸ Centre for Economic and Business Research. 2021. [Physics and the Economy: Measuring the value of physics-based industries in Wales](#). London: Centre for Economic and Business Research.

³⁹ CBI. 2022. [Paradigm shift: Unlocking the power of physics innovation for a new industrial era](#). London: Institute of Physics..

multitude of reasons; to develop new products/services (88%) and grow the company (83%), to adapt to new technologies (71%) or changing preferences (54%). Wales innovators are also motivated to innovate for societal benefits, with 48% looking to increase sustainability or energy efficiency and 33% motivated to advance general scientific understanding.

Q11. 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?

There is no mention of the substantial reforms to RDI culture being pursued by the Higher Education Funding Council for Wales (HEFCW), nor those being developed and implemented by the UK Government and UKRI.^{40 41 42 43} The strategy should include actions that either align with these aims or propose alternative activities and explain their potential benefits. The quasi-devolved nature of RDI means that the strategy needs appropriate mapping to show alignment and divergence from UK Government schemes.

c. Are there any existing inequalities within the research, development and innovation sector that have not been highlighted in the draft strategy? How could the strategy address these inequalities?

Yes. There are persistent problems with underrepresentation in physics and, by extension, physics-led RDI.^{44 45} The strategy could make more of the bold and progressive reforms that the Welsh Government is pursuing in pre- and post-16 education. In pre-16, the new curriculum is far more radical with regards to equality, diversity and inclusion than those in the rest of the UK.

Particular strengths are the statutory obligations for whole-school approaches and implementation of further reforms arising from the Black, Asian and Minority Ethnic Communities, Contributions and Cynefin in the New Curriculum Working Group.^{46 47} This is a unique strength that can be celebrated and enhanced. If Wales can buck the trend of underrepresentation in physics, then the benefits will flow to individual citizens and the wider society.

That ambition is essential, with underrepresentation taking place in post-16 education. Looking at gender, females have increasingly selected a GCSE in physics, as opposed to the dual award. But there has been no pull through into AS and A level, where female participation remains low. Between 2002 and 2022, females have moved from 43% to 51% of the participants in GCSE physics. However, the participation rates at A and AS level are still as low as 23%.⁴⁸ Such patterns repeat in higher education. The strategy could include more concrete targets, as has been done with gender and apprenticeships.

d. Are there any under-represented groups that have not been identified as priority groups within the strategy?

Yes. With regards to physics and the innovators it produces, we know there is underrepresentation in terms of gender, ethnicity, disability, socioeconomic background and language. As with the previous answer, the strategy should highlight the bold and progressive reforms the Welsh Government is pursuing in pre-16

⁴⁰ Higher Education Funding Council for Wales. 2021. [HEFCW Action Plan for the Concordat to Support the Career Development of Researchers](#). Caerphilly. Higher Education Funding Council for Wales.

⁴¹ Department for Business, Energy & Industrial Strategy. 2021. [R&D People and Culture Strategy: People at the heart of R&D](#). London: UK Government.

⁴² UKRI. 2022. [UKRI strategy 2022 to 2027: transforming tomorrow together](#). London: UKRI.

⁴³ UKRI. 2022. [UKRI corporate plan](#). London: UKRI.

⁴⁴ Institute of Physics. 2022. [Institute of Physics \(IOP\) Response to the House of Commons Science and Technology Committee Inquiry into Diversity in STEM](#). London: Institute of Physics.

⁴⁵ Institute of Physics. 2021. [IOP submission to the All-Party Parliamentary Group on Diversity and Inclusion in STEM inquiry on equity in the STEM workforce](#). London: Institute of Physics.

⁴⁶ Welsh Government. 2021. [Framework on embedding a whole-school approach to emotional and mental wellbeing](#). Cardiff: Welsh Government.

⁴⁷ Welsh Government. [Black, Asian and Minority Ethnic Communities, Contributions and Cynefin in the New Curriculum Working Group: Final report](#). Cardiff: Welsh Government.

⁴⁸ Ibid.

and post-16 education. The IOP believes they hold considerable potential to make physics and, consequentially, physics-led innovation far more representative.

e. In the context of the UK levelling up agenda, how can we further consider Welsh regional diversity within the development of this strategy?

It is well-established that Wales lags in terms of RDI investment and, hitherto, EU funding was used in part to mitigate that fact. The IOP has put on record its belief that the replacements for EU regional development funding are a *de facto* cut to science and innovation in Wales.⁴⁹ The IOP has also made representation to the UK Government in a bid to ensure greater involvement from Wales in the running and structures of UKRI.⁵⁰

Irrespective, the UK Government controls most of the funding for RDI. If the Welsh Government wants to attract more of that funding—from both UKRI and the various ‘levelling up’ pots—then it needs to help organisations in Wales to do so. This should be a key pillar of the strategy.

It is also important to recognise the shift in emphasis from the UK Government. The matter of RDI being underfunded in Wales is long-running, and calls have been made for the UK Government to address the issue regularly. Faults with the EU replacements notwithstanding, it should be welcomed that the UK Government now acknowledges underfunding and is committed to action. This includes setting a target of increasing R&D spend beyond England’s Greater Southeast by 40% and reviewing how HM Treasury’s cost-benefit analyses can better incentivise investment beyond the Golden Triangle.^{51 52}

The innovation strategy should put greater emphasis on *how* the Welsh Government will help Wales to take advantage of the targets and agenda. As stands, too much of the strategy is a description of the activity the Welsh Government wishes to see rather than action that will help funding levels increase. The top-up funding proposed by the Reid review is a quick-to-implement action that should be included.

The creation of a Wales Innovation Network is a positive step, provided it engages strongly with the private sector, and it is positive to see the Welsh Government recognise the network in the strategy.⁵³ It is important to clarify, however, that the Wales Innovation Network does not obviate the need for the recommendations of the Welsh Government’s Reid review. There has been some confusion on this matter (the creation of the network was a recommendation Reid made to Universities Wales via a separate piece of work and does not supplant his official public review).

Q12. 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?

No. As before, the strategy is light on actions and objectives.

Q15. As part of Welsh Government commitment to a vibrant culture and thriving Welsh language, the proposed Innovation Strategy looks to ensure multi-lingual development as standard.

Do you agree that the strategy outlines the ways in which it hopes to successfully create the right conditions to increase the use of the Welsh language across all proposed innovation activities? If not, what additional activities should be undertaken?

⁴⁹ Institute of Physics. 2022. [Response to the Senedd Finance Committee’s inquiry into post-EU funding \(13 May 2022\)](#). London: Institute of Physics.

⁵⁰ Institute of Physics. 2022. [IOP Response to the Nurse Review](#). London: Institute of Physics.

⁵¹ Department for Levelling Up, Housing and Communities. 2022. [Levelling Up the United Kingdom](#). London: UK Government.

⁵² HM Treasury. 2020. [Green Book Review 2020: Findings and response](#). London: UK Government.

⁵³ Universities Wales. 2022. [Wales Innovation Network](#). Cardiff: Universities Wales.

Subject participation from Welsh-medium communities and schools is not equitable. The ability to maintain Welsh-medium learning in physics (and other sciences) is a substantial barrier to access, as is the associated lack of physics-trained Welsh-medium teachers (also the case for other sciences).⁵⁴ In turn, this prevents many young people from progressing into a subject that contributes substantially to Welsh RDI. Further STEM outreach would be appropriate, as would reconsideration of incentives for initial teacher education.

Q16. The strategy aims to create a culture of innovation in Wales, one which collaborates, shares risk, encourages participation and supports the ecosystem to innovate.

a. What does an innovation culture mean to you? What is needed to develop an innovation culture in Wales?

Education and skills are wholly devolved to Wales and should be playing a much greater role in the strategy. They are the most significant levers at the Welsh Government's disposal to create a new culture. As outlined in previous answers (see Q8), Wales's physics innovators felt direct costs are the most substantial challenge to undertaking RDI, with labour the most significant contributor to the cost pressure. Wales's physics innovators were also more likely than UK counterparts to cite the costs of lab and workshops, as well as insufficient access to testing equipment and simulation or demonstration facilities.

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In terms of policy solutions, a greater proportion of Wales innovators than UK saw easier navigation of existing support as a key enabler for RDI. A focus on long-term funding schemes was the most popular option, while a majority of Wales innovators also believed greater access to direct funding for early-stage R&D and late-stage development could help increase spending in the next five years.

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?

See answers to Q8 and Q16a.

Q17. Do you think this Innovation Strategy would positively impact you? If not, how could this be changed?

As stands, there is insufficient evidence to make a judgement.

⁵⁴ Thomas, E. and Parry, N. M. 2021. [Provision for Welsh-medium STEM subjects: an exploratory study](#). Bangor: Bangor University.

⁵⁵ British Business Bank. 2021. [The UK Business Angel Market 2020](#). Sheffield: British Business Bank.

Q18. 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?

The IOP disagrees with the strategy's argument that fundamental research has taken too much of the funding at the expense of applied research and RDI. The truth is that Wales lags in both areas and it is more a case of an overall deficit. The strategy should be implemented in a way that protects fundamental, discovery-led physics and science. As outlined in previous answers, it is the surest means for futureproofing and bolstering economic resilience; it is difficult to predict which branch of research or 'niche' area will suddenly become crucial.

Accordingly, the Reid review recommendations now need to be implemented in full. Too much time has passed, with QR and other funding streams failing to keep pace with cost pressures. The Welsh Government has been asked, consistently and by a range of sectors, to implement all the Reid recommendations. Without doubt, a single body can implement the reforms. Ideally, the reforms could be implemented before the commission is fully online later this decade.

It is also worth noting that the UK Government is maintaining its 2.4% GDP target, with a range of supplementary targets on regional spread, and the Irish government has its own target of 2.5% GDP. The Welsh Government cannot set an equivalent target, as it does not have the same fiscal powers as the other governments, but the extent of its ambition should be up for discussion. Notably, its five priorities for RDI amount to maintaining the status quo, vowing to:

“Ensure Wales has a fair share of available research, development and innovation funding and we will work to secure funding levels at least equivalent to those we received historically, via the European Union. We will also work to address historic underfunding from both competitive and non-competitive UK investment sources.”⁵⁶

Wales was insufficiently RDI-active before Brexit, so aiming to return to those funding levels is unlikely to meet the challenges we face. The new body for innovation should consider whether current ambitions are sufficient.

Q20. We would like to know your views on the effects that the Innovation Strategy for Wales would have on the Welsh language, specifically on opportunities for people to use Welsh and on treating the Welsh language no less favourably than English.

What effects do you think there would be? How could positive effects be increased, or negative effects be mitigated?

As outlined previously, Welsh-medium pathways in science are not currently at an equitable level.

Q21. Please also explain how you believe the proposed strategy could be formulated or changed so as to have positive effects or increased positive effects on opportunities for people to use the Welsh language and on treating the Welsh language no less favourably than the English language, and no adverse effects on opportunities for people to use the Welsh language and on treating the Welsh language no less favourably than the English language.

As above, there is a need for stronger alignment with the Curriculum for Wales and the actions proposed by the Welsh Government in its 10-year plan for the Welsh-medium education workforce. The shortfall in physicists and the barriers faced by Welsh-medium students is hampering innovation.

⁵⁶ Drakeford, M. 2021. [Written Statement: Five priorities for research, development and innovation](#). Cardiff: Welsh Government.

Q22: 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:

One final matter is the nature of a cross-government strategy and cabinet ownership. If the strategy is truly cross-government, then careful consideration should be given to the ministerial portfolio. The UK Government moved much of its innovation strategy planning into the Cabinet Office in order to be as bold as possible.