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Welsh Government

Innovation Wales Consultation

Institute of Physics in Wales response to the Welsh Government's consultation on the development of an Innovation Strategy for Wales

A full list of the Institute's responses and submissions to consultations can be found at www.iop.org

July 2012

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Innovation Wales
QED Centre,
Main Avenue,
Treforest Industrial Estate,
Treforest,
Pontypridd
CF37 5YR

Dear Sir / Madam,

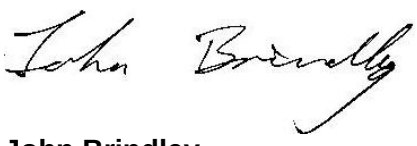
Welsh Government: Innovation Wales – Call for Evidence

The Institute of Physics in Wales (IOPW) is part of the Institute of Physics, which is a leading scientific society promoting physics and bringing physicists together for the benefit of all. The Institute of Physics has a worldwide membership of around 40 000 comprising physicists from all sectors, as well as those with an interest in physics. It works to advance physics research, application and education; and engages with policy makers and the public to develop awareness and understanding of physics. Its publishing company, IOP Publishing, is a world leader in professional scientific communications.

The Institute of Physics in Wales (IOPW) welcomes the opportunity to contribute to the Welsh Government's consultation on the development of an Innovation Strategy for Wales.
If you need any further information on the points raised please do not hesitate to contact us.

Yours sincerely

Professor Chris Allton
Treasurer, Institute of Physics in Wales



John Brindley
Director, Membership and Business, Institute of Physics

Q1) In what ways do you think innovation can help improve the economic prospects and well being of the people of Wales?

The foreword by The First Minister of Wales and the Minister for Business, Enterprise, Technology and Science for *Science for Wales*[1] clearly states "A sound and vibrant scientific and technological base has substantial potential to boost the economy, through advanced ideas, skills and developments and an effective translation through innovation to more high quality jobs."

Innovation not only boosts the economy but can help deliver improved living standards. The *Innovation and Research Strategy for Growth*[2] states "A large body of evidence shows that innovative economies are more productive and faster growing. They deliver higher returns on investment and increased living standards. They are better at responding to changing circumstances through redeploying old activities and jobs. They are more able to find solutions to global challenges such as reducing dependence on fossil fuels, helping people live longer and healthier lives."

Physics-based industries, where physics knowledge and expertise are critical to the survival of the businesses, make a substantial contribution to the economy of Wales. Physics-based industries contribute a greater proportion of wealth to Wales than to the UK as a whole. Between 2000 and 2005 physics-based businesses accounted for 14.2% of total national turnover compared with 8.6% in the UK.[3]

This comparatively high level of turnover generated in physics-based sectors is reflected in higher levels of turnover per employee in the sector. The turnover per employee between 2000 and 2005 in physics-based sectors was, on average, £214,000 per annum. This is £141,000 more than the Welsh national average where turnover per employee equates to £73,000. It is also much greater than that of banking, finance and insurance as well as the construction sector in Wales. (The equivalent figure for turnover per employee in physics-based sectors in the United Kingdom was £165,000 – the UK national average is £72,000.)

Physics-based sectors in Wales account for (2005 figures):[3]

- more than 50,000 jobs, around 4.4% of the workforce.
- £4.1 billion of GVA, 10% of total economic output of Wales.
- £13 billion in turnover, making up 14.3% of all total business turnover in Wales.
- High value jobs, the GVA per employee is £80,000, over double the national average in Wales.

While the majority of people working in physics-based sectors will not be directly engaging in 'physics' through their everyday work, the existence of the sectors (and so their jobs) is critically dependent on physics.

Q2) What would a more innovative Wales look like?

Government procurement supporting and driving Welsh innovation
(see response to Q5)

[1] Science for Wales – A strategic agenda for science and innovation in Wales

[2] Innovation and Research Strategy for Growth, Department of Business, Innovation & Skills, December 2011

[3] The importance of physics to the Welsh Economy, centre for economics and business research ltd, 2007

Increased research and development investment

A more innovative Wales would have a higher spend on Research and Development (R&D). The Welsh Government StatsWales website shows that the gross domestic expenditure on research and development (GERD) in Wales in 2010 was £527 million. The Welsh Government StatsWales pages include a detailed dataset on GERD. Some of the data has been reproduced in Table 1.

	Wales	Northern Ireland	Scotland	North East England	North West England
Total expenditure on R&D (in millions)	527	502	1,890	536	2,730
Higher education bodies R&D	262	159	968	239	592
Business enterprise R&D	244	324	622	297	2,047
Government and Research Councils R&D	21	19	300	~	91

Table 1 - Latest R&D by type of expenditure and UK country / English region (StatsWales)[4]

A concern is that if you rank the UK countries and English Regions, Wales is bottom of the table when it comes to business enterprise R&D (2010 figures).

While R&D as a proportion of GDP (Gross Domestic Product) cannot be said to be a perfect measure of the strength of innovative business, it is a measure that can easily be compared internationally. Fig II-2b (page 13) of the European Commission report on *Exploring regional structural and S&T specialisation: implications for policy*[5] shows the regions with an R&D intensity (GERD as % of GDP) between 1-2%. Wales is situated at the bottom end of this list with a R&D intensity of 1.04%. The UK has a 'Lisbon' target of spending 2.5% of GDP on R&D therefore we suggest that Wales also makes 2.5% of GDP its target on R&D spend.

Cross-section of businesses (size and sectors)

An innovative Wales would have at its core a strong research base that encompasses both pure and applied research areas. Sometimes the applicability of a discovery may not be immediately relevant. Reference 25 of *Science for Wales*[1] states "Many great breakthroughs which have transformed the way we live have come from undirected, curiosity driven research such as antibiotics, the laser, nuclear fission, optical fibres, optoelectronics, polymers, the transistor, DNA & genomics and magnetic resonance imaging (MRI)." It is notoriously difficult to predict scientific breakthroughs. Therefore, it is counterproductive to fund only research which is perceived to be of immediate public benefit. Some examples of the economic benefit of pure research can be seen in *The economic impact of research conducted in Russell Group universities*.[6]

Wales also needs a broad base of innovative businesses in order to improve its performance in bringing innovation physics-based "things" to the market. The Department for Business, Innovation & Skills (BIS) produces *Business Population Estimates for the UK and Regions*[7]. It is a concern that Wales has a low share of enterprises in the professional, scientific and technical activities sector (Table 2), especially as the data given in response to Q1 shows that physics-based sectors in Wales account for a significant number of high-value jobs and GVA (2005 figures).

[4] www.statswales.wales.gov.uk/TableViewer/tableView.aspx?ReportId=11296

[5] http://ec.europa.eu/invest-in-research/pdf/download_en/kina24049enn.pdf

[6] www.russellgroup.ac.uk/uploads/RG_ImpactOfResearch2.pdf

[7] www.bis.gov.uk/analysis/statistics/business-population-estimates

	Figure 8	Figure 9	Figure 10
	Number of private sector enterprises per 10,000 adults, start of 2011	Share of enterprises in the Professional, scientific and technical activities sector, start of 2011.	Share of enterprises in the Construction sector, start of 2011.
London	1188	16.6	15.4
South East	1078	15.3	19.5
East of England	1002	14.4	22.5
South West	982	13.8	21.3
East Midlands	838	12.7	18.5
North West	803	11.2	17.8
Y. and the H.	767	10.5	20.8
West Midlands	757	11.9	21
North East	552	14.3	20.1
England	**927**	**13.9**	**19.2**
Northern Ireland	**861**	**7.3**	**23.9**
Wales	**784**	**7.6**	**19.7**
Scotland	**673**	**12.4**	**17.6**

Table 2 - Business Population Estimates for the UK and Regions 2011[8]

Increase share of funds won competitively

One of the suggestions of the *Lambert Review of Business-University Collaboration*[9], "the most effective forms of knowledge transfer involve human interaction" shows that people are the most important part of the innovation equation. Schemes are run by the UK research councils for people to cross the divide between industry and academia. It is a disappointment that no university in Wales has a Knowledge Transfer Account and only two Industrial Doctorate Centres (and these two involve the same University).

A funding body that awards grants to business is the Technology Strategy Board (TSB)[10]. A recent initiative is the Catapult centres. "Catapults bridge the gap between universities, research and technology companies"[11]. It is not clear what the Welsh involvement is in the catapults that have already been announced.

A more innovative Wales would gain a larger share of the UK funding agencies funds. We should look into opportunities such as these and address the reasons why we are not obtaining these kinds of support. Is it because we are not applying, or that our applications are unsuccessful? We need to address the reasons and increase the funds that Welsh businesses and universities win competitively.

[8] www.bis.gov.uk/assets/biscore/statistics/docs/b/bpe_2011_stats_release.pdf

[9] Lambert Review of Business-University Collaboration, December 2003

[10] www.innovateuk.org/

[11] https://catapult.innovateuk.org/

Q3) What are the barriers preventing Wales becoming more innovative? What needs to be done to overcome these barriers?

Capital investment in the science base is important, as it provides the research on which future innovation is founded, and helps to ensure sustained long-term growth. Experimental facilities such as the Diamond synchrotron or ISIS neutron sources provide excellent examples of how capital investment can lead to technological advances. “Significant amounts of present-day research, resulting in major science-based innovation, are carried out on large-scale centralised facilities that require substantial capital investment,” says Prof. Mike Poole of Daresbury Laboratory. Expected breakthroughs as a result of work at ISIS, for example, range from novel ways to heal cleft palates to a new type of easily transportable hydrogen fuel. *Science for Wales*[1] states that “there are too few UK or international facilities on Welsh soil.” We need to ensure that when new facilities are planned that Wales is seen as potential location for these facilities. We should not be responding reactively following an announcement of a new facility but should be involved in the formative discussions.

R&D can be a long-term project. Often years will elapse between the original discovery or innovation and a first sale, and further time still before the company turns a profit. These long timescales mean that for science-based companies to survive and succeed, they need access to the right investment and support at the right time. Even with appropriate investment, within the physical sciences in particular, there is the further barrier that technologies and innovations tend not to reach the market as stand-alone products, but are instead incorporated into other products or devices e.g. a novel electric component in a mobile phone handset. In the same way, there is often not a single precise application, benefit or market trajectory for a new idea in the physical sciences, meaning that the innovative component must find its way through several companies, and several R&D cycles, before it can be seen to be profitable. As such, for physics-based innovations to be commercialised in the UK, there must be a chain of companies producing technologies or devices into which new innovations can be incorporated. A critical mass of innovative small and large companies, and supply chains, is an essential part of any commercialisation landscape.

Q4) What experience do you or your organisation have of the initiatives that support innovation? How accessible and effective are the various forms of innovation support programmes?

The TSB is the key government agency supporting innovation in business and creating an environment where businesses are encouraged to invest in R&D and knowledge exchange between universities and business. Its returns on investment, even at what could be described as a very early stage of its existence, have been significant, with figures of 700% quoted last December,[12] however the true impact of the TSB will be seen in the long term. A more relevant short-term indicator should perhaps be the positive responses of companies that have engaged with the agency’s programmes.

We suggest that the Welsh Government engages fully with the TSB to ascertain how Welsh businesses are engaging and whether mechanisms that already exist in Wales could support the TSB in reaching out to businesses in Wales.

[12] www.guardian.co.uk/commentisfree/2011/dec/08/4g-mobile-windfall?newsfeed=true

Q5) How should innovation in Wales be better supported in the future? What should be the role of Government?

An area that has an important role to play in promoting commercialisation, and which has perhaps the strongest need for cross-government, long-term support is public procurement. The government procurement budget is orders of magnitude greater than the direct and indirect support provided to research and science-based companies through other programmes. Innovative procurement has the potential to be a 'game-changer' in the support and growth of high-technology businesses, but it needs a strong and visible commitment from the government.

There must be effective intermediaries to link research with the steps to commercialisation. These include, but are not limited to, the work done by agencies such as the research councils and the TSB, and also many effective networks and programmes in science parks and other private sector enterprises. This category should also include accountants, lawyers and other professionals; areas that are sometimes neglected in analyses, but are essential for effective linkages between researchers, businesses and investors.

We recommend that support is provided for universities and businesses in Wales to take advantage of sources of funding to enable the flow of people between academia and industry. The role of Government should be to monitor the proportion of funding won by Welsh universities and industry and help support these in gaining a larger share (see response to Q2).

We recommend that the Welsh Government follows the principle on page 8 of the *Science for Wales*[1] strategic agenda – "tracking and pursuing UK and European opportunities to attract institutions, facilities, science and innovation capability and investment into Wales."

The Welsh Government should look at the innovation landscapes of certain other European countries, for example Finland and Germany. These countries seem better suited to retaining, investing in and growing science-based businesses, and a closer understanding of why this is would also be beneficial.

For example, the *Proposal for Finland's National Innovation Strategy*[13] states "Finland has succeeded well in international comparisons of education, research and technology, being one of the leading countries in the world in terms of innovation and the quality of enterprises' operating environments. Finland's success has largely been based on its high-quality educational system, longterm investments by enterprises and the public sector in research & development, and its wellfunctioning, networked institutions."[13] However, they also realise that in a rapidly changing global landscape that they need to pursue new opportunities. "Finland's long-term investments in expertise and technological research & development have produced good results, and its successful science and technology policy has created a basis for many successful industries. This provides a good basis for constructing the future. However, the challenges of growth and competitiveness can no longer be tackled only by means of a sector-based, technology-oriented strategy. Instead, a demand-based innovation policy must be strengthened alongside a supply-based innovation policy."

[13] http://ec.europa.eu/invest-in-research/pdf/download_en/finland_national_innovation_strategy.pdf

There are many factors in an innovation landscape. Some of these factors include transport links, broadband speed[14], skilled workforce etc. We suggest that the Welsh Government looks at the existing body of knowledge around these factors and decides on actions to take, in conjunction with the other relevant government departments, to address these factors.

There are already industrially focussed groupings in Wales who have knowledge and experience of the road to innovation. The Welsh Opto-Electronics Forum is "a consortium of Welsh companies, University research groups, users and support organisations".[15] They have produced a photonics enabled innovation strategy for Wales which suggests a new innovation model for Wales.[16]

Q6) What facilities or resources exist which may help differentiate Wales and provide a potential competitive advantage?

Wales has a number of small to medium sized businesses. We should therefore look into schemes where large companies invest time and resource into business that could potentially form a part of their supply chain, or become business partners, for example *Microsoft BizSpark*[17]. Such programmes have been evident in other countries but less so in the UK. The Welsh Government should look into what the barriers are in Wales to such projects.

Q7) What should be the role for knowledge transfer from Higher and Further Education and the use of intellectual property in supporting innovation?

Q8) Do you have any other comments you would like to make or are you aware of any information which might be useful to the Welsh Government in formulating a new Innovation Strategy?

The strategy should be long term, and far-sighted but also include short to medium term action points. "Building science and innovation capacity is a long term endeavour. It requires a sustained and consistent approach if we are to achieve impact in economic, environmental and societal outcomes."[1] The strategy will need to span many policy areas and several government departments. For example, education is part of the innovation landscape. A skilled workforce, and one that is able to adapt to a rapidly changing technological landscape, is crucial.

[14] Ofcom maintain a broadband map (http://maps.ofcom.org.uk/broadband/index.html). On overall performance Wales has most of its regions in rank 5 (the map is coloured in a scale of 1 to 5, with 1 the highest or fastest, and 5 the lowest or slowest).

NESTA - Getting up to speed: making super-fast broadband a reality www.nesta.org.uk/library/documents/Getting-up-to-speedv5.pdf

DTI - Exploiting the broadband opportunity: lessons from South Korea and Japan www.lboro.ac.uk/departments/mm/research/IPM-KTN/pdf/Globalwatch_archives/exploiting-the-broadband-opportunity-lessons-from-south-korea-and-japan.pdf

[15] www.wof.org.uk/

[16] www.wof.org.uk/resource/WOF%20Photonics%20Enabled%20Innovation%20Strategy%20for%20Wales.pdf

[17] www.microsoft.com/bizspark

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IOPW has over 1000 members and it aims to promote the role of physics in society, covering education, health, the environment, and technology. Its membership is wide-ranging and multidisciplinary, including the education, industrial, medical, and general public sectors. It also seeks common purpose with other organisations to promote science and science-based learning and to influence science policy. Special emphasis is placed on supporting physics teachers by promoting in our schools the value, joy and benefits of a knowledge of physics and its applications.

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