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Welsh Government

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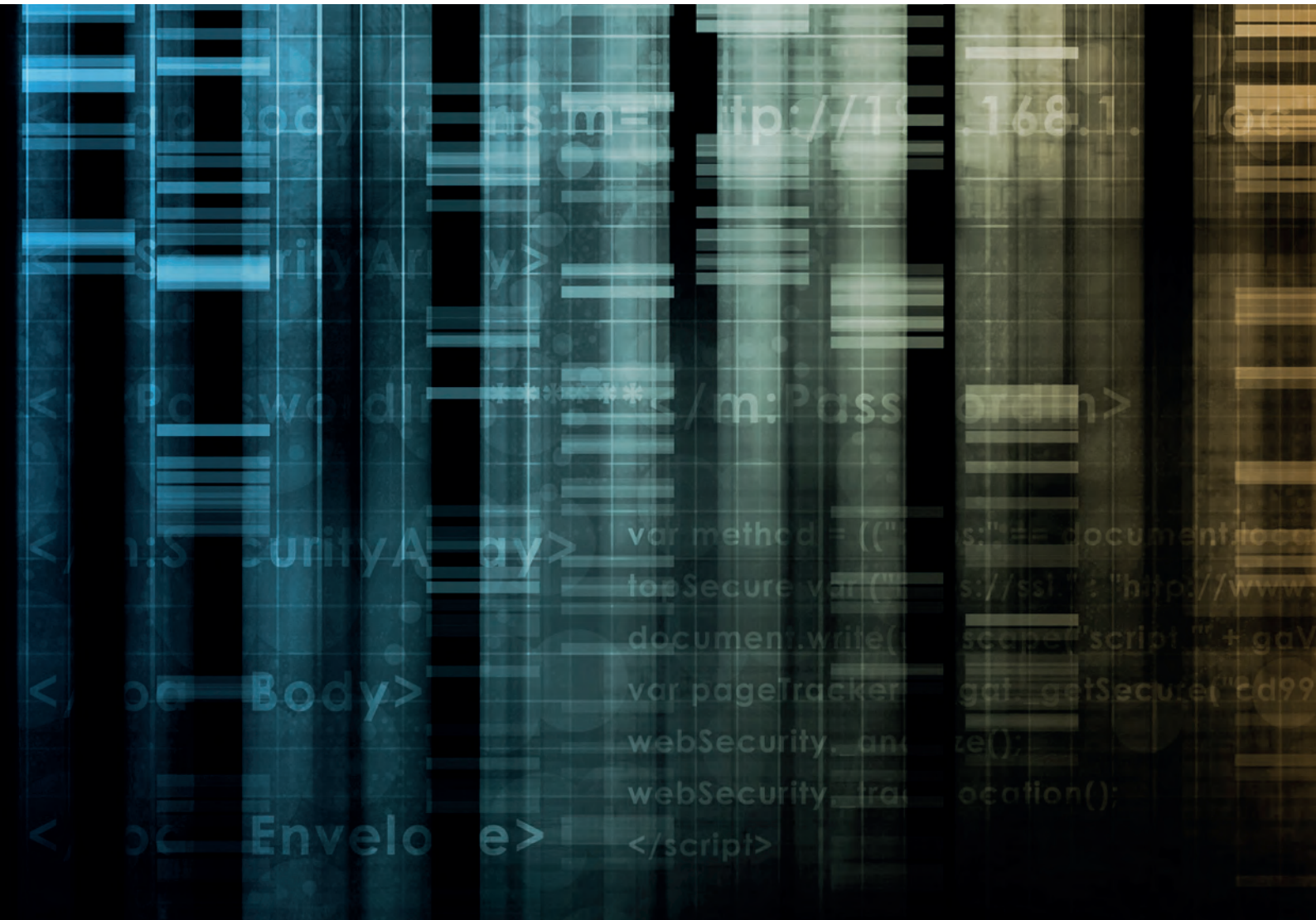
Delivering Science for Wales 2012-13

Annual report on our strategic agenda for science and innovation in Wales



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Foreword

A year ago we launched our strategic agenda for science – *Science for Wales*. It set out an ambitious approach to helping science thrive in Wales to benefit us all through better jobs in a stronger economy, with enhanced health and an improved environment.

We are clear that actions both by the Welsh Government and our partners in higher education and business are needed to make the vision set out in *Science for Wales* a reality. Whilst some actions can be completed quickly others will take sustained effort over time. It can take fifteen years to build up a successful research group in a University. This progress report focuses on our first steps over the past twelve months.

We are already making significant progress through our Ser Cymru programme to attract world-class researchers and to create new research networks to help Welsh universities to win more competitive funding and collaborate more effectively.

Promoting business innovation is a cornerstone of *Science for Wales*. We received a wide range of views and advice on business innovation in response to our consultation on a new innovation strategy. A peer review version of our response to the findings, *Innovation Wales*, has been published with the final version due very soon.

We are committed to encouraging and supporting young people to study science and go into scientific careers. This year has seen two major Welsh Government reviews – on qualifications, which has now reported, and on curriculum and assessment, which we expect to report later in the year.

I am pleased to see the National Science Academy continuing its work of coordinating and supporting science engagement across Wales.

Although it is early days for this long-term strategic agenda, we have seen positive steps towards strengthening research in our universities; towards helping businesses in Wales innovate and engage with technology and science opportunities; and towards bringing more young people into the world of science. In early March I chaired the first meeting of the *ad hoc* Ministerial group – the group that Cabinet committed to establish to oversee this broad-reaching and vital agenda. Further meetings will monitor progress through the life of *Science for Wales*.

Professor John Harries has now retired at the end of his three year term as the first formal Chief Scientific Adviser for Wales and we want to reiterate our thanks to him for his critical evidence based approach to developing our plans and his energy in driving them forward.

Mrs Edwina Hart MBE CStJ AM
Minister for Economy, Science and Transport

Introduction by the Chief Scientific Adviser for Wales

I said in my introduction to *Science for Wales* that Wales has clear objective scientific strengths which we should rightly praise rather more than we have done. Equally, though, we needed to guard against complacency and to raise our performance in securing research funding. I wanted to see regular and strengthened engagement with the funders of research and processes to judge research quality. I was pleased at the immediately positive reaction from the Cabinet to what I felt we should do to improve things.

Over the past year Sêr Cymru has commenced – with consultative workshops and meetings ahead of a bidding round which has produced very encouraging results – both in terms of the calibre of the world-class scientists we need to draw to work in Wales and of the National Research Network proposals, seeking to make our academics better and more effective at winning funding for their research work. I am delighted that the first appointments can now be made.

I am greatly encouraged at such positive progress, but we must keep in mind that we are seeking to make true and deep transformations within and across the research universities in Wales so they continue to thrive and grow in the respect of their peers. This is not an overnight process and we must give it time to bear fruit.

I and many others see the vital importance of bringing on the coming generations of scientists and researchers for Wales. We ought to offer our children a stimulating, relevant STEM (science, technology, engineering and maths) curriculum, delivered by motivated and up to date teachers. This year has seen a curriculum and assessment review brought forward by the Minister for Education and Skills. This is due to report later in the year. My team, among others, are engaging to put the case for science and maths.

Science for Wales did not set out detailed plans for innovation. It showed how important it was that we have businesses that can adapt and move swiftly to exploit opportunities in markets and in technologies to help boost the economy of Wales. Economic prosperity is a core driver for *Science for Wales*. The innovation strategy has taken longer than originally anticipated. We needed to follow European best practice and consult as widely as possible. Now that the European Smart Specialisation review has taken place, the innovation strategy is imminent. It will provide a vital complement to the measures set out in *Science for Wales* to make Wales more prosperous.

Within the Welsh Government, I have seen science and science advice given greater prominence, through the founding of a Science Division. Work has started on drawing together the scientists we have working for Wales here in Government in terms of their training, career paths and support from other scientific colleagues. The aim is to deliver better advice to policy makers and Ministers on the scientific and technical challenges we face.

I could not have done my job over my three year secondment without the

able assistance of the advisory council I appointed to help me – the Science Advisory Council for Wales. This group, all distinguished in their own fields, have been a support and sounding board for me in my role as Chief Scientific Adviser and I would like to record my thanks to them all. I also wish to thank the team in the Office of the Chief Scientific Adviser for Wales, who have supported and helped me with great ability and integrity.

Over the last year we have started on our way with *Science for Wales* and already seen progress made, but there is much more to do – by Welsh Government itself but also by our partners in this endeavou, the universities of Wales, our innovative and technological businesses, our schools and colleges. I look forward to seeing further such progress in the years to come.

Professor John Harries
Chief Scientific Adviser for Wales

(retired 30 April 2013)

Delivering on our commitments

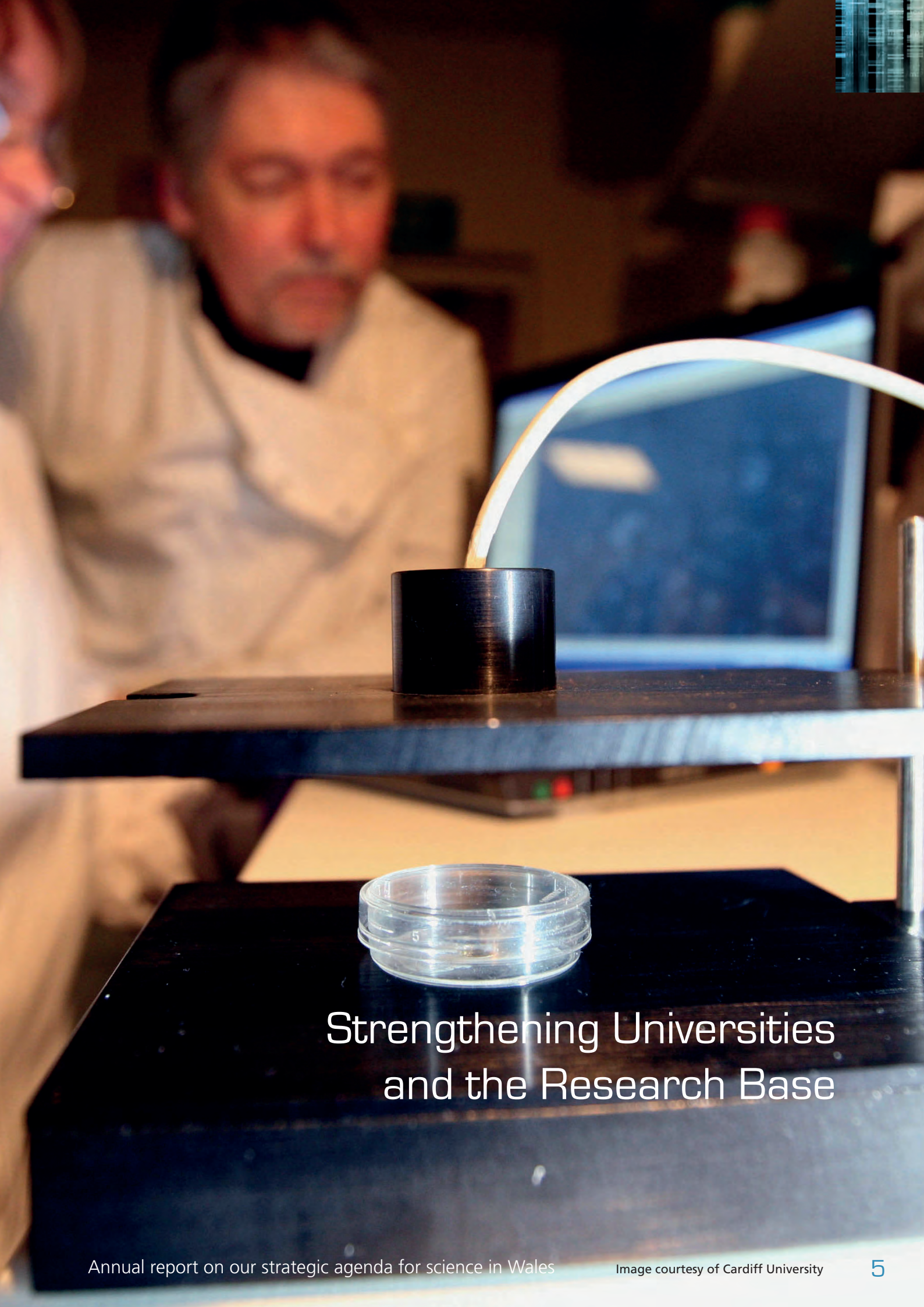
Science for Wales saw the Welsh Government set out its strategy for science, the principles it would follow in implementation and some commitments that it would aim to deliver within its first year. Other commitments and proposals for the longer term were set out too – for the Welsh Government, for partner institutions and businesses, with the aim of delivery in up to five years. We report here on these year one commitments, along with any progress towards the longer term objectives.

Many of the actions set out in *Science for Wales* are designed to move us towards excellence in science and its exploitation, with the ultimate aim of supporting achievement of goals in our *Programme for Government*. Those *Programme for Government* goals where science is a key contributor are:

'The building of strong links with our anchor companies…embedding them in the Welsh economy by developing close links with our further and higher education institutions.'

'Encouraging collaboration between our universities and the best universities outside Wales…and the scientific knowledge and expertise of our world-leading academic groups to be made available to support innovation and job creation in Wales.'

Science also underpins several other *Programme for Government* priorities, from health to education and the natural environment.



Strengthening Universities and the Research Base

Image courtesy of Cardiff University

Science for Wales highlighted the need for Wales to coordinate its limited resources and have an overall plan to strengthen science and innovation, providing all partners with leadership and a sense of direction.

Universities and industry had begun to do this. However it was recognised that the effort must continue, building on the opportunities in this strategic agenda. They must improve communications between research groups and their members, as part of a drive at institutional leadership level to move rapidly to a better structure for the higher education sector. Overall, better leadership, management and coaching skills in science are needed. This section sets out the progress made in the first year.

Chapters 1 and 6 highlighted measures to strengthen our university research base. We said we would aim, as a first step, to achieve at least parity in securing competitively funded research with the other UK nations.

In 2009-10 the amount of research funding won by Welsh higher education institutions was 3.3 per cent against our population share of 4.9 per cent. This figure increased to 3.4 per cent in 2010-11. The latest figure for 2011-12 is also 3.4 per cent. These figures, however, still reflect a period before the publication of *Science for Wales* and in any case need to be considered as a trend over a number of years.

We said we will aim for the proportion of research in Wales's universities achieving 3* and 4* quality and impact levels to reach the highest UK level.

The next assessment will be available after the Research Excellence Framework (REF) is undertaken in 2014. This is a long-term target with assessments taking place every few years. The last assessment put Wales at 49 per cent compared with England's HEIs at 55 per cent, although there are a number of factors affecting this figure, set out in a recent paper by Professor Robin Williams.

We said we will set up a new initiative called 'Sêr Cymru', with two elements. The first of these is setting up of National Research Networks, led by specialist directors, for each of our three major grand challenge areas, or others deemed to be a priority to support the grand challenges. The second is a scheme to attract new global 'stars', world class research chairs, to work in Wales.

Negotiations for Sêr Cymru chairs and to establish national research networks are well advanced. Decisions have been made on expressions of interest and full proposals for Sêr Cymru chairs, which universities are now taking forward in negotiation with individuals. We have emphasised that we will not compromise on research excellence and recognise that it may take time to secure the talents of the right individuals.

Considerable efforts have been devoted by research partners to develop national research networks to cover the Grand Challenge areas. These networks will bring together the best research in Wales, identify the research and funding opportunities and pursue these under an agreed science strategy. The Networks will include a graduate doctoral training school, leadership of knowledge transfer and commercialisation, and promotion of science technology and mathematics.

The networks will help research-intensive universities come together to build sustainable and competitive collaborations to drive the 'pursuit of excellence'. We have adopted an open and collaborative approach to selecting the network and peer reviewers and research funding agencies have helped focus the proposals on areas likely to have the most impact on the programme's objectives.

Following a series of workshops with partners and external review, much of the scope and approach for these networks is now agreed.

> We said we recognise the importance of maintaining the strength of four crucial underpinning activities and will consider support for these. They are Science, Technology, Engineering and Maths (STEM) outreach; e-infrastructure; exploitation of intellectual property and fundamental research.

Activities to support all of these fields have taken place and are reported on under the appropriate section below. It is too early to consider national research networks in fundamental research disciplines, the initial networks in the 'grand challenge' areas must be set up and seen to be functioning effectively before we consider the scope for more.

The Life Sciences and Health Grand Challenge

The Welsh Government life sciences sector panel has provided a strong vision and focus for accelerating growth of the life sciences sector in Wales. Creating a strong life sciences and health ecosystem to bring the whole sector together and amplifying excellence in Wales to a global audience is paramount.

A study commissioned by the life sciences sector panel identified around 300 life sciences companies in Wales, employing around 10,000 people. When public sector and academic jobs and economic impact are factored in, these figures are considerably greater.

BioWales is one of the UK's largest international life sciences conferences and brokerage events outside London. BioWales 2013, attracting some 500 delegates, showcased Wales based expertise and provided top international networking opportunities. The conference announced the twinning of the life sciences sector in Wales with one of Europe's strongest biotech clusters, Medicon Village, a dynamic hub for research, innovation and entrepreneurship within life sciences in Lund, Sweden.

In Wales we have a range of funding mechanisms and infrastructure to support the development and growth of business in the life sciences sector. This includes online portals to help businesses find and access specialised knowledge, facilities and support from Universities and Colleges in Wales (Expertise Wales). It also includes information and support for companies wishing to undertake clinical research in Wales (Health Research Wales).

Life Sciences Investment Fund

A £100 million venture equity fund for the life sciences sector in Wales is now operational. The Welsh Government has invested £50 million in the fund, demonstrating its commitment to growing the sector and ensuring Wales can retain the value of commercial activity created here. Arthurian Life Sciences has been awarded the fund management contract and has committed to raising at least another £50 million. The fund is being used to invest in the most promising life sciences businesses in Wales and to attract life sciences companies and entrepreneurs to Wales.

Life Sciences Hub

The Minister for the Economy, Science and Transport announced at BioWales 2013 that a Life Sciences Hub is to be established and become operational in 2013. The hub, a 12,000 sq ft site located in Cardiff Bay, will be a shop window for the life sciences sector in Wales. The Minister said "Wales has to take advantage of its scale to be connected, focussed and fast." The hub will serve as a 'one-stop-shop' for all integrated stakeholder support in life sciences. It will house the life sciences fund and seek to attract overseas investment.

Welsh Wound Innovation Centre

A new £4 million national centre of excellence in wound prevention and treatment is to be established in Wales to deliver health and wealth benefits for the people of Wales. The centre's leader, Professor Keith Harding, describes wounds as a "silent global epidemic". The Welsh Wound Innovation Centre will improve management and delivery of wound prevention and treatment, enhancing quality of life for patients. The Centre will provide better diagnosis and treatment, resulting in fewer hospital admissions and shorter hospital stays, reduce healthcare costs for NHS Wales. Wound healing is a niche specialty in Wales, and there is a strong network which links the business, clinical and academic communities. The Centre will be funded by the Welsh Government, all seven local health boards and the private sector, with the aim of becoming self-financing within three years.

The new Centre will act as a focus for research, clinical and commercial excellence in wound prevention and treatment. In its first five years it aims to save NHS Wales over £187 million and deliver at least 11 inward investments to create a business cluster. This will position Wales as a global leader in addressing this growing healthcare issue.

There have been a number of other key initiatives in life sciences and health that underline its importance to Wales and the commitment shown by the sector.

Swansea University's eHealth Research Centre of Excellence

Due to open in June 2013 the centre is one of four Medical Research Council centres of excellence for e-health in the UK. The new Centre for the Improvement of Population Health through E-health Research (CIPHER) will play a pivotal role in maximising the use of routine, health-related data to support research to improve the nation's health.

GE Healthcare's New Cell Science Laboratories in Cardiff

Officially opened by the First Minister in 2012 the new laboratories are a £3 million investment by GE Healthcare to create a world-class centre of excellence in Cell Science in Cardiff. An international team of scientists is pioneering novel technologies to support the development of new, safer medicines and to advance the rapidly emerging field of cell therapy. The laboratories are also manufacturing cells for use by the international pharmaceutical industry.

Cardiff University's European Cancer Stem Cell Research Institute

This Institute has been awarded £2.45 million by Cancer Research UK to further its world-class research in investigating the causes of cancer and developing new therapies to halt its spread.

Science for Wales promotes research and innovation as core to improving health and social care outcomes. Over the past year, significant progress has been made to improve collaboration between NHS Wales, businesses and universities in Wales to enable speedier introduction of new technology into and out of the NHS.

A national Health and Wellbeing Best Practice and Innovation Board was established by the Welsh Government Minister for Health and Social Services in November 2012. The board will identify and implement innovation and the rapid adoption and diffusion of best practice across NHS Wales.

Speaking at BioWales 2013, the new Minister for Health and Social Services, Mark Drakeford AM, said he would explore ways for more rapid uptake of innovations in NHS Wales. He outlined £20 million extra funding to pursue this aim over the next two years – "to establish the local NHS as an outstanding collaboration partner".

The Welsh Government's National Institute for Social Care and Health Research (NISCHR) is at the forefront of research and innovation in health and social care in Wales. Over the last year significant progress has been made:

- NISCHR has run two healthcare innovation funding programmes:
  - Invention for Innovation supports and advances research and development in innovative healthcare technologies and their translation into the clinic to benefit patients;
  - INVENT is a patent and proof-of-concept scheme to support technological innovations conceived by NHS employees across Wales.
- In autumn 2012 NISCHR launched the new Research for Patient and Public Benefit Wales funding scheme for NHS based researchers to conduct high quality patient and public focused studies in Wales.

- NISCHR is publishing their Research and Development Strategy in spring 2013. The first two of nine delivery plans were published in 2012, Health and Social Care R&D Funding in April and Industry Engagement in October. The remaining delivery plans will be published during 2013 – 2015.
- NISCHR's Biomedical Research Centre and Units have won 29 new grants, with a total income of £9.4 million, and published 88 articles since they were established in March 2011.
- The NISCHR Faculty to support and recognise researchers in Wales in health, social care and life sciences was launched in April 2013.

We want to make contact between patients and researchers easier so as to optimise the amount, quality and diversity of health research undertaken in Wales. With this in mind the NHS Delivery and Monitoring three-year Framework was published in autumn 2012.

The framework has set targets for NHS research, covering patient recruitment, study set-up and increasing high quality research. NISCHR is working with NHS organisations to monitor their delivery against the framework.

The Advanced Engineering and Materials Grand Challenge

Science for Wales identified Advanced Engineering and Materials as a Grand Challenge area. Although having a broader scope than the existing Advanced Manufacturing and Materials sector there is considerable overlap with the sector strategy.

The sector strategy identifies four priority areas of activity: aerospace, automotive, opto-electronics and process manufacturing. These are supported by five strategic priorities: finance for growth; innovation (research, development and innovation, and design); skills; globalisation (foreign direct investment and export/trade) and capacity building (including infrastructure, supply chains, enterprise zones, Anchor company approach, competitive interventions).

Welsh Government anchor companies have continued to make advances through research and development.

SPECIFIC – Port Talbot

The Sustainable Product Engineering Centre for Innovative Functional Coatings (SPECIFIC) aims to turn buildings into 'power stations' capable of generating, storing and releasing their own energy resources. It is designing functional, conductive steel, glass and other building products that can be built into roofs, walls and ceilings to generate electricity.

The partnership involves Swansea University collaborating with groups from Imperial College, Bath, Bangor, Cardiff, Glyndŵr and Sheffield Universities. Its academics are working with multi-national companies such as BASF and NSG Pilkington, Tata Steel and specialist hi-tech SMEs. Based at the Baglan Bay Innovation and Knowledge Centre near Port Talbot, it is part of the UK wide Innovation and Knowledge Centre programme. It is supported by some £10 million from the Engineering and Physical Sciences Research Council (EPSRC) and the Technology Strategy Board (TSB), with a further £2 million from the Welsh Government. ▶

▶Over the past year the SPECIFIC pilot manufacturing facility has been established and opened by the First Minister Carwyn Jones and Dr Vince Cable, the UK Government's Secretary of State for Business, Innovation and Skills. The pilot line is now equipped with manufacturing equipment for one square metre panels on both glass and metal substrates and is being further tested. Additional equipment for full operation is being identified and further partners have joined the project. Accelerated testing equipment has been installed for a range of environmental conditions, allowing a full range of product integrity tests to be undertaken.

A 2 year project review by EPSRC and TSB was successfully completed in April 2013. This confirms a total of £9.45 million of UK funding, which is secured to the end of the five year project in March 2016.

Control Techniques

Based in Newtown, Powys, Control Techniques specialises in AC and DC variable speed drives and solar power conversion technologies. Recently, with Welsh Government support, the company agreed plans to create an additional bespoke research and development centre to support expansion into new markets. The new facility will create 40 highly skilled jobs to compliment the existing 150 highly qualified research and development engineers.

GE Aviation

Aerospace is an extremely important industry to Wales whether in relation to repair, maintenance and overhaul or assembly, manufacturing and research.

The Welsh Government has been able to continue to work with GE Aviation, an Anchor company, which has a world-class facility in Wales. This provides high quality employment and jobs for some 1,200 people. The Welsh Government has already contributed major funding of £490,000 to build capacity for engine repair and maintenance. A Wales Economic Growth Fund offer of up to £350,000 has been made to support the development of a Fan Case Centre of Excellence and the safeguarding of 25 jobs. The new facility, part of a wider 5 year growth plan, will help secure the future of the Nantgarw site and introduce investment of approximately £1.25 million in new technologies such as composite repair.

Qioptic

Qioptic maintain a permanent research and development effort for their range of cutting-edge night vision products, widely used by the UK Ministry of Defence and other military and law enforcement customers.

The Low Carbon, Energy and Environment Grand Challenge

The Sector Framework vision here is to 'put Wales at the forefront of the transition to a low carbon, low waste economy in order to secure maximum economic, social and environmental benefits for the people of Wales. We have identified, together with our Sector Panel, five key enablers, namely: Access to Finance; Strategic Infrastructure; Regulatory Framework; Innovation, Research and Development; Procurement and Supply Chain.

Wales's first commercial tidal energy farm

The Skerries Tidal Stream Array project has been granted a marine licence from the Welsh Government and has subsequently secured £10 million UK government funding. The project will see five 2MW tidal generators located in up to 130ft (40m) of water about half a mile from Holyhead near a group of rocks called the Skerries. The scheme is the largest of its kind in the UK to date. Developers Siemens say it will generate enough power for 10,000 homes. On announcing the marine licence for the project, the First Minister said it "demonstrates the significant benefits of choosing Wales for marine energy investment, with our unique tidal resources, good port facilities and proximity to the grid." Siemens said it hoped the tidal energy farm would be in commercial operation in 2015.

Technology Innovation Needs Assessments

The Low Carbon Innovation Coordination Group published eleven assessments in August 2012 to identify priority areas for research, development and innovation in the UK covering the following energy sectors:

Bio-energy
Carbon Capture and Storage
Domestic Buildings
Electricity Networks and Storage
Heat
Hydrogen
Industrial Sector
Marine
Non-domestic Buildings
Nuclear Fission
Offshore Wind

Using these as a starting point, a study commissioned by Welsh Government to understand the particular strengths and opportunities for Wales will conclude in May 2013. After initial analysis three priorities are now subject to more detailed examination and will forecast the possible economic benefits in Wales that would follow success in gaining a strong research, development and innovation presence in the priority sectors.

Enterprise Zones

Wales has over 41,000 people employed in the energy and environment sectors contributing over £5.1 billion to the economy. The Welsh Government are leading on a science and research facility in North Wales and proposals and a budget of up to £250K to develop a business case have recently been approved. Subject to a satisfactory business case being developed, Welsh Government has agreed to invest £10m into the project.

The Energy and Environment sector team are working closely with all the designated Enterprise Zones with an energy component on the development of a number of projects to maximise the opportunities for job creation, including higher added-value technical posts, and business growth, from nuclear energy in connection with the Trawsfynydd site to marine infrastructure in the Milford Haven Waterway.

SolaVeil®

DBS (Daylight Business Solutions), based in Cardiff, are applying their SolaVeil® Daylighting technology, as a retrofit solar energy control technology to newly manufactured glass and retrofitted to existing buildings, using a range of treated materials such as polyester and polycarbonate. A patented technology, SolaVeil® uses digitally manufactured surface arrays to control and stabilise the transmission, reflection and diffusion of solar radiation entering a building through glazing. SolaVeil® treated glass lets in more usable light whilst excluding nearly all UV light and much infra red. This makes for cooler and more pleasant interiors, saves energy and reduces carbon emissions. The company was successful in a Technology Strategy Board (TSB) Small Business Research Initiative competition 'Energy Efficient Whitehall' and retro-fitted their glass to a UK Government building in Central London. SolaVeil® was the outstanding technology success of the competition, prompting the TSB to publish a Case Study on SolaVeil® technology, receiving an outstanding final report on the project in 2012.

SWALEC Smart Energy Centre Project

The project involves the creation of 250 new jobs within a major training base and operations centre for Scottish and Southern Energy (SSE), a designated Anchor Company within the Energy and Environment Sector, supporting the development of a number of existing and new businesses. The new training Centre will provide an excellent training facility for staff from Wales and throughout the UK to enhance their skill in new green technologies and will also be a platform to build new commercial opportunities from the Government's Green Deal proposal.

The Welsh Government provided £2m of Business Finance to SSE plus up to an additional £1.6 million of training support towards the creation of the SWALEC Smart Energy Centre in Treforest and the ongoing training requirements of SSE in South Wales. The SSE Group currently employs over 20,000 people and has a turnover of c£28.3 billion. SSE operates in Wales under its SWALEC brand and supplies electricity and gas to over 1.2 million Welsh customers. SWALEC is headquartered in Cardiff and SSE now employs around 2,000 staff in Wales.

EU Funding

We said we would facilitate greater synergy between EU Structural Funds and research programmes in Welsh universities and industry, and improve technical and peer review of WEFO-funded research proposals.

Development of the 2014–2020 Structural Fund programmes is well underway. Research, development and innovation again feature heavily in the proposals, reflecting the European Commission's 'smart specialisation' approach that focuses on areas of competitive strength. *Science for Wales* will act as the cornerstone for investments under the research and development strand as will the emerging *Innovation Wales* strategy for investments under the innovation strand. The proposals for European Regional Development Fund (ERDF) investments in research and development focus on opportunities for the commercialisation of research, research infrastructure, and capacity building.

A thorough re-evaluation of the implementation processes for the Structural Funds programmes is underway, including an independent review completed by Dr Grahame Guilford. All aspects of implementation are being looked at, including the best use of expertise and peer review in assessing project proposals.

The current 2007–2013 Structural Funds programmes continue to invest in research capacity and links between academia and business. Three projects have been approved under the research and development element of the ERDF Structural Funds programmes since March 2012, worth over £65 million and with an ERDF contribution of £36 million.

Over 2007–2013 the Structural Funds will have supported in total around £400 million of investment in research and development projects, with £200 million ERDF contribution.

Swansea Bay Innovation Hub

£31.9 million total project cost with an estimated EU funds of £15 million.

A Swansea University project, approved in July 2012, it will establish a purpose built Swansea Bay Innovation Hub at a new site to the east of the city. The Hub includes world class facilities for innovation, industrial research, product design and development and industrial collaboration. By providing an open innovation environment the Hub will integrate several ERDF and European Social Fund (ESF) funded projects, including ASTUTE (Advanced Sustainable Manufacturing Technologies); the Swansea elements of the Low Carbon Research Institute (LCRI), STRIP (Steel Training Research and Innovation Partnership), KESS (Knowledge Economy Skills Scholarships) and ATM (Access to Masters). Greater links between these projects will add value to their activities. As part of the wider Science and Innovation Campus the project has also helped secure a very substantial private sector contribution and a loan from the European Investment Bank.

Wales Centre for Behaviour Change

£1.82 million cost with an EU funds of £1.09 million.

This Bangor University project will deliver a behaviour change knowledge transfer centre. It aims to help businesses across key sectors in Wales including ICT, advanced materials and manufacturing, life sciences, creative industries, energy and environment and financial services. Research and development activities include device design to enhance the effectiveness of the behaviour change procedures, creation of media that support effective behaviour change and development of technologies for effective monitoring of behaviour as it changes.

Engineering Manufacturing Centre (EMC)

Total Project Cost circa £31.7 million including EU funds of £20 million.

This Swansea University project will create an engineering manufacturing centre at the new Science and Innovation Campus. It will focus on civil and computational engineering, electronic engineering and materials, mechanical engineering and printing and coating. Like the Swansea Bay Innovation Hub it builds on previous funding, including providing suitable facilities for the SPECIFIC project, a collaboration with Tata Steel, and the ERDF funded and EURegio Star award-winning Welsh Centre for Printing and Coating.

We said that we would set up new arrangements to work more closely with the higher education sector in improving research effectiveness and encourage deeper and broader engagement with the UK Research Councils and Technology Strategy Board.

Co-operation on key research effectiveness issues outlined in *Science for Wales* is underway with the Higher Education Funding Council for Wales (HEFCW) and Universities. For example the Welsh Government and HEFCW are co-funding a development programme for senior academic leaders with the Leadership Foundation for Higher Education (LFHE). The need was highlighted by Professor Teresa Rees, the Foundation's lead for Wales and will run in July 2013.

We said we would commission a detailed study to establish the factors which determine our performance in winning competitive research grants and research funding in Wales, including analysis of the scale and quality of proposals, success rates, funding outcomes, and the influence of EU Structural Funds.

Significant analysis has already been undertaken of Wales's performance in winning competitive research income. Following discussions with the St David's Day Group of universities and HEFCW, we identified a need for specific evidence to assess performance more fully, through a comprehensive bibliometric analysis.

The Welsh Government and HEFCW are partners in an independent study, led by Cardiff University, into the comparative international standing of Welsh research, drawing on bibliometric and other data.

The results will provide a baseline for the *Science for Wales* strategy, as well as supporting Universities in developing their research strategies.

In future the focus of research and development through the 2014-2020 Welsh Structural Funds will be more directly linked to the Horizon 2020 programmes – worth circa £60 billion across EU Member States. Investment to build the capacity and capability of the Welsh research base will enable applicants to bid more successfully for competitive research funding in areas of excellence. The Welsh European Funding Office (WEFO) will monitor progress and target investments to address any specific barriers faced in accessing those competitive funds.

During 2012 the Welsh Government reviewed its arrangements for integrating EU funding streams. As a result, a new Horizon 2020 Unit has been set up within WEFO to provide a central contact point or one-stop-shop for integrated, consistent and targeted advice and support to Welsh organisations on accessing the most appropriate research and innovation funding from the EU. WEFO's knowledge and expertise in Structural Funds means that they are well placed to explore complementarities and synergies between the two funding streams. By working closely with stakeholders the Unit can help Wales increase its share of Horizon 2020, in turn helping to drive forward its global competitiveness.

Promoting Business Innovation and the Exploitation of Science

Science for Wales recognised that building on an excellent science base, innovation and the commercialisation of research and development have been key priorities in recent Welsh Government economic policy. Innovation is also at the heart of the EU's *Europe 2020* strategy, being seen as central to tackling major societal challenges, such as climate change, energy and resource scarcity, health and ageing.

In this section we set out progress on innovation and the exploitation of science.

> We said we would develop a new national innovation strategy, based on the framework laid out in chapter four of *Science for Wales*. This would encompass the wider innovation agenda; the needs of small and medium sized enterprises; the vital links between research, innovation and commercialisation; and science, commercialisation and intellectual property. The aim is to improve exploitation of UK and EU opportunities, including from the Technology Strategy Board (TSB), the recent UK Research and Innovation Strategy and the EU's Horizon 2020 programme for research and innovation.

The need to develop an innovation strategy not only came from *Science for Wales* but also the European Commission (EC) requirement that regions across Europe should develop a 'Research and Innovation Strategy for Smart Specialisation'. The strategies should identify the particular strengths and opportunities for each region as a means to improve the overall European approach. This more targeted approach aims to enable the EU and its regions to compete more effectively with established and emerging economies across the world.

The Welsh Government adopted a 'Smart Specialisation' methodology to develop *Innovation Wales* which, with *Science for Wales*, recognises our strengths and defines our research and innovation priorities for the future.

We recently completed an extensive consultation on *Innovation Wales* and were also advised by a task and finish group of experienced representatives from a wide range of organisations, including small and large businesses, universities and UK innovation organisations. Responses were very positive and challenging, with contributors recognising the breadth of innovation and highlighting its potential to make Wales more competitive.

Innovation Wales identifies one overriding principle – the need to promote, encourage and enable innovation across the whole economy, but that key investments should be made on the basis of clear strategic priorities, built on Wales's strengths.

It also identified five key themes for action on innovation:

- Improving collaboration
- Promoting a culture of innovation
- Providing flexible support for innovation
- Innovation in government
- Prioritising and creating critical mass

Innovation, by definition, is an exercise of constant challenge and renewal, so this document is just the start of the process. *Innovation Wales* has gone through the peer review process run by the EC Smart Specialisation Platform and a final version is imminent. We

are committed to continuing an open dialogue with our partners.

> We said that, depending on the new innovation strategy development, we would consider setting up an over-arching innovation strategy board, to advise the Minister for Business, Enterprise, Technology and Science (now Economy, Science and Transport), comprising sector champions, and chaired by a credible leader well-versed in the business of innovation.

Although a formal strategy board has not been set up, *Innovation Wales*, as outlined above, was developed through the smart specialisation methodology, with extensive consultation input and an expert task and finish group which was able provide the expertise needed to formulate an effective innovation strategy.

> We intended to support priority funding and investment opportunities, assigning project teams to work with stakeholders on a pan-Wales basis, and work with existing strategic projects such as in high performance computing to ensure Wales takes full advantage of the investment.

We have dedicated teams of innovation specialists who are able to work with companies and stakeholders across Wales to ensure funding and investment opportunities are given priority. In principle offers of financial support have been made to Toyota and Tata Steel (SPECIFIC), with dedicated teams of specialists to support companies in defining the scope of innovative projects.

High Performance Computing Wales (HPC Wales) is working with a number of SMEs in Wales and is expanding its service offering to engage more companies in their projects. HPC Wales is also delivering a skills and training development programme to build a pool of high performance computing expertise in Wales, especially amongst companies that work closely with universities on research and development work. It is ERDF funded.

HPC Wales works closely with researchers in the higher education sector, where the latest high performing computing computational techniques are being developed and tested. This is leading to enhanced computer modelling capability in many areas of science and engineering, from plate tectonics modelling (important for oil and minerals exploration), to blood flow in heart pumps and extreme weather event modelling.

Welsh Government officials worked closely with Cardiff City Council in their bid for a £24 million future cities demonstrator, bringing together universities, HPC Wales and business. This was highly competitive and although not successful, at least one research project in this area has been funded as a result of this work.

The Welsh Government Innovation Support Service actively supports projects that promote long term sustainable investment in Wales by strengthening the economy through research and development, design, innovation and business growth. It is funded by ERDF.

We said we should encourage Welsh involvement with the Small Business Research Initiative (SBRI) of the Technology Strategy Board (TSB). This encourages businesses to develop innovative solutions to major public sector challenges.

Welsh Government science and innovation staff have actively promoted this programme to a wide range of public sector bodies across Wales in the health, environment and local government fields as well as those Welsh Government departments who might have research needs, to encourage them to:

- Try new innovative approaches to address challenges and overcome public sector problems
- Stimulate business innovation in the Welsh economy and
- Improve public service delivery in Wales.

During the past year, the first Welsh Government-led national SBRI project was successfully launched and delivered in partnership with the Technology Strategy Board and the Ordnance Survey. The £125,000 Wales Coast Path SBRI challenge received 56% of the applications from Wales-based businesses resulting in 3 of the 5 contracts being awarded to Welsh organisations. These businesses are now actively developing digital prototype demonstrators to help connect communities, businesses and visitors to the Wales Coast Path.

We said we are committed to conduct an options review to maximise overall impact of public funding for commercialisation and university engagement with business in Wales.

and

We said we would undertake a review of intellectual property commercialisation models, the emerging collaborative approaches between major research-led universities and implications of the Hargreaves review of intellectual property, and recommend the best option for maximising the economic benefit from intellectual property in universities, the NHS and businesses in Wales.

As part of the ERDF-funded Academic Expertise for Business (A4B) programme we are undertaking an extensive exercise to determine the impact in academia and business of the current round of funding to academic institutions to commercialise their intellectual property and to undertake collaborative research and development with businesses. We have also reviewed the current model employed by A4B for early stage identification and development funding for intellectual property commercialisation in universities.

The HEFCW-funded St David's Day Group Intellectual Property Commercialisation Project (IPCoP) includes the establishment of a task and finish group. Its role is to pick up emerging conclusions and make recommendations to HEFCW and Welsh Government on structures and models for the delivery of intellectual property from higher education institutions in Wales. The project has two years to run.

Feeding in the outputs from these studies, an independent review into intellectual property commercialisation models, and options to maximise overall impact of public funding for commercialisation and university engagement with business will be commissioned in June 2013, to be completed and report by November.

NISCHR recognises the significant potential to increase technological and intellectual property related product innovation from within the NHS and social care sectors in Wales.

Two documents have been developed by NISCHR, promoting best use of intellectual property in the NHS and social care and also in activities which it funds. The template intellectual property policy is a voluntary document which NHS Health Boards and Trusts in Wales can use, either in whole or in part. Also available on their website is a set of principles which underpin the terms and conditions relating to intellectual property and the use of research results arising from NISCHR funding.

> We stated that we would, with EADS, rigorously evaluate their foundation model and take steps to disseminate what has worked well, encouraging anchor companies adopt 'open innovation' models such as that in operation in EADS and other companies.

Twelve projects are currently being supported by EADS Foundation Wales. The Welsh Government has a three year funding commitment to the Foundation, subject to a mid term review. A formal evaluation is taking place from May 2013 to determine the continuation of funding support.

In November 2012, the Minister for Business, Enterprise, Technology and Science approved a pilot project to identify effective ways for the Welsh Government to encourage and support companies in open innovation. The project provides intelligence to the Welsh Government on open innovation in Welsh companies, disseminates best practice and recommendations for the future role of the Welsh Government in this field.

In February 2013, competitive development awards were made to seven anchor companies. They will trial different approaches to 'Open innovation' to encourage culture change and collaboration, particularly with smaller Welsh companies, sharing best practice and disseminating their experiences. These awards will run until March 2015.

In *Science for Wales* we outlined the importance of the digital economy as the single biggest lever for productivity and competitiveness across every sector of the economy. The importance of the digital economy is also reflected in the *Programme for Government* and in Delivering the Digital Economy.

Increasing the Science and Engineering Talent Pool

In *Science for Wales* we highlighted the importance of science, technology, engineering and mathematics (STEM) skills at all levels, as widely acknowledged by stakeholders consulted during the production of *Science for Wales*, and, indeed its predecessor, *A Science Policy for Wales 2006*. These skills were seen as essential to the development of a prosperous and sustainable knowledge economy. STEM subjects, along with other quantitative disciplines, are highly valued across a range of occupations, offering students varied career opportunities. In this section we set out progress made so far on STEM.

We said we would develop our STEM strategy, building on a survey of existing activity, to engage and develop children and young people and increase the proportion of the cohort studying science and pursuing STEM-related careers, including more girls and women.

Review of Qualifications

The Review of Qualifications for 14-19 year olds in Wales considered how Wales can achieve the vision of 'qualifications that are understood and valued and meet the needs of our young people and the Welsh economy', to answer concerns with complexity, relevance, value and rigour. They consulted widely and drew on much data and evidence on qualifications. The Minister for Education and Skills and Deputy Minister for Skills and Technology have broadly accepted all the recommendations in the report, restating their vision of doing what is best for learners in Wales and for the Welsh economy.

A model for a revised Welsh Baccalaureate Qualification (WBQ) was set out in the report of the Review of Qualifications as a basis for further development. Under that model, WBQ learners in pre-16 learning would need to gain a GCSE at a level appropriate to the level of their WBQ in English or Welsh First Language and Numeracy. Working with WJEC and other stakeholders, officials have established a steering group to oversee further development of the model. As part of that work consideration is being given to whether other subjects should be included as 'Essential external qualifications' within the WBQ for pre-16 learners. The Deputy Minister specifically asked that consideration should be given to whether science should be included in this category.

Science remains a core subject and part of the statutory curriculum at Key Stage 4. Two new mathematical GCSEs covering numeracy and mathematical techniques, for teaching from September 2015, are being developed. They will reflect and support the relevant improvements expected from the Literacy and Numeracy Framework. Having two GCSEs in this area will reflect the importance of the subject for progression and employment. We expect most learners will take both of these mathematics GCSEs.

Further work will revise equivalence ratings between vocational qualifications and GCSEs to enhance credibility and clarify the range of options for students, including those in science, within a broad and balanced curriculum.

Review of assessment and the National Curriculum

The assessment and curriculum review was announced after *Science for Wales* was published. It will examine the whole curriculum, including a review

of the teaching of science, technology and mathematics subjects in our classrooms. The first phase of the review will be completed by September 2013. The second phase will be completed by September 2014 and will include identification of any revisions to the current assessment and curriculum arrangements in Wales, informed by public consultation.

STEM Education and Engagement

Guidance on the provision of STEM for three to 19-year-olds in schools and colleges in Wales was published in October 2012. It will provide clarity on the extensive range of support materials and activities available and identifies opportunities within and beyond the STEM curriculum.

'Get on with Science' is a project, led by ContinYou Cymru and Chwarae Teg, to develop a coordinated approach to delivering science in schools that better reflects the needs of girls and boys to address negative stereotypes and to see more girls pursuing science and science-related careers. Welsh Government funding has supported this two year pilot project. It includes a focus on industry engaging with a female workforce to improve practice and policy.

Annual Welsh Government grant funding on £1.7 million supports Techniquest, Cardiff and Techniquest Glyndŵr in Wrexham for their delivery of science in schools to raise awareness of STEM subjects at their centres and in outreach work with schools. They are also working to support Get on with Science.

The Science Advisory Council for Wales (SACW) formed a task and finish group in late 2012 to examine STEM engagement and education enrichment activity. The group expects to report its findings to the Council. It consulted with a range of individuals and organisations and found a wealth of recent research and sources of information. Useful links have been made between SACW and officials in the Department for Education and Skills. The group will also make recommendations about promoting science in the media in Wales.

> We said we would set direction for and coordinate outreach STEM activities through the National Science Academy (NSA), to engage more young people in science. This action includes the appointment of an NSA STEM Coordinator.

The National Science Academy is currently responsible for over 25 STEM projects. It launched an NSA competitive grant scheme in July 2012. From 52 proposals received, grants were awarded to 21 projects in autumn 2012, including seven university-led proposals. These projects all build on STEM-related engagement and include activity based workshops, site visits, presentations, road shows, festivals, exhibitions, competitions, challenges, taster experiences, award schemes, revision events, public lectures and debates, together with continuous professional development (CPD) for STEM teachers. NSA supported projects help break down barriers to engaging with STEM subjects, including gender, poverty and disability.

The National Science Academy and Higher Education Funding Council for Wales developed a co-funding model contributing a further £121,000 to support the seven university-led projects with NSA funding of £610,000 to provide total funding of £731,000.

The National Science Academy and the Ford Motor Company

NSA has developed an innovative pilot project, working with Ford Motor Company Ltd to financially support and manage two 12 week Saturday club training programmes at the Ford Bridgend Engine Plant. Undertaken in conjunction with the advanced materials and manufacturing sector team this programme will focus on encouraging students into a career in engineering through the development of practical skills, including through study of electrical installation, control systems and engine build.

We said we were taking steps to improve labour market intelligence to help shape informed career choices for young people, including market needs for STEM skills.

Labour market intelligence can be complex and a project has been established to explore how best to bring this information to young people in ways that make sense to them. During the last 12 months, the team has run awareness sessions with many external organisations such as the Youth Service, Clic Online and the Family Information Service. The team has developed a range of communications including synopsis documents, articles in key Welsh Government publications, monthly statistical and media updates and engagement in The Real Conversation events.

The Working Futures 2010-2020 initiative provides detailed, comprehensive UK labour market projections, giving a picture of employment prospects by a range of factors for the UK and its constituent parts up to 2020. It involves eight of the independent, employer-led, UK-wide Sector Skills Councils (SSCs) associated with meeting STEM skills needs in their respective fields. There are estimated to be around 337,000 workers in these STEM related SSCs in Wales in 2010 and a further 16,000 new workers are projected to be required by 2020, resulting in a total of 353,000 workers by 2020. In addition the number of people needed to replace those leaving the professions is projected to be around 134,000.

We committed to examine ways to raise the standard of science and mathematics teaching from primary through to secondary education, including how improved or specialist teaching can be encouraged though recruitment and training (both initial and through Continuous Professional Development) to provide effective learning for all pupils, including those who want to study sciences as single A-levels.

We are committed to the provision of continuous professional development (CPD) for all STEM teachers and to working with partners in developing standards. Welsh Government CPD funding worth £3 million for computer science teachers was announced by Minister for Education and Skills in June 2012.

Improving Delivery in Government

Welsh Government staff dealing with science and technology are traditionally distributed quite widely across the organisation. This means they are closely integrated with policy making in a given area, although it presents challenges in implementing a coherent strategy to improve performance. An informal review using the UK Government Office for Science's science and engineering assurance framework showed we were well connected to the expertise we need in several areas but found vulnerabilities in a number of key areas. This section sets out the progress we have made so far.

We said we would establish a new Chief Scientist's Department to lead this work across our government. Professor John Harries would act in a Chief Scientific Officer leadership role as well as his Chief Scientific Adviser for Wales (CSAW) independent advisory role.

New structures including a Science Division were set up in February 2012 and, with the appointment of a new Chief Scientific Adviser in 2013, we will refresh our approach to delivery across the Welsh Government.

We said we would bring the National Institute of Social Care and Health Research (NISCHR) under the direction of the Chief Scientific Adviser for Wales and reporting in turn to the Health and Social Care Department to maximise the opportunities to promote patient benefit, research and innovation capacity through health research.

From February 2012, NISCHR has been directed, in terms of the overall science strategy, by the Chief Scientific Adviser, while remaining in other respects part of the Health and Social Services Department.

We said we would establish a new Science Division, as part of the new department, to lead efforts to improve the quality of research conducted in Wales, lead action to develop larger scale research and development proposals and raise the profile of science and engineering skills and careers.

We said we would, through the Science Division, lead improvement of science advice, working with colleagues across government to improve access to scientific evidence, promote good professional practice, inform policy through science-based futures evidence and agree priorities for developing our evidence.

Science Division staff have, with scientific and technical colleagues across the Welsh Government, started work on promoting good professional practice, developing consistency of approach to publication of research and advice. This includes seminars and workshops within Wales and as part of the wider Government Science and Engineering (GSE) community of scientific colleagues from across the UK. Several science-based projects have been initiated and contributed to policy making and Welsh Government officials are engaged in a range of UK-wide futures projects.

We said we would continue to support the Chief Scientific Adviser for Wales's role in providing independent advice across government, drawing on advice from the Science Advisory Council for Wales (SACW), on science issues and from the new innovation leadership that emerges from the forthcoming innovation strategy, on innovation issues.

Because no Chief Scientific Adviser can be expert in all the areas of science which might require advice, he has appointed the Council of well-respected experts, to advise him and act as a support and sounding board. They meet three or four times a year and have a website. Advice can be reactive, such as in responding to emergencies or proactive, where the Chief Scientific Adviser judges a science-related issue should be brought to the Government's attention. He arranged for the Welsh Bovine TB Science Review Group to form, using some Council members. Their report to him provided a basis for the Cabinet's commitment to take a science-based approach to bovine TB.

A Council task and finish group has been examining science, technology, engineering and maths (STEM) engagement activity.

We said that a longer term skills and succession plan would aim to improve the internal science and engineering career structures, enhance skills in brokerage of science expertise and make more use of secondments in providing specialist science expertise.

An exercise to establish the scope of scientific and technical skills and roles for Welsh Government staff has been undertaken and proposals for science careers developed, contributing to wider changes in Welsh Government handling of skills and careers.

Tracking and overseeing delivery

We indicated that our plans for monitoring progress over the life of the strategy would include tracking a variety of relevant measures.

Not all possible measures are yet relevant. Many 'lag' behind by a year or more and so reflect the historic position rather than any action taken under *Science for Wales*. Some of these can, however, provide a baseline for future monitoring. Some data on trends in science publication and impact require the completion of work currently being undertaken.

- **Numbers participating in STEM engagement activities:** During the 2012-13 year, National Science Academy funded and project managed initiatives are expected to deliver over 150 STEM engagements, attracting over 3,600 student participants. They are also projected to facilitate more than 15 Continuous Professional Development events attracting over 140 STEM teacher attendees.

- **Numbers of Wales-based Academics serving on United Kingdom Research Councils, their Boards and Committees:**

Research Council	Council Members (Total membership shown in Brackets)	Boards and Committees
Arts and Humanities	- (15)	2
Biotechnology and Biological Sciences	1 (18)	9
Engineering and Physical Sciences	- (17)	5
Economic and Social	- (14)	3
Medical	1 (15)	3
Natural Environment	- (16)	1
Science and Technology Facilities	- (11)	7

- **Achievement of agreed metrics in EU-funded projects:** Priority 1 of both programme areas covers research and innovation. Although progress is currently variable across targets in this area, with some remaining a challenge, collaborative R&D projects reached 814 by February 2013, against a forecast of 294 by this date and 709 by programme. Further detail is here.

- **Research Income of Higher Education Institutions in Wales 2011-12 – by Institution:**

	Total Research Income	Recurrent Research Funding	Research Councils	UK-based charitable bodies	UK central government bodies	UK industry, commerce and public corporations	EU sources	Non-EU sources	Other sources
University	£k	£k %	£k %	£k %	£k %	£k %	£k %	£k %	£k %
Glamorgan	6,816	2,626	455	207	1,609	613	1,303	3	0
Aberystwyth	28,365	7,779	8,987	568	4,028	1,518	5,239	182	64
Bangor	26,395	7,645	5,286	1,203	4,513	350	6,375	669	354
Cardiff	130,354	42,700	26,465	18,158	25,231	4,667	8,542	4,037	554
University of Wales, Trinity St David	907	708	42	1	59	49	0	0	48
Swansea	45,704	12,573	9,506	1,642	8,189	1,498	11,241	378	677
Cardiff Metropolitan	3,779	1,201	29	57	1,687	181	616	3	5
University of Wales, Newport	867	469	222	14	88	0	74	0	0
Glyndŵr	1,785	0	439	28	746	454	109	9	0
Swansea Metropolitan	326	148	18	112	48		0	0	0
University of Wales CAWCS‡	891	397	354	50	0	61	26	0	3
WALES TOTALS	246,189	76,246 30.97%	51,803 21.04%	22,040 8.95%	46,198 18.77%	9,391 3.81%	33,525 13.62%	5,281 2.15%	1,705 0.69%

‡Centre for Advanced Welsh and Celtic Studies

Sources:

Higher Education Statistics Agency – Resources for Institutions of Higher Education 2011/12 (all figs. except recurrent research funding). All figures subject to rounding. HEFCE, HEFCW and SFC Recurrent Grant Circulars, 2011/12 (recurrent research funding – consists of QR and PGR, or equivalent.

- **Research Income of Higher Education Institutions 2011-12 Wales compared to England, Scotland, Northern Ireland and UK Totals:**

	Total Research Income	Recurrent Research Funding	Research Councils	UK-based charitable bodies	UK central government bodies	UK industry, commerce and public corporations	EU sources	Non-EU sources	Other sources
	£k	£k %	£k %	£k %	£k %	£k %	£k %	£k %	£k %
WALES	246,189	76,246 31%	51,803 21%	22,040 9%	46,198 18.8%	9,391 3.8%	33,525 13.6%	5,281 2.2%	1,705 0.7%
Wales as per cent of UK (%)	3.8	4.0	3.4	2.3	5.7	3.3	5.6	1.6	3.5
ENGLAND	5,206,219	1,558,000 29.9%	1,204,696 23.1%	779,666 15%	636,593 12.2%	230,147 4.4%	479,295 9.2%	285,269 5.5%	32,553 0.6%
England as per cent of UK (%)	80.9	80.9	79.8	83.0	79.1	80.8	79.9	88.2	66.8
SCOTLAND	851,082	241,196 28.3%	229,215 26.9%	127,209 15%	96,429 11.3%	40,221 4.7%	74,672 8.8%	29,310 3.4%	12,830 1.5%
Scotland as per cent of UK (%)	13.2	12.5	15.2	13.5	12.0	14.1	12.5%	9.1%	26.3
NORTHERN IRELAND	132,401	50,734 38.3%	23,363 17.7%	9,902 7.5%	25,888 19.6%	4,925 3.7%	12,237 9.2%	3,680 2.8%	1,672 1.3%
N. Ireland as (%) per cent of UK	2.1	2.6	1.5	1.1	3.2	1.7	2.0	1.1	3.4
TOTAL UK	6,435,891	1,926,176 30%	1,509,077 23.5%	938,817 14.6%	805,108 12.5%	284,684 4.4%	599,729 9.3%	323,540 5%	48,760 0.8%

Sources:

Higher Education Statistics Agency – Resources for Institutions of Higher Education 2011/12 (all figs. except recurrent research funding). All figures subject to rounding. HEFCE, HEFCW and SFC Recurrent Grant Circulars, 2011/12 (recurrent research funding – consists of QR and PGR, or equivalent).

- **Numbers of Pupils in Wales Studying Science-related Subjects at GCE Advanced Level:**

Group	Subject name	2005	2006	2007	2008	2009	2010	2011	2012
Science	Biology	2000	1887	1822	1832	1785	1862	1916	1849
	Biology: Human	21	15	23	22	16	32	0	0
	Chemistry	1414	1411	1332	1467	1476	1448	1514	1420
	Physics	956	972	942	889	982	1013	974	919
	Science: Environmental	8	6	8	0	5	*	0	*
	Science (VQ)	13	7	22	41	32	85	130	132
Design and Technology	D & T Food Technology	33	47	40	50	44	7	52	44
	D & T Product Design	706	864	792	764	797	792	805	679
	D & T Systems Cont.	*	*	8	*	0	0	*	*
	D & T Textiles Technology	0	0	0	0	0	36	25	24
	Design And Technology	0	0	0	0	0	19	0	0
	Home Economics	51	56	46	48	32	0	0	0
	Home Economics:food	0	0	0	0	0	16	24	19
Mathematics	Additional Mathematics	0	0	0	0	0	0	0	*
	Mathematics	1724	1690	1826	1967	2058	2171	2130	2133

Sources:

Higher Education Statistics Agency. Maintained sector candidates only.

- **SME Participation in, and feedback on, innovation programmes:**
  - Business Innovation programme offers support for new product development and best practice development in manufacturing, design and intellectual property. In the financial year 2012-13, the programme has assisted 250 businesses, with 25 receiving financial support. 49 new products, processes or services were launched, with a direct profit benefit of £566,150 to date. £3,951,000 of investment was induced and 40 new jobs created.
  - SMART Cymru supports a full range of innovation activity from conceptualisation to market placement for products, processes or services. This begins with technical and commercial feasibility, through industrial research and experimental development, to commercial exploitation. SMART can also fund larger enterprises (such as anchor companies) – see below. From April 2012 to March 2013, SME outputs were:

Small and Medium Enterprises	SMARTCymru RD&I Convergence	SMARTCymru RD&I Competitiveness	Total
Grants paid (£ k)	1,413	375	1,788
Private Sector Investment (£ k)	1,406	234	1,640
Enterprises Financially Supported	21	11	32

See also initial results for the Small Business Research Initiative (SBRI) activity highlighted in Chapter 4 on page 20.

- **Numbers of successful research and development projects with anchor and major companies:** See explanation of SMART Cymru above in SME Participation section.

Anchor Company/ Non-SME	SMARTCymru RD&I Convergence	SMARTCymru RD&I Competitiveness	Total
Grants paid (£ k)	123	0	123
Private Sector Investment (£ k)	217	0	217
Enterprises Financially Supported	1	0	1

The longer term measures of our proportion of UK competitive research funding and percentage of Wales's research judged to be at the highest UK levels have been referred to above. See page 4.