



**Enterprise, Innovation and Networks
Committee**

Review of Science Policy in Wales

Members

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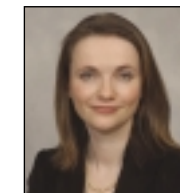
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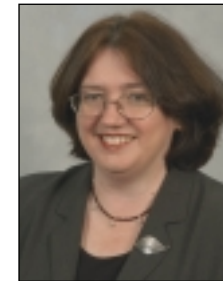


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Chair's Foreword



Science plays a vital role in all our lives. It is the basis of many products and services in everyday use and generates wealth and employment for the people of Wales. Scientific principles also inform many of our public and social policies. Our report explains why Wales needs a science policy and makes recommendations regarding its content and implementation.

It is important that teachers should develop an appreciation amongst school children that science is interesting, by stimulating their natural curiosity about how things work. This in turn should encourage more young people to study science and engineering in further and higher education institutions. Wales needs more scientists, particularly those with entrepreneurial vision.

The key to sustained economic growth in Wales is closer collaboration between academia and businesses to share resources, ideas and expertise. The Welsh Assembly Government must play a pivotal role in facilitating this process; both by direct funding and also by helping universities and businesses to apply for research grants from the European Union.

I would like to thank everyone who contributed to our inquiry, either by responding to our written public consultation or by presenting evidence in person during formal meetings. I am particularly grateful to Committee Members, Dr Robin Fears our expert adviser, members of our reference group, our researchers and our secretariat for their assistance and support in the preparation of this report.

I commend this report to the Welsh Assembly Government and look forward to receiving their response, in due course.

A handwritten signature in black ink that reads "Christine Gwyther". The signature is written in a cursive, flowing style.

Christine Gwyther AM
Chair, Enterprise, Innovation and Networks Committee

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Section 1

Introduction

1. Introduction

Background

1.1 In November 2004, we decided to carry out a review of science policy in Wales. We agreed, owing to the scope and technical nature of this subject, to appoint both an expert adviser and an external reference group to assist in carrying out the review.

1.2 Following an external recruitment procedure, Dr Robin Fears was appointed as expert adviser in April 2005. The reference group was appointed by invitation in May 2005, to assist in drawing up the terms of reference and to suggest speakers to present evidence at formal committee meetings. The membership of the reference group is at Annex 1.

Terms of Reference

1.3 We agreed the following terms of reference for the review:

To consider a science policy in Wales that more effectively supports the development of a knowledge-based economy; in particular:

- *The current range of research and development carried out in Wales in both public and private sectors;*
- *Ways in which it can be strengthened and made more effective;*
- *Covering likely priorities for science awareness, skills provision, higher education excellence, technology transfer and innovation; and*
- *To make recommendations for the development of policy in this area.*

The Review

1.4 We carried out a written consultation exercise during August - September 2005. A copy of the consultation letter is at Annex 2, a schedule of those consulted is at Annex 3 and a schedule of those responding is at Annex 4. We heard oral evidence in formal committee meetings from October 2005 to March 2006. A schedule of the oral evidence is at Annex 5. The papers, consultation responses and transcripts of the evidence can be viewed on the National Assembly website – www.wales.gov.uk.

1.5 The expert adviser and reference group assisted the Committee in identifying the key issues and suggesting possible recommendations. Members agreed their recommendations, in private meetings, in May and June 2006.

Section 2

Policy Framework

2. Policy Framework

Introduction

2.1 The purpose of this section is to set out the Welsh Assembly Government policy framework. All these documents can be viewed on the National Assembly website. They are relevant to our inquiry and were referred to during our information gathering.

Wales: A Better Country

2.2 In September 2003, the Welsh Assembly Government set out its overarching strategic agenda in *Wales: A Better Country*. This identified four key areas on which to focus policy development:

- Helping more people into jobs;
- Improving health;
- Developing strong and safe communities; and
- Creating better jobs and skills.

2.3 The document outlined policies across all departments and set out a range of commitments, aims and implementation plans. These included commitments to:

- Further develop the knowledge economy through stronger links between further education, higher education and businesses; and
- Promote innovation and research in business.

2.4 To help achieve these aims, the Welsh Assembly Government provided some £25 million in funding to promote innovation and research in business; and established further 'Technium' Centres, using European Union structural funding (Objective 1) where appropriate. Also, the Welsh Development Agency (now absorbed within the Welsh Assembly Government) was given responsibility for delivering the Knowledge Exploitation Fund.

2.5 In evidence to our inquiry, the Welsh Assembly Government referred to their science framework and set this in the context of the above strategy. The purpose was to:

- Create a culture in which the importance of research is actively recognised within the National Assembly, their agencies and other partners in Wales and effectively used for policy development; and
- Strengthen the research base in Wales.

Wales: A Vibrant Economy

2.6 In November 2005, the Welsh Assembly Government set out its strategic framework for economic development in *Wales: A Vibrant Economy (WAVE)*. This set out policies intended to deliver sustainable growth and improving prosperity across Wales. These policies included supporting the main drivers to business growth; innovation, entrepreneurship, skills, investment and trade.

2.7 Of particular relevance to this inquiry was the *Innovation Action Plan*, which included the following themes:

- Communicating the importance and benefits of innovation to business;
- Supporting high growth businesses, in particular through the network of 'Technium' Centres across Wales that provide incubator space and strong links to research and expertise in higher education institutions;
- The creation of a *Knowledge Bank for Business*, to provide advice and support to businesses with high growth potential; and
- Making the most of capabilities in our higher education institutions, encouraging technology development, transfer and commercialisation; and forging closer links more generally between businesses and academia.

Reaching Higher: A Strategy for the Higher Education Sector in Wales

2.8 In March 2002, following a comprehensive review by the Assembly's Education and Lifelong Learning Committee, the Welsh Assembly Government published *Reaching Higher* - its strategy for the higher education sector in Wales. This included policies for widening access, reconfiguration and collaboration within the sector, promoting research and knowledge exploitation.

People, Places, Futures: The Wales Spatial Plan

2.9 In November 2004, the Welsh Assembly Government published *The Wales Spatial Plan*. The purpose was to set an overall planning framework for promoting sustainable communities in Wales; taking account of existing conditions, likely demographic trends, and the impact of Welsh Assembly Government policies and those of the United Kingdom Government and the European Union. *The Spatial Plan* incorporated the requirements of *The Sustainable Development Action Plan* for the period 2004 – 2007.

A Science Policy for Wales

2.10 In January 2006, the Welsh Assembly Government launched a consultation entitled *A Science Policy for Wales?* The First Minister's foreword acknowledged that arguments in favour of Wales having a science policy had become more compelling; because of the need to compete in the global knowledge economy and to ensure the integration of higher education and private sector strengths in science and technology.

2.11 The consultation document defined three main strands of a future science policy for Wales:

- Health developments;
- Low-carbon energy systems; and
- Enabling sustained economic and social renewal (utilising both natural and social sciences expertise).

2.12 The Welsh Assembly Government's consultation was completely separate from that carried out for our inquiry.



Section 3

Consultation Responses

3. Consultation Responses

3.1 When reviewing the consultation responses, we found significant support for the principle of developing a coherent science policy for Wales. We consider that two main strategic challenges face research and development in Wales; namely, the relatively small size of the research community and the lack of connectivity between its components.

3.2 There was reasonable consensus on what should be covered within an overarching science policy. This included:

- Building and sustaining higher education research excellence; finding the balance between supporting fundamental and visionary research, while recognising that strategic decisions must be made for Wales in order to prioritise resources and exploring the potential for new types of support, such as research professorships and centres of excellence;
- Fostering mutual trust and collaboration between academia and the business sector for knowledge transfer, commercialisation of research and developing an entrepreneurial culture in higher education institutions;
- Funding infrastructure for research and development and innovation;
- Fostering an interest in pupils to study science subjects in secondary schools; and developing policies to recruit and retain science teachers;
- Developing the skills required by companies; at technician, graduate and postgraduate levels, plus issues for retention of skilled staff in Wales; and
- Promoting a positive public awareness of science, as a means of wealth creation and also a means of developing more effective public policy across the board.

3.3 Respondents acknowledged that much is already happening in many of these areas. However, we feel that individual plans and strategies are sometimes uncoordinated; with resultant confusion, gaps and duplication. We consider that an effective science policy should inspire, as well as coordinate and direct activity. It should also promote Welsh strengths to the rest of the United Kingdom and beyond.

3.4 We were told of many examples of research and development excellence in Wales; although these were sometimes understated. But there was a common perception that Wales was under-performing in comparison with, for example, England and Scotland. In identifying the requirements for a science policy, respondents advised that we should take account of lessons learned elsewhere; for example, in models of knowledge transfer.

3.5 Many of the respondents stated that a coordinated science policy should cover education at all levels; with particular emphasis on teaching school science, attracting skilled and motivated teachers and encouraging more young people to study science subjects. We consider that fostering an interest in science in schools would have a fundamental impact on the numbers of students progressing through further and higher education and on to a scientific career.

3.6 Several other issues were raised by respondents, which were also aired in the oral evidence sessions. These included the need:

- To audit current research and development strengths;
- For further strategic research collaboration between higher education institutions in Wales, to develop critical mass, to avoid duplication, to agree research priorities and to ensure regional provision;
- To build inter-disciplinary links between Welsh university science departments based on excellence in individual disciplines;
- To maximise access to research and development funding outside Wales; in particular, from the European Union, from UK research councils and from UK government departments;

- To improve awareness that science makes a significant contribution to public policy, business decision-making and quality of life;
- To better advertise Welsh research strengths and skills – to the business sector and internationally; and
- For an overarching science policy to be imbedded within the Welsh Assembly Government's policy framework.

3.7 Many of the consultation responses were ambitious in defining what a science policy might achieve. But they were unclear about the scale of extra funding required, how coordination would be managed, responsibility allocated or effectiveness measured.



Section 4

Oral Evidence

4. Oral Evidence

Current Research Strengths in Wales

4.1 The starting point for discussion was to accept that Wales could not be good at everything. In making hard choices for investment, we were told that there must be a better match between research excellence and business needs for science and technology. As Wales cannot afford to fund all the desired research, the goal for strategic investment should be to concentrate on areas of existing strengths or where there is potential to become world class.

4.2 Among the principal examples of research strengths noted by witnesses were; health, energy, advanced manufacturing, telecommunications; diagnostic agents, disease biomarkers; environmental sciences, medical sciences and their inter-disciplinary connections; cognitive neurosciences; civil engineering; nanotechnology; astronomy and its instrumentation; semi conductor physics, particle physics, condensed matter physics; and opto-electronics.

4.3 We consider that mapping research strengths and identifying research potential requires evidence rather than anecdote. It is also very important to understand the needs of industry and businesses. As discussed with the reference group, we feel that choices for investment in the science base must reflect the Welsh Assembly Government's economic policy objectives and be market-led rather than supply-led. We consider that an audit of science and technology strengths is critically important for evaluating present performance and for providing a means of monitoring future improvement.

4.4 The Welsh Development Agency's report on the *Future Technologies* initiative was very helpful; both in identifying promising areas of technology in Wales, and also the development of links between academia and the business sector to capitalise on specific strengths. The Federation of Small Businesses proposed an independent foresight exercise to identify future exploitable research areas. We support this idea and consider that the following research areas, amongst others, show promise; chemistry and energy research; and clinical research – possibly involving collaboration between Welsh universities, the National Health Service and the pharmaceutical industry.

4.5 In summary, we feel that our recommendations should aim to encourage and augment the present procedures to explore and establish consensus on current Welsh strengths and also future potential. Current analysis should be used to provide a set of baseline data against which to monitor progress. Mapping should cover skills supply as well as research capability; also addressing cross-border implications. In parallel, there is need for an assessment of company links with higher education institutions and company in-house investment in research and development and other innovation-related activities; with a view to shedding light on the causal relationship between research and development and company financial performance.

Benchmarking Science

4.6 We consider that it is important to measure research and development impact (economic development) as well as research and development input (funding) and relevant outputs (for example, publications and trained staff) and to make comparative evaluation of performance in Wales with other regions. It is also important to understand the nature of wealth creation in Wales, in order to decide whether, or not, spending on research and development is a good input measure.

Higher Education Research Funding

4.7 Welsh higher education institutions contribute to the promotion of science and technology in Wales in three ways; by advancing scientific education; by their research activity; and by knowledge transfer (sometimes referred to as 'third mission') – by exploiting their scientific knowledge and expertise, usually in partnership with private companies, for the benefit of society and the economy. These were covered by the Higher Education Funding Council for Wales in their presentation.

4.8 The Funding Council told us that they regarded science and technology research and teaching as a particular important funding priority. We were told that scientific research in Welsh universities is relatively under-funded compared with England and Scotland. This is a matter that the Education, Lifelong Learning and Skills Committee might wish to examine. In some fields (for example, engineering), Wales appears to be attracting less than its share of external funding. Many academics felt that, in recent years, Welsh higher education institutions had been under-performing, in terms of research outputs, but there had been a significant improvement in research quality.

4.9 We learnt that inward investment by industry in life sciences was low and that the importance of research and development investment by manufacturing industry was often not sufficiently recognised. Nonetheless, the Funding Council told us that the *Reaching Higher* goals of increasing investment in higher education from external sources were likely to be achieved. The funds potentially available from external sources will always be much greater than those from the internal sources.

4.10 We were told by the Royal Society of Chemistry and the Institute of Physics that their subjects were vulnerable; with departments suffering from financial hardship and recruitment problems. We were told that vulnerable subjects could not be protected by the current formulaic approach to funding. The reference group advised that this should be replaced by a more strategic approach. For example, Funding Council support for research in engineering and in medicine is declining, and yet these fields are highly important for wealth creation. Witnesses from the academic and industry sectors agreed that chemistry is strategically important.

4.11 However, we were told by the Northwest Development Agency that, in their experience, provision of funding for research must be based on current excellence or future prospects of success, rather than on specific geographical criteria; and funding decisions must focus on investment in growth areas rather than respecting obsolete disciplinary boundaries.

4.12 If the Higher Education Funding Council for Wales should become more strategic in planning the development of research capacity, witnesses from the higher education sector asked who then should advise the Funding Council. There are also sensitive issues concerning the autonomy of Welsh higher education institutions and the extent to which they can be instructed or guided by outside bodies. These are not matters for this inquiry. The Funding Council has been asked by the Welsh Assembly Government to look at the question of vulnerable subjects. We consider that a solid evidence base is required, if seeking to change the current funding pattern and it must be accepted that the issue is a strategic one for Wales, rather than an internal matter for individual institutions.

4.13 The Scottish model shows that designation of strategic importance (for chemistry) can work if accompanied by new funding; and witnesses from academia acknowledged that any loss of institutional control is outweighed by more effective investment. It has to be recognised that unpopular or under-performing departments may close. Although there is need to retain a broad science base, witnesses agreed that this need not be accomplished in every university. The reference group advised that it is important to ensure that collaboration and consolidation within a discipline does not lead to a fortress mentality; it can be even more important to break down the barriers between disciplines.

4.14 Although its future is currently uncertain, we feel that the Institute of Grassland and Environmental Research (IGER) at Aberystwyth provides one model for a strategically-defined research programme within a national framework. But wider adoption of this model would have implications for governance and independence of higher education institutions.

4.15 Strategic creation of professorial or other research appointments in specific areas (for example, the Institute of Life Sciences at Swansea University) can help to attract new funding. Other examples of pump priming to attract external funding are nanotechnology (Swansea University) and astronomy (Cardiff University). Industry support for funding research professorships is usually confined to the larger companies but Wales is ahead in creating a research chair, with support from the Welsh Development Agency. The Royal Academy of Engineering gave practical examples of enhancing excellence in engineering teaching and research, by encouraging and supporting links between academia and industry. These included industrial secondment schemes, research chairs and research fellowships, visiting fellowships, visiting professors schemes and global research awards.

4.16 Where areas of science are strategically important but currently below critical mass, we were informed that new activity could be stimulated by attracting researchers (sometimes a whole team) who are leaders in their field. However, in a global market, it will be difficult to attract researchers of the highest calibre by financial inducements alone; Wales must be seen as an excellent place in which to live, work and do business.

4.17 We were told that capacity might also be built by providing undergraduate bursaries for less popular subjects and by strategically funding postgraduate studentships, as well as by the efforts to attract (back) the research leaders. However, there was concern that differential incentives and subsidy just raise the costs for everybody, in a mobile transfer market and globally competitive environment.

4.18 In summary, there is a need to explore the options for identifying and supporting strategically important, yet possibly vulnerable, fields without succumbing to the temptation to pick “winners” or excessively interfering with the autonomy and governance of higher education institutions. Support must be focused on those fields and departments with the potential to grow; and on developing inter disciplinary strengths. These objectives for growing the research community must be accompanied by a continuing commitment to encourage collaboration within the research community, to build critical mass, facilitate training and attract external investment.

Research Collaboration between Higher Education Institutions

4.19 We consider that such collaboration is very important to support an adaptable science base. It is a fundamental part of the Welsh Assembly Government's *Reaching Higher* strategy, supported and facilitated by the Higher Education Funding Council for Wales. In their evidence, the Funding Council referred to the *Knowledge Economy Nexus Report* by a working group, on behalf of the Welsh Assembly Government, on the role of higher education in Wales. This recommended ways in which the research activities of Welsh higher education institutions might be developed to the benefit of academia and the economic and social wellbeing of the people of Wales. The Funding Council gave several examples of collaborative ventures between higher education institutions and also between institutions and private companies.

4.20 The Scottish mechanism for complementary research across all their universities (Scotchchem), referred to by the Royal Society of Chemistry, shows that collaboration to attain critical mass can attract external funding and promotes the training of researchers.

4.21 We learnt that collaboration between some Welsh universities in physics is already being supported by the Funding Council, at relatively low cost.

4.22 We see no reason to suppose that collaboration weakens prospects for the Research Assessment Exercise (a periodic, UK-wide assessment of the quality of research undertaken by higher education institutions) – although there was some difference of opinion on this point by some of our witnesses. We agree with the Funding Council that collaboration can both enhance individual performance and create the conditions for new funding.

4.23 Collaboration between universities and companies should capitalise on all opportunities; and regional needs may not require purely local solutions. For example, requirements in North Wales may be more easily accessed in Northwest England than in South Wales. But Wales should develop cross-border collaboration from a position of equality and investment; partnership cannot be built on weakness.

4.24 Federation of Small Businesses member companies did not report much cross-border collaboration but the Federation, in their evidence, identified an opportunity to connect Wales into existing successful networks (for example, the German knowledge transfer intermediary bodies and the university innovation networks in England) to import expertise and facilitate further activity within Wales.

4.25 **The Higher Education Funding Council for Wales, in pursuing the Welsh Assembly Government's higher education strategy 'Reaching Higher', should facilitate collaboration between Welsh universities in the fields of science and technology; for example, in bidding for research funding, sharing staff and joint working.**

4.26 **The Welsh Assembly Government should identify priority areas in which to support research and development in science and technology in the higher education and business sectors, following analysis of its science policy consultation exercise.**

4.27 **In addition to instituting the activities necessary to support collaboration and prioritisation, the Welsh Assembly Government should also provide significantly increased funding to develop research infrastructure and increase the total volume of world class science performed in Wales. The Advisory Council should be charged with clarifying objectives for science base infrastructure, funding level and method of distribution. The short-term objective should be to close the current funding gap in support for public sector research relative to comparator nations and regions.**

Knowledge Transfer

4.28 In supplementary evidence, the Welsh Assembly Government provided a useful background note setting out current examples of interaction between higher education and business; called 'knowledge transfer' or 'third mission' – this is at Annex 6.

4.29 The Campaign for Science and Engineering felt that the public policy aim of engaging universities more with business *"is failing to achieve its full potential because it tends to be geared towards finding commercial uses for existing university research rather than finding solutions to existing industrial challenges"*. The reference group considered that there was a need for a culture change within the higher education sector in Wales, in pursuit of innovation and delivery of the knowledge agenda.

4.30 We were told by several witnesses that exploiting basic research for wealth creation is not a simple matter of linking basic and applied research; there must be greater emphasis on the skilled individual not just understanding the science but also appreciating the complex world of business and commerce. We consider UK-wide initiatives to build innovation linkages (for example, LINK, Teaching Company schemes) are valuable but there has been relatively little effort to determine means of measuring success. We feel that the new collaborative research and development initiative, run by the Department of Trade and Industry, has the advantage of being able to fund business-to-business collaboration.

4.31 The Higher Education Funding Council, in an annex to their paper, provided data from the 2004 annual survey of the Higher Education – Business and Community Interactions (HEBCIS), which compared the research and development performance of higher education institutions in Wales with those elsewhere in the United Kingdom. This showed some encouraging results; for example, Welsh universities achieved a 28% increase in income from collaborative research involving both public and business funding.

4.32 We would like to see the establishment of a science fund to promote collaboration between Welsh higher education institutions and the private sector, with the aim of supporting mutual interests in innovation.

4.33 The United Kingdom Government has simplified the number of support programmes available, although there may also be need to rationalise these further at regional level. We feel that this would be particularly helpful for small and medium-sized businesses, which are often unaware of the plethora of support schemes available.

4.34 The Regional Innovation, Science and Technology Network is proving useful in drawing together common issues for integrated action. The recent publication by the Department of Trade and Industry of the *Science and Innovation Investment Framework 2004 – 2014: Next Steps* announces further consultation on how national and regional policies can work together more effectively to increase innovation and business-university collaboration. The United Kingdom Government will soon consult on how to build on the work of the *Lambert Review*, and proposes an increasing role for the Technology Strategy Board.

4.35 In their evidence, the Department for Trade and Industry informed us that information was being collated on the impact of research and development tax credits but it is already clear that some companies find it difficult to take advantage of the credits because of a relatively narrow accounting definition of research and development. It is important to remember that many companies (for example, in service sector) may undertake little research and development but invest in innovation in other ways.

4.36 ‘Graduate Opportunities Wales’ has been judged particularly valuable in placing graduates into small and medium enterprises and, thereby, building greater awareness of what higher education institutions can offer to business. However, much of the regional selective assistance currently focuses on cost-effective job creation. We feel that more funding is also needed to support company commitment to research and development; possibly by relaxing regional selective assistance rules. There is great potential for funding vehicles such as SMART Cymru in support of research and development, if the investment limit is raised sufficiently.

4.37 Companies have expressed support for the introduction in the United Kingdom of Small Businesses Investment in Research schemes (an idea originating in the United States of America - whereby a proportion of government department research and development spend is allocated to small and medium-sized enterprises). We were told by some witnesses that support for ‘spin-off’ companies (and their retention of skilled staff within Wales) requires more effort between higher education institutions, the Funding Council and the Welsh Assembly Government.

4.38 We feel that it is important to develop good practice in ‘Technium’ Centres (for example, the ‘OpTIC Centre’ in North Wales) in support of regional development and linking with higher education. The reference group judged that ‘Technium’ Centres play an important role in facilitating the knowledge economy in Wales, although evidence from elsewhere suggests that some incubator facilities are expensive and not especially productive. The Campaign for Science and Engineering and the Association of the British Pharmaceutical Industry considered that sometimes innovation was better served by licensing technology to a large company, rather than by initiating a ‘spin-off’ venture.

4.39 There is a globally competitive environment; and so industry investment in research and development (in higher education and in its own facilities) must be cost-effective. The Association of the British Pharmaceutical Industry told us that intellectual property issues were sometimes an impediment to collaboration between larger companies and higher education institutions. The shared focus needs to be on exploitation of intellectual property, rather than its retention.

4.40 The Federation of Small Businesses warned us that smaller companies may feel intimidated by the prospect of collaboration with higher education institutions. We were told that much of the current policy discussion focused on the links between small and medium-sized enterprises and higher education. But we felt that the research and development needs of larger companies must also be considered. Some proposed a longer-term goal to attract major corporate research and development companies into Wales, although others were sceptical about the prospects for achieving this goal. We consider that some larger companies might be attracted to work in Wales with existing smaller companies, rather than physically moving their corporate research and development base.

4.41 For companies of all sizes, some witnesses suggested that collaboration could be facilitated by a single point of contact for Welsh higher education institutions. However, such efforts have not always worked well because of the challenge of geographical dispersal. *Business Eye* is one model but it does not have the expertise to cover every sector throughout Wales. There is also the need to ensure that Welsh higher education institutions take responsibility for brokering collaboration with businesses. The Funding Council told us that collaboration was often most successful when built on individual relationships, rather than relying on formal schemes. Nonetheless, we feel that there is need for companies to better understand research activities across the whole higher education sector in Wales.

4.42 The Confederation of British Industry in their response to the Welsh Assembly Government's consultation, which they shared with our inquiry and with which we agree, stated that "... *if we are to transform the Welsh economy, and improve the level of wealth creation in Wales, we must increase the development of knowledge in Wales, and its commercialisation. We must provide the fertile ground in which new wealth-creating companies are spawned, and try to create the environment to draw knowledge-focused companies from outside Wales.*"

4.43 Higher and further education institutions have an important role to play in skills provision and continuing professional development for company employees. While large companies may already have a commitment to staff development via in-house programmes, we consider that small and medium-sized enterprises need more support to maintain skills. This view was endorsed by the Royal Academy of Engineering.

4.44 We consider that the Welsh Development Agency's Centres of Excellence programme is important to help broker linkages between the business sector and academia. But academic witnesses noted that there was a continuing need for better dissemination of the importance of research and development links to the community at large and, particularly, to small and medium-sized enterprises. We feel that the Cardiff University Innovation Network provides a valuable model for developing and nurturing such links.

4.45 We agree with the Federation of Small Businesses that there is potential for creating a forum where business and higher education can discuss mutually important research and development issues and where companies can share their experience of good practice. But efforts to clarify business research and development needs must be supported by resources to deliver tangible action.

4.46 Academic witnesses suggested that a forum could help to provide the instant service often requested by small and medium-sized companies, while at the same time building longer-term links; for example, via studentships. We feel that funding should be provided for new joint public-private sector partnership activities available for either sector to access research and development for mutual benefit. Identification of this mutual benefit could be helped by a virtual network/database of higher education excellence and expertise, to overcome the impediments of geographical distance and limited time for engagement.

4.47 **The Welsh Assembly Government should support Welsh universities and businesses in attracting external funding for research and development in priority areas. This support should include access to impartial expert advice, in addition to focused financial support; for example, by covering costs incurred in applying for funding from the European Union's framework programme (FP7) for funding research and development.**

4.48 **The Welsh Assembly Government should review current policies for supporting research and innovation in the private sector, to promote long-term scientific development within the identified priority areas.**

4.49 Complementary to current support schemes, the Welsh Assembly Government should create a new science fund, accessible by industry and academic researchers working in partnership. Smaller companies should be particularly encouraged to become involved in this new research and development support mechanism.

4.50 The Welsh Assembly Government should aim to attract new research-based industries, particularly multi-national companies, into Wales; for example, by facilitating and participating in overseas missions, and other events, with Welsh universities and businesses.

4.51 The Welsh Assembly Government should encourage the development of local partnerships to share ideas and to exploit the fruits of research; these partnerships should include central and local government, industry and academia. The Welsh Assembly Government should promote strong links between these local partnerships, the Advisory Council and scientific institutions. Policies to encourage such partnerships should be responsive to the needs of industry.

4.52 The Higher Education Funding Council for Wales should promote academic capacity to analyse and facilitate good practice in knowledge transfer in Wales.

4.53 In summary, we feel that there is need to better understand industry expectations of higher education and to provide databases of resources, whereby companies can learn about the research strengths of Welsh higher education institutions. Linkages between the business and higher education sectors should include the service sector, as well as manufacturing industry, and should involve the social sciences, as well as the physical/natural sciences. In considering options for new models to help broker research and development interaction between companies and between sectors, it is vital that a broad view is taken of the range of useful collaborative activities.

4.54 With regard to the regional and national support mechanisms for companies, there is continuing need to clarify and improve value by removing artificial limitations. There may also be further room to develop a simplified and coherent approach; for example, across research and

development tax credits, regional selective assistance, Business Eye, Knowledge Bank, SMART Cymru, 'Technium' Centres, university innovation networks, and support schemes run by the Department for Trade and Industry.

4.55 There may be potential for creation of a 'Knowledge Transfer Centre' in Wales in a university location; analogous to the Cambridge Massachusetts Institute of Technology (CMIT) model with a remit to understand and develop business-higher education collaborations and to become involved in teaching and supporting entrepreneurship. Relevant research has been published recently in the CBI Innovation Survey and the CMIT Innovation Benchmarking Survey.

Schools, skills provision and public engagement

4.56 The reference group strongly advised that a coherent science policy must cover the issues for schools in teaching science and providing the next generation of researchers. The Campaign for Science and Engineering informed us that there was a continuing shortage of trained science teachers and they felt there was need for more coordination in support for teachers' continuing professional development.

4.57 The Royal Society for Chemistry pointed to a declining enthusiasm for science by students in their mid-teens. They felt that young people could be attracted to science through its applications and by explaining the broad career choice provided by science degrees. Women into Science and Engineering (WISE) felt that there was a need for more coordination across activities aimed at generating new scientists. The Royal Academy of Engineering told us that external provision and coordination of engineering activities in schools in Wales was a success, although industry placement of students was weak.

4.58 The Higher Education Funding Council felt that the best incentive to studying science was the expectation of employment but some companies struggled to recruit graduate scientists and there were problems of local collaboration between further and higher education institutions. The Campaign for Science and Engineering felt that school-business partnerships were important and that there was also need to foster entrepreneurial skills throughout education.

4.59 The United Kingdom Government publication *Science and Innovation Framework 2004-2014: Next Steps* includes proposals for improving school provision of science, engineering and mathematics; to increase the number of pupils studying science subjects; their attainment in those subjects; and the recruitment, retraining and retention of specialist teachers. We support these aims and hope that the Welsh Assembly Government will pursue similar policies.

4.60 A recent publication by the Biosciences Federation entitled '*Enthusiasing the next generation*' makes a wide range of recommendations in support of bioscience education; with regard to modernising and focusing the curriculum, ensuring its coherence between successive stages, incorporating practical work, assessment of learning and its applications and with regard to the provision of career advice and to the continuing professional development of teachers.

4.61 Independent research commissioned by another witness (Royal Society) into possible means whereby government can receive coherent, independent advice from the science community on issues in science education will be published later this year.

4.62 The Campaign for Science and Engineering felt that Wales did not sufficiently celebrate its scientific achievements. We consider that public engagement should be a core part of science policy and should involve the business and higher education sectors as well as schools. This view was endorsed by Women into Science and Engineering and also 'Techniquest'. We suggest that the National Assembly might emulate the Westminster politician-scientist pairing scheme, currently operated by the Royal Society.

4.63 **The Welsh Assembly Government, in consultation with relevant bodies such as the General Teaching Council for Wales, Estyn and the teacher unions, should review current policies on the recruitment, retention and professional development of science teachers; and also the content and development of the science curriculum in schools, to make it more relevant to the needs of industry.**

4.64 **Welsh universities, scientific institutions and professional bodies should develop stronger links with schools to promote an interest by pupils in science; both for its own sake and as a possible career. Relevant bodies should build on existing programmes to spread the message that science is interesting, has a profound effect on our everyday lives and could prove crucial in determining the future of our planet.**

4.65 In summary, we feel that without attention to issues for school science, other recommendations are unlikely to realise their full potential. Improving the provision of science in schools and enthusing new students requires, among other things, increased outreach to schools from business and higher education institutions; improving and coordinating continuing professional development for teachers; and ensuring coherence and consolidation between the external providers of science education.

External Partners

4.66 Coherent science policy in Wales is not just a matter for the Welsh Assembly Government but also requires input into policy at the United Kingdom level, when an impact on Wales is anticipated. This view was put forward by the Biosciences Federation and others. The Higher Education Funding Council felt that Wales was under-represented when developing relevant policies at the United Kingdom level and that this has had negative consequences for research funding in Wales.

4.67 In addition, the Campaign for Science and Engineering and the Biosciences Federation felt that Assembly Ministers should be more proactive in their interaction with United Kingdom government departments (such as the Department for Environment, Food and Rural Affairs and the Department for Trade and Industry), to argue that research for policy needs in Wales should be appropriately funded. We welcome the recent meeting between representatives of the Welsh Assembly Government and the United Kingdom Science Minister and hope that such meetings will continue to focus on matters of mutual interest.

4.68 The National Assembly for Wales could implement a science policy without requiring any changes to the devolution settlement. But there may be need to clarify the treatment of National Assembly officials in meetings with Westminster officials, on those occasions when discussion might be deemed advice to the United Kingdom Cabinet.

4.69 The European Union represents an important source of funding for science and technology. But Wales struggles to attract sufficient research and development funding; partly because of a lack of potential industry participants and partly because of lack of a critical mass in the higher education sector. The Welsh Development Agency told us that Welsh companies report a higher success rate in winning funds from the Department for Trade and Industry than from the European Union. Academic witnesses said that Welsh universities needed to be more proactive in advertising its research and development strengths when applying for funding from the European Union.

4.70 Eluned Morgan MEP told us that Wales currently has a singular advantage, compared with elsewhere in the United Kingdom, in being eligible for both European Union Structural Funds (previously Objective 1 – now called Convergence Funding), which will be much more focused on research and development in the next round of funding, and also the European Union Framework Programmes for Research and Technological Developments (Capacity Programme). This will include support for trans-national secondment of research staff, purchase of equipment, organisation of meetings to facilitate knowledge transfer and expert evaluation of research quality and infrastructure.

4.71 We were told that Welsh universities have not been particularly effective in communicating research and development strengths to the various institutions of the European Union. We believe there is now a major opportunity for science policy in Wales to capitalise on European Union initiatives by:

- Understanding and influencing the scope of Framework Programme 7;
- Appreciating that there will be an increasing availability of Structural Funds for science and its applications;
- Welsh Assembly Government support for Framework Programme funding applicants from Wales (analogous with the Scottish support scheme) so that Wales wins its appropriate share of funding;
- Integrating European Union funding opportunities with the broader Welsh Assembly Government science policy goals; and
- Ensuring that European Union funding for research and development is accompanied by effective exploitation of knowledge transfer.

4.72 In summary, new external funding can be attracted as a consequence of implementing the strategy previously described; to increase the impact of internal funding (pump-priming and selective research appointments), if coupled with efforts to communicate and champion Welsh research relevance and strengths to other decision-makers. In addition, in order to attract European Union Framework Programme funding, the Welsh Assembly Government should support applicants; both at the stage of their bid for funding and for overhead costs incurred in successful bids. We firmly believe that it is worth making the effort: Wales is in a unique position in the United Kingdom in being able to draw extensively on the twin sources of European Union funding described above.

Requirements for a Science Policy in Wales

4.73 Many witnesses (including the Institute of Physics, Federation of Small Businesses, Campaign for Science and Engineering and the Biosciences Federation, Cardiff University and Swansea University) agreed that Wales needs a science policy: to reap the economic benefits of science and to aid government evidence-based decision-making; to draw on best practice established elsewhere; and to capitalise on the United Kingdom investment framework for science. The reference group emphasised the need for the active involvement of the Welsh Assembly Government and commitment to partnership – and the allocation of new money in support of science.

4.74 According to the Federation of Small Businesses, Cardiff University and Swansea University, an overarching science policy should:

- Build the knowledge-based economy, investing in people and scientific infrastructure and covering education across the whole spectrum from schools to further and higher education, educating society in science as well as training the next generation of scientists;
- Guide research and development and innovation, supporting the generation of new science as well as exploiting the outcomes of science and developing third mission awareness of higher education institutions;
- Identify thematic challenges to face rather than picking individual subjects to fund;

- Ensure that the Welsh Assembly Government uses science to inform its decisions; and
- Increase the international profile and esteem of Welsh science and technology.

4.75 The Welsh Assembly Government should develop a science policy for Wales, to build the knowledge-based economy, to cover strategies for: supporting the generation of new science and the development of new scientists, as well as exploiting the outcomes of science; identifying thematic priorities; ensuring the Welsh Assembly Government uses science to inform its decision-making across all departments; thereby increasing the international profile and esteem of science and technology in Wales.

4.76 The science policy should be set within the strategic policy framework of 'Wales: A Vibrant Economy' and 'The Wales Spatial Plan' and also 'The Sustainable Development Action Plan' - to promote excellence in science and technology in Wales and to develop three of the key drivers to business growth; innovation, entrepreneurship and skills.

4.77 We agree with the Northwest Development Agency that science policy and strategies must be accompanied by measurable targets and implementation plans. The development of these strategies must start with the appraisal of present strengths and gaps (all witnesses) – in the quality of research performed and the mechanisms to use research outputs; whether by business, policy-makers or other stakeholders.

4.78 Any new initiative for science policy in Wales should align with recent moves by the Welsh Assembly Government to prioritise its activities in respect of the exploitation of science, for health, low carbon energy systems, sustainable development and economic renewal.

4.79 The Welsh Assembly Government sets the strategic directions for research and development in Wales, based on its consultation with the scientific community. According to this analysis, we consider that the Welsh Assembly Government requires a Science Advisory Council composed of stakeholders from industry and the higher education sectors – to steer rather than rigidly prescribe. University witnesses stressed that this advisory

function should not be too inward looking, but recognise the value of wider collaboration and build the external profile to attract inward investment.

4.80 The value of a Science Advisory Council (business-led) was well illustrated by the Northwest Development Agency when they referred to the critical role played in regional development agency initiatives on science policy, infrastructure development, support for small and medium-sized businesses, growing higher education excellence and the promotion of image externally.

4.81 Several witnesses felt that creating a new Chief Scientist role in the Welsh Assembly Government would add value in terms of: functioning as champion for Wales in communicating externally about Welsh strengths in science and innovation; representing Wales in United Kingdom-wide science strategy discussions; providing visibility, accountability and coordination across all research sectors and the strategic development of science in pursuit of agreed Welsh Assembly Government goals for higher education and business; motivating, assessing and stimulating attention to science in all Welsh Assembly Government departments.

4.82 The Welsh Assembly Government should establish a full-time post of Chief Scientist, in charge of an Office of Science and Technology; to develop and coordinate policy development in these fields, across all departments.

4.83 The Federation of Small Businesses advocated the establishment of a junior ministerial post for science, innovation and technology, supported by a Chief Scientist and Advisory Council. We consider that, while parts of the Scottish model may not be practical for the smaller Welsh Assembly, dedicated ministerial responsibility is needed to coordinate development of the knowledge economy.

4.84 While science policy in Wales clearly has to capitalise on the strategic opportunities emerging elsewhere in the United Kingdom and European Union, it is also important for policy to be prioritised and distinctive. The temptation to compete with everyone else in fashionable areas should be resisted although niche strengths could be developed, even in highly competitive fields. We acknowledge that prioritisation can be controversial and is likely to generate internal tensions. But experience from the Northwest Development Agency indicates that industry should lead in advising on the regional focus.

4.85 The Welsh Assembly Government should establish an industry-led Science and Technology Advisory Council; to include the Chief Scientist, business leaders from inside and outside Wales, senior scientists and engineers from the higher education sector and relevant institutions.

4.86 The Advisory Council should identify areas in which to concentrate investment in science and technology; its work should be shaped by a remit, issued annually by the Assembly Minister for Enterprise, Innovation and Networks.

4.87 The Assembly Minister should instruct the Advisory Council to establish the strategic objectives for a science policy in Wales; a programme for achieving these objectives; and a process for monitoring progress.

4.88 The Assembly Minister should instruct the Advisory Council to establish current strengths in research and technology in Wales; and to report within a year. The purpose would be to obtain baseline data, to facilitate the monitoring of progress in future years, by quantifying:

- Research of international quality in Welsh universities;
- Business investment in research and development and other innovation-related activities in Wales;
- The relationship between such investment and the financial performance of companies; and
- The extent of cross-border and international collaboration; including the sharing of ideas, equipment and staff.

4.89 In summary, recommendations from this inquiry must inspire the Welsh Assembly Government to clarify and disseminate the principles, objectives and scope of an overarching policy, aligned with their current initiatives for science. Delivering the science policy will require reinforcing the mechanisms for funding efficiently, networking effectively and measuring appropriately. The science policy should also foster an environment where scientific evidence is used to support decision making across all Welsh Assembly Government departments.

Section 5

United Kingdom and European Context

5. United Kingdom and European Context

5.1 Generally, the science policy objectives for Wales are similar to those for the rest of the United Kingdom and many other developed nations; namely, to ensure a world class research base, to ensure a world class work force and to ensure a strong knowledge-based economy. Reference was made to individual initiatives outside of Wales with regard to points of detail in the oral evidence – a brief summary is now provided of the strategic context.

United Kingdom/England

5.2 The United Kingdom Government's strategy was launched in July 2004 and a review of progress was published in March 2006; *Science and Innovation Investment Framework 2004 – 2014: Next Steps*. This strategy is noteworthy in several respects: it takes a long-term view of performance, it represents a coherent approach across all departments and it makes a powerful case for investment in research. In discussing Wales, this report briefly reviews activity by the Welsh Development Agency and the Higher Education Funding Council for Wales; describes the Nexus objectives; notes that Wales is active in knowledge transfer enterprises and is increasing in research quality.

5.3 *The Science and Innovation Investment Framework* is also important in making the point that central Government support for science is not confined to the national objective of economic growth. Science is recognised as particularly important for the National Health Service and significant research funding is undertaken by many Whitehall departments. In 2003, the National Audit Office reviewed efforts by central government departments to commission, manage and use research to support service delivery and improve policy. Audit Office recommendations covered clarification of departmental strategic research aims, development of coherent systems for procuring research and sharing best practice to improve commissioning.

5.4 The trend in United Kingdom Government support for industry technology development is embodied in three specific initiatives:

- Research and development tax credits;
- Department for Trade and Industry National Technology Strategy;
- Provision of funding to regional development agencies to support technology.

5.5 The Department for Trade and Industry has lead responsibility for taking forward the United Kingdom Government response to the Lambert Review (relating to business-university collaboration); the Lambert Review recommendations cover a lot of areas relevant to our inquiry; for example:

- Focusing Government business research and development support on small and medium-sized enterprises: one major vehicle for this is the *Small Business Research Initiative* whereby government departments have the target of procuring 2.5% of their research and development from such businesses;
- Increasing exchange of expertise and perspectives between academia and companies, for example appointing academics as non-executive directors to Boards, seconding industry people to teach in higher education, and encouraging universities to capitalise on their alumni networks of graduates working in the business community;
- Sharing and implementing best practice in research collaborations between industry and universities and increasing 'third mission' funding to support knowledge transfer from academia; sharing, where appropriate, technology transfer services between institutions to optimise capacity and improve performance;
- Supporting Sector Skills Councils in exerting real influence over university courses and their curricula. (The Higher Education Funding Council for Wales is probably ahead of the rest of the UK in ring-fencing part of the teaching budget for developing employability skills and providing work experience).

5.6 Regional development agencies are now well established in England and all have created a Science and Industry Council, fulfilling a recommendation from the House of Lords Science and Technology Committee; in their 2003 report "Science and the Regional Development Agencies". The Lords' Committee emphasised the five 'Cs' – coherence, connectivity, coordination, communication and cooperation – as fundamental to the exploitation of science and technology at the regional level.

5.7 The Northwest Development Agency, which presented evidence to our inquiry, has pioneered the Science Council and Science Strategy concept. The strategy emerged from objectives to build on and cluster business strengths in biotechnology, aerospace, chemical technologies and nuclear energy and major scientific infrastructure such as Jodrell Bank and Daresbury Laboratory – to create jobs by positioning the Northwest of England as a centre of excellence in science.

5.8 Apart from their science and industry councils, the experience of the regional development agencies is relevant in many other ways to our inquiry. They emphasise their responsibilities to support innovation and enterprise, to maintain the supply of appropriate skills for employers, to coordinate regional transfer and use of research and development. The role of development agencies in bringing together higher education, further education, the voluntary and the private sectors to invest in science is particularly applicable in areas like Northeast England, Northern Ireland and Wales, where respondents to the Lambert consultation noted that demand from the private sector for the kind of expertise that universities can offer is relatively weak.

5.9 Another United Kingdom Government initiative to promote enterprise and further links between education and business is the formation, in 2004, of a network of local Science Enterprise Centres. These Centres are expected to contribute to business creation by teaching scientists about enterprise; encouraging technology transfer by supporting academics in their dealings with industry (by mentoring and other consciousness raising); and providing support for spin-out businesses (identifying availability of financial resources).

5.10 Science Enterprise Centres are distributed across England, Scotland and Northern Ireland – but not currently in Wales. Of course, their functions can be provided in other ways and some might argue that Wales already does very well in inculcating enterprise. For example, the Global Entrepreneurship Monitor study (London Business School) shows that entrepreneurial activity in Wales increased by 74% between 2002 and 2003, the second largest increase of any UK region. But only 10% of such new businesses in Wales use technologies in their product or service that were not available one year ago. This is considerably less than the UK average.

Scotland

5.11 The Science Strategy for Scotland provides one benchmark for what Wales might hope to achieve in its science policy. The Scottish Science Strategy covers five main goals:

- Maintain a strong science base, fully connected to United Kingdom and international activity and funding sources;
- Increase the effective exploitation of research to grow strong Scottish businesses and provide cutting edge science to meet the needs of the people of Scotland;
- Ensure that enough people study science to a standard which will enable the future needs of the country to be met;
- Promote the awareness, appreciation and understanding of science across society; and
- Ensure the effective use of scientific evidence in policy formulation and resource allocation by government.

5.12 The Scottish Executive funds a wide range of research programmes contributing to these objectives and also supports various initiatives to build innovation and competitiveness. The Scottish Institute of Enterprise (embracing all 13 of Scotland's universities) is part of the Science Enterprise Centres network.

5.13 One initiative of particular interest encompasses three Intermediary Technology Institutes, created to stimulate entrepreneurial dynamism in the key areas of life sciences, energy and 'techmedia'. These institutes function across higher education and business sectors to identify emerging markets and develop the technologies to exploit them.

5.14 The report from the recent inquiry by the Enterprise and Culture Committee of the Scottish Parliament on "Business Growth" is also relevant to our inquiry; in particular, regarding its analysis of international comparator regions, its focus on growing research and development investment and its analysis of the best means of stimulating innovation. The recommendations in this report cover a wide range of challenges, including fostering entrepreneurial attitudes, building links between business and academia, generating a skilled and flexible workforce, strengthening science education, and raising the international profile of Scotland.

Northern Ireland

5.15 The Northern Ireland Department of Enterprise, Trade and Investment's research and evaluation agenda covers issues for competitiveness; research and development and innovation; enterprise, skills and labour market; infrastructure and investment that are also relevant to our inquiry. The programme of evaluation scheduled for 2005-2006 will include analysis of the type and amount of research and development undertaken in the higher education sector and within government departments; with a view to identifying policy needs to support research and development.

5.16 Recent analysis of the situation in Northern Ireland by the Campaign for Science and Engineering emphasised the relative under-funding of the science base (similar to Wales) by comparison to England and Scotland. One contributory factor in both Northern Ireland and Wales may be the lack of Research Council Institutes. The solution proposed for Northern Ireland to capitalise on what research excellence it has and build business research and development is composed of three elements:

- Attract inward investment from existing larger science-based companies;

- Grow the endogenous small and medium-sized businesses that recognise the importance of innovation; and
- Encourage those companies, which do not yet conduct research and development, to start doing so.

Eire

5.17 The 2004 Report *“Building Ireland’s Knowledge Economy – The Irish Action Plan for Promoting Investment in research and development to 2010”* is a detailed account of the current research and development performance, the vision for 2010 and an action plan to achieve agreed goals. In May 2005, the Minister for Enterprise, Trade and Employment announced the appointment of a Science Advisory Council, as part of the desired coordination and governance of science and technology and innovation. This new Council, which includes representatives from industry, academia and local government, has roles to act as primary interface between stakeholders and policy makers; contributing to development and delivery of coherent and effective national strategy and to provide advice to government on policy.

5.18 Another key initiative was the launch of Science Foundation Ireland to enable Irish universities to work together rather than, as in the past, competing with each other for funding and linkage with foreign universities. Three new centres for science, engineering and technology are planned (in human proteomics, alimentary ‘pharmabiotics’ and digital enterprise) - together with other interdisciplinary clustering of industry and academic researchers.

5.19 The Irish government has recently launched a new research and development strategy. This includes wide-ranging targets for generation of postgraduates, public research infrastructure, researcher mobility, technology transfer, school science education, involvement in European Union initiatives and increased spending on research and development. It also includes proposals to establish ‘Technology Ireland’ - to encourage industry-led research by simplifying grant support and building industry capabilities.

European Union

5.20 The European Union is an important source of comparative statistics on national and regional performance in research and development and innovation, and supports a range of analytical projects to identify best practice. The principal instrument for European Union funding of research and development have been the framework programmes, referred to earlier in this report, designed to stimulate, organise and exploit all forms of cooperation in research.

5.21 The proposed framework programme FP7 (due to start in 2007) will introduce two additional funding vehicles:

- **European Research Council;** essentially to support fundamental research of the highest quality, without the criterion of EU collaboration;
- **Technology Platforms;** essentially led by industry and able to draw on additional funding from Member States under Article 171 of the Treaty. Selected technology platforms will be eligible for additional strategic support, on evolution into Joint European Technology Initiatives. These will cover a wide range of key industry sectors, for example energy (hydrogen and fuel cells), agriculture (plant genomics and biotechnology, animal health), health care (innovative medicine, nanomedicine), transport (aeronautics, road, rail, maritime), other manufacturing (sustainable chemistry, nanoelectronics).

5.22 In addition to direct funding of research, the European Union has been active in encouraging private sector research and development investment as part of the Lisbon and Barcelona goals to reach an investment level of 3% of gross domestic product by 2010.



Section 6

Our Recommendations

6. Our Recommendations


6.1 We recommend that:

1. **The Welsh Assembly Government should develop a science policy for Wales, to build the knowledge-based economy, to cover strategies for: supporting the generation of new science and the development of new scientists, as well as exploiting the outcomes of science; identifying thematic priorities; ensuring the Welsh Assembly Government uses science to inform its decision-making across all departments; thereby increasing the international profile and esteem of science and technology in Wales. [4.75]**
2. **The science policy should be set within the strategic policy framework of 'Wales: A Vibrant Economy' and 'The Wales Spatial Plan' and also 'The Sustainable Development Action Plan' - to promote excellence in science and technology in Wales and to develop three of the key drivers to business growth; innovation, entrepreneurship and skills. [4.76]**
3. **The Welsh Assembly Government should establish a full-time post of Chief Scientist, in charge of an Office of Science and Technology; to develop and coordinate policy development in these fields, across all departments. [4.82]**
4. **The Welsh Assembly Government should establish an industry-led Science and Technology Advisory Council; to include the Chief Scientist, business leaders from inside and outside Wales, senior scientists and engineers from the higher education sector and relevant institutions. [4.85]**
5. **The Advisory Council should identify areas in which to concentrate investment in science and technology; its work should be shaped by a remit, issued annually by the Assembly Minister for Enterprise, Innovation and Networks. [4.86]**

6. The Assembly Minister should instruct the Advisory Council to establish the strategic objectives for a science policy in Wales; a programme for achieving these objectives; and a process for monitoring progress. [4.87]
7. The Assembly Minister should instruct the Advisory Council to establish current strengths in research and technology in Wales; and to report within a year. The purpose would be to obtain baseline data, to facilitate the monitoring of progress in future years, by quantifying:
 - Research of international quality in Welsh universities;
 - Business investment in research and development and other innovation-related activities in Wales;
 - The relationship between such investment and the financial performance of companies; and
 - The extent of cross-border and international collaboration; including the sharing of ideas, equipment and staff. [4.88]
8. The Higher Education Funding Council for Wales, in pursuing the Welsh Assembly Government's higher education strategy 'Reaching Higher', should facilitate collaboration between Welsh universities in the fields of science and technology; for example, in bidding for research funding, sharing staff and joint working. [4.25]
9. The Welsh Assembly Government should identify priority areas in which to support research and development in science and technology in the higher education and business sectors, following analysis of its science policy consultation exercise. [4.26]
10. In addition to instituting the activities necessary to support collaboration and prioritisation, the Welsh Assembly Government should also provide significantly increased funding to develop research infrastructure and increase the total volume of world class science performed in Wales. The Advisory Council should be charged

with clarifying objectives for science base infrastructure, funding level and method of distribution. The short-term objective should be to close the current funding gap in support for public sector research relative to comparator nations and regions. [4.27]

11. The Welsh Assembly Government should support Welsh universities and businesses in attracting external funding for research and development in priority areas. This support should include access to impartial expert advice, in addition to focused financial support; for example, by covering costs incurred in applying for funding from the European Union's framework programme (FP7) for funding research and development. [4.47]
12. The Welsh Assembly Government should review current policies for supporting research and innovation in the private sector, to promote long-term scientific development within the identified priority areas. [4.48]
13. Complementary to current support schemes, the Welsh Assembly Government should create a new science fund, accessible by industry and academic researchers working in partnership. Smaller companies should be particularly encouraged to become involved in this new research and development support mechanism. [4.49]
14. The Welsh Assembly Government should aim to attract new research-based industries, particularly multi-national companies, into Wales; for example, by facilitating and participating in overseas missions, and other events, with Welsh universities and businesses. [4.50]
15. The Welsh Assembly Government should encourage the development of local partnerships to share ideas and to exploit the fruits of research; these partnerships should include central and local government, industry and academia. The Welsh Assembly Government should promote strong links between these local partnerships, the Advisory Council and scientific institutions. Policies to encourage such partnerships should be responsive to the needs of industry. [4.51]

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16. The Higher Education Funding Council for Wales should promote academic capacity to analyse and facilitate good practice in knowledge transfer in Wales. [4.52]
 17. The Welsh Assembly Government, in consultation with relevant bodies such as the General Teaching Council for Wales, Estyn and the teacher unions, should review current policies on the recruitment, retention and professional development of science teachers; and also the content and development of the science curriculum in schools, to make it more relevant to the needs of industry. [4.63]
 18. Welsh universities, scientific institutions and professional bodies should develop stronger links with schools to promote an interest by pupils in science; both for its own sake and as a possible career. Relevant bodies should build on existing programmes to spread the message that science is interesting, has a profound effect on our everyday lives and could prove crucial in determining the future of our planet. [4.64]

Note: Numbers in parentheses refer to relevant paragraphs.

Members of the Reference Group

Name	Organisation
Chris Gwyther AM (Chair)	Committee Member
Kirsty Williams AM	Committee Member
Alun Cairns AM	Committee Member
Elin Jones AM	Committee Member
Mike Scott	North East Wales Institute of Higher Education
Richard Davies	University of Wales Swansea
Richard Rossington	Welsh Assembly Government
Ron Loveland	Welsh Assembly Government
Steve Sloan	Amicus
Virginia Chambers	Welsh Development Agency
Haydn Ellis	Cardiff University
Grahame Guilford	GE Healthcare
Dr Martin James	GE Healthcare
Dr Robin Fears	Expert Advisor
David Rosser	Confederation of British Industry
Amanda Wilkinson	Higher Education Wales



Cynulliad National
Cenedlaethol Assembly for
Cymru Wales

Bae Caerdydd / Cardiff Bay
Caerdydd / Cardiff
CF99 1NA

Eich cyf / Your ref
Ein cyf / Our ref

19 August 2005

Dear Colleague,

Science Policy

1. The Economic Development and Transport Committee has chosen for its forthcoming policy review to look at science policy in Wales. At the Committee's meeting on 10 November they discussed a paper (*EDT2 15-04 (p4)*), which sets out the background to the issues and discusses some of the underlying factors and policy considerations.

2. The Terms of Reference for the Review will be:

To consider a science policy in Wales which more effectively supports the development of a knowledge based economy. In particular:

- i. the current range of research and development carried out in Wales in both public and private sectors.*
- ii. ways in which it can be strengthened and made more effective.*
- iii. Covering likely priorities for science awareness, skills provision, HE excellence, technology transfer and innovation.*

and to make recommendations for the development of policy in this area.

3. The Committee would welcome written submissions of evidence from interested parties in relation to these issues. When it has considered these the Committee may invite further oral evidence.

4. Should you wish to contribute, written submissions should be sent by e-mail to **Economic.comm@Wales.gsi.gov.uk** or in hard copy to:

Meriel Singleton
Economic Development and Transport Committee
National Assembly for Wales
Cardiff Bay
Cardiff
CF99 1NA

to arrive by 30 September 2005. We welcome responses in English or Welsh.

5. As part of the National Assembly's commitment to openness, we will place copies of written responses in the National Assembly's libraries and will make them available to the public on request. Please indicate if you wish your response or any part of it, not to be made publicly available.

6. Please feel free to pass this invitation on to anyone else you feel may have an interest.

7. If you need any further information please contact the Committee's Clerk Sian Wilkins on 029 2089 8224 or its Deputy Clerk Sarah Bartlett on 029 8029 8153. I look forward to hearing from you.

Yours sincerely



Christine Gwyther AM
Chair, Economic Development and Transport Committee
Cadeirydd, Pwyllgor Datblygu Economaidd a Thrafnidiaeth

Website: <http://www.wales.gov.uk/keypubasemecondevtran/index.htm>

Schedule of Organisations Consulted

Association of the British Pharmaceutical Industry Cymru Wales	British Institute of Learning Disabilities
Academy of Medical Sciences	Caerphilly County Borough Council
Applied Industrial Research Trading Organisations	Cardiff & the Vale Parents Federation
All Assembly Members	Cardiff University
All Wales Ethnic Minority Association	Care Council for Wales
All Wales Support Unit	Care Forum Wales
Amicus the Union	Careers Wales
Anti Poverty Network Cymru	Careers Wales Association Ltd
Arfon Access Group	Carers National Association Wales
Association of Medical Research	Carmarthenshire County Council
British Association of Social Workers Cymru	Cartrefi Cymru
Beta Technology Ltd.	Confederation of British Industry
Bevan Foundation	Confederation of British Industry (Wales)
Bio Industry Association	Ceredigion County Council
Black Environment Network	Chamber Wales
Black Voluntary Sector Network Wales	Chemical Industries Association
Blaenau Gwent County Borough Council	Chwarae Teg
Brecon Beacons National Park Authority	Citizens Advice Cymru
Bridgend County Borough Council	City and County of Swansea Council
British Association for the Advancement of Science	Civil Service Pensioners Alliance
	Clerk, Enterprise and Lifelong Learning Committee
	Clerk, Enterprise, Trade and Investment Committee
	Clerk, Welsh Affairs Committee
	Cody Technology Park

Commission for Racial Equality
Wales Office

Community Enterprise Wales

Conservative Central Office for
Wales

Conwy County Borough Council

Council for Industry and Higher
Education

Countryside Council for Wales

Community Practitioners' and
Health Visitors' Association Wales

Community Service Volunteers
Wales

Cyngor Sir Ynys Môn

Denbighshire County Council

Department for Work and Pensions

Department of Trade and Industry

Department of Enterprise Trade and
Investment Northern Ireland

Development Trust Association

Disability Rights Commission

Disability Wales

Dysg

ECCO Trust Natural Health Centre

Education and Learning Wales Mid
Wales

Education and Learning Wales North
Wales

Education and Learning Wales South
East Wales

Education and Learning Wales South
West Wales

Engineering Employers Federation

Equal Opportunities Commission

Equal Opportunity Commission
Wales

Federation of Small Business Wales

Federation of Small Businesses

Finance Wales

Flintshire County Council

Forestry Commission

Foundation for Science and
Technology

GE Healthcare

Gwynedd County Council

Health Professions Wales

Higher Education Funding Council
for Wales

IBM UK Head Office

Institute of Chemical Engineers

Institute of Civil Engineers

Institute of Directors

Institute of Electrical Engineers

Institute of Mechanical Engineers

Institute of Physics

Labour European Office

Leonard Cheshire

Living Streets

Marland House

Mencap Cymru

Mencap in Wales

Menter a Busnes

Merlin Biosciences Ltd

Merthyr Tydfil County Borough
Council

Mid Glamorgan Education Business
Partnership

Mid Wales Partnership

Mind Cymru

Monmouthshire County Council

National Autistic Society

National Council – Education and
Learning Wales

National Office – Care Standards
Inspection for Wales

National Childminding Association
of England and Wales

North East Wales Institute

Newport County Borough Council

National Farmers Union Cymru
Wales

North East Wales Institute

North Wales Economic Forum

One Voice Wales

Pembrokeshire County Council

Pembrokeshire National Park
Authority

People First Wales

Port Talbot County Borough Council

Powys County Council

Policy Research in Engineering
Science and Technology, University
of Manchester

Prospects

RAND Europe

Regional Development Agencies
National Secretariat

Rethink

Rhondda Cynon Taf County
Borough Council

Royal National Institute for the Blind
Cymru

Royal National Institute for the Deaf
Cymru

Royal Academy of Engineering

Royal Society of Chemistry

Save British Science

Science Council

Science, Eng, Tech and Math
Network

Sector Skills Development Agency

Shaw Trust

Snowdonia National Park Authority

Society of British Aerospace
Companies

South East Wales Economic Forum

South West Wales Economic Forum

Science Policy Research Unit,
University of Sussex

Stonewall Cymru

Swansea Institute for Higher
Education

Techniquet

The Arts Factory

The Basic Skills Agency

The Council Of the City and County
Of Cardiff

The Environment Agency for Wales

The Mental Health Foundation

The Open University in Wales

The Royal Institution of Great Britain

The Welsh Consumer Society

Torfaen County Borough Council

Trinity College	Welsh Local Government Association
United Kingdom Science Enterprise Centres	Welsh Local Government Association Caerphilly County Borough Council
Uneb Ffermwyr Cymru	Women into Science and Engineering
University College of North Wales	World Trade Centre
University of Glamorgan	Wrexham County Borough Council
University of Wales Institute, Cardiff	Y Frenni
University of Wales Swansea	
University of Wales, Aberystwyth	
University of Wales, Bangor	
University of Wales, College of Medicine	
University of Wales, Lampeter	
University of Wales, Newport	
University of Wales, Swansea	
Vale of Glamorgan Council	
Wales Audit Office	
Wales Consumer Council	
Wales Council for the Blind	
Wales Council for the Deaf	
Wales Council for Voluntary Action	
Wales Gene Park, Institute of Medical Genetics	
Wales Leader Network	
Wales Rural Development Network	
Wales Social Partners Unit	
Wales Tourist Board	
Wales Trade Union Congress	
Welcome Trust	
Welsh College of Music and Drama	
Welsh Development Agency	

Schedule of Consultation Responses

(These can be viewed on the National Assembly website - www.wales.gov.uk)

Reference Number	Organisation
EDT2 SP1	Mid Glamorgan Education Partnership
EDT2 SP2	Ceredigion Council
EDT2 SP3	Justin Cooper, Caerphilly Council
EDT2 SP4	Vale of Glamorgan Council
EDT2 SP5	Forestry Commission Wales
EDT2 SP6	Torfaen Council
EDT2 SP7	Professor Tony Campbell
EDT2 SP8 and Annex	John Steele
EDT2 SP9	Campaign for Science and Engineering
EDT2 SP10	Association of British Pharmaceutical Industry
EDT2 SP11	Welsh e-Science
EDT2 SP12	Professor Jeremy Jones
EDT2 SP13	SetPoint Wales
EDT2 SP14	Biosciences Federation
EDT2 SP15	Wales Trade Union Council
EDT2 SP16	Wales Gene Park
EDT2 SP17	Bangor University
EDT2 SP18	SEMTA – the Sector Skills Council for Science, Engineering and Manufacturing Technologies
EDT2 SP19 and Annex	Higher Education Funding Council for Wales
EDT2 SP20	Swansea University
EDT2 SP21	Cardiff University
EDT2 SP22	University of Glamorgan
EDT2 SP23	Federation of Small Businesses
EDT2 SP24	Martin Evans
EDT2 SP25	Heads of Chemistry UK
EDT2 SP26	Royal Society of Chemistry
EDT2 SP27	Pembrokeshire County Council
EDT2 SP28	Welsh Development Agency
EDT2 SP29	Environment Agency Wales

Schedule of Committee Papers

Date	Name of Paper/ Organisation	Paper Reference Number
29 June 2005	Background Paper	EDT(2) 09-05 (p.3)
6 October 2005	Science Policy – Position paper from EDT Minister	EDT(2) 12-05 (p.1)
6 October 2005	Science Policy – Paper from Expert Adviser	EDT(2) 12-05 (p.2)
6 October 2005	Science Policy – Relevant data from MRS	EDT(2) 12-05 (p.3)
6 October 2005	Royal Society of Chemistry	EDT(2) 12-05 (p.4)
6 October 2005	Royal Society of Chemistry – Spin Out Report	EDT(2) 12-05 (p.4a)
6 October 2005	Campaign for Science & Engineering	EDT(2) 12-05 (p.5)
6 October 2005	The Association of the British Pharmaceutical Industry (ABPI)	EDT(2) 12-05 (p.6)
6 October 2005	Biosciences Federation	EDT(2) 12-05 (p.7)
2 November 2005	Higher Education Funding Council for Wales (HEFCW)	EDT(2) 14-05 (p.1)
2 November 2005	HEFCW Annex	EDT(2) 14-05 (p.1a)
2 November 2005	Cardiff University	EDT(2) 14-05 (p.2)
2 November 2005	Swansea University	EDT(2) 14-05 (p.3)
2 November 2005	The Royal Society	EDT(2) 14-05 (p.4)
2 November 2005	Analysis of written evidence	EDT(2) 14-05 (p.5)
16 November 2005	Federation of Small Businesses	EDT(2) 15-05 (p.2)
26 January 2006	Women into Science, Engineering and Construction	EDT(2) 02-06 (p.1)
26 January 2006	Wales Development Agency	EDT(2) 02-06 (p.2)
26 January 2006	North West Regional Development Agency	EDT(2) 02-06 (p.3)
2 March 2006	Department of Trade and Industry	EDT(2) 04-06 (p.1)
2 March 2006	Royal Academy of Engineering	EDT(2) 04-06 (p.2)
2 March 2006	Institute of Physics	EDT(2) 04-06 (p.3)
2 March 2006	Oral evidence from Eluned Morgan	EDT(2) 04-06

Briefing Note on Knowledge Transfer

Background

Knowledge Transfer (or Third Mission) is a term which is used to describe all activities undertaken by higher education institutions which is the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments. It traditionally refers to all HEI activities not related to teaching, learning and research.

The funding provided by the Welsh Assembly Government, via the Higher Education Funding Council for Wales (HEFCW), for Third Mission activities in 2004/05 was set at £3.1m and is to substantially increase to £6.1m in 2007/08. Within the context of Third Mission activities, Heads of HEIs have discretion in the use of this fund reflecting both institutional autonomy and the diverse nature of the institutions in Wales. The majority of institutions also direct some of their own resources to support Third Mission activities, which adds considerable value to the funding provided specifically for this purpose.

Higher education institutions are requested by HEFCW to produce Third Mission strategies. The current strategies cover the period of 2004/05 to 2006/07. Institutions have been encouraged to adopt a holistic approach to third mission activities. Following the publication of the Nexus Report in March 2004, Third Mission funding has been used to support the Knowledge Exploitation Fund and higher education institutions also considerably add to the funding from their own un-hypothecated resources.

There are five main areas where higher education institutions are contributing to the economic and social well-being of Wales:

- Enterprise and Entrepreneurship
- Services to Business
- Skills and Employment

- Innovation and Knowledge Transfer
- Social and Community Developments.

These are very wide-ranging areas and cover a whole host of activities.

Enterprise and Entrepreneurship embraces such initiatives entrepreneurship scholarships, university-based enterprise networks and the appointment of entrepreneurship champion in both higher education and further education institutions to promote the enterprise agenda to staff and students, including via curriculum developments.

In the case of **Services to Business**, HEFCW considers that this is an area of relative strength, with Wales being the first area of the UK to report via the Higher Education Business and Community Interaction Survey (HEBCIS) that all of its universities provided a dedicated point of access for business callers. However, there is a need to promote more effectively the higher education sector and what it has to offer to more businesses in Wales; particularly Welsh based small and medium-sized enterprises.

Skills and Employment is an area where great strides are being made and where Wales is at the forefront of improving graduate skills and employability. **GO Wales** is an initiative that is funded by HEFCW and levers in substantial European funds via European Structural Funds. GO Wales undertakes a range of activities, including graduate placements in small and medium enterprises (SMEs). GO Wales Phase 1's evaluation showed that 1644 students and graduates were placed with SMEs and around 60% of graduates found that their placement led to permanent employment with their host or another organisation. In addition, around 1500 companies benefited from work experience or continuous professional development (CPD) activities.

There is also active engagement with the Sector Skills Councils (SSCs). Higher education institutions are actively engaging with the SSCs, and in particular are developing courses that are industry –relevant. An example of this is the Skillset Screen Academy, which is being supported by Reaching Higher funding together with funding from Skillset (the SSC for the film and Television industries).

Innovation and Knowledge Transfer is an area where Wales has a mixed performance as evidenced in the latest HEBCIS. Wales is successful in spinout activity, which is the creation of new businesses emanating from the higher education sector. Third Mission funding supports specialist staff that are able to engage with the Wales Spinout Programme. The programme offers start up packages to academics, graduates, post graduates and entrepreneurs wishing to transfer their skills and knowledge to a commercially viable business. It provides special help with premises, finance, technical and business expertise and generally within an HEI.

HEBCIS 2005, which covers academic year 2003/04 (HEBCIS 2005 has not been published yet) shows that Welsh HEIs established 17 new spinout companies and four new start-ups, and accounted for over 12% of total UK spinout and staff start-up activity. The Welsh sector achieved almost 7% of total UK income from the sale of shares in university spin-offs. The turnover from all active spinout companies in Wales is estimated at around £25 million, which accounts for over 5.5% of all UK turnover.

Another activity that falls in this category is the Knowledge Transfer Partnership programme (more detail follows later), which enables higher education institutions to apply their wealth of knowledge and expertise to important business problems. At the heart of each Knowledge Transfer Partnership is a relationship between a company and staff in a knowledge-based organisation applying their expertise to a project that is central to the development of their company partner. In the process, staff in higher education institutions are able to enhance the business relevance of their teaching and research.

HEFCW has identified that Welsh higher education institutions could do better in terms of commercialising their intellectual property, principally through licensing and patenting, and access to venture capital. This is an area of activity that benefits from the employment of specialist staff and faces strong competition UK-wide. Only larger research-intensive institutions have the resources to employ such staff. Therefore, a collaborative approach has been developed, and Third Mission funding together with Knowledge Exploitation funding is being used to support the **Patent and Proof of Concept** scheme (PPOC). The Third Mission funding has enabled several institutions to engage Technology Transfer officers.

These individuals work closely with key academic groups to identify, evaluate and protect licensable intellectual property and are generally the institution's main liaison point with Patent Agents and other professional advisers specialising in technology transfer and brokerage. The PPOC scheme has invested in a number of technology transfer projects which allow the development of these to be accelerated beyond what could have been achieved from the institution's own resources.

Social and Community Development embrace community oriented outreach activities to address economic inactivity. There are social and economic impacts, although HEFCW states that this is the least quantifiable of Third Mission activities.

Knowledge Exploitation Fund

The Knowledge Exploitation Fund (KEF) provides financial assistance (approx £40M 2003 – 2007) to enable Higher and Further Education Institutions in Wales to:

- Create a culture of innovation and entrepreneurship,
- Develop the skills of staff and students within their institutions, and
- Facilitate the transfer of knowledge to industry.

Supported by the Welsh Assembly Government and European Union Structural Funds – it:

- **Builds upon collaborative R&D undertaken between Welsh universities and private industry.**

Through collaborative industrial research projects (CIRP), KEF is providing funding for industry-academic collaborative R&D projects in order to increase the R&D capacity of Wales and to stimulate the development of more high-technology, R&D driven businesses.

- 23 collaborative industrial research projects funded to date worth £4.3M with equal private sector investment leveraged into the projects.

- Resulting in 238 Collaborative Projects between industry & academia

- **Enhances the knowledge transfer between established centres of expertise in Higher and Further Education and knowledge-led businesses.**

Technology Transfer Centres (TTC) provide an opportunity for businesses to access leading edge technology and specialist advice and test services located within the resources of Higher and Further Education Institutions. Technology Transfer Networks (TTNs) are designed to facilitate joint working between research and technology transfer centres to provide an integrated and Wales-wide service to businesses.

- Funded 22 new Technology Transfer Centres (£5M),
- 4 incubator centres (£0.6M) and
- 10 Technology Transfer Networks (£0.7M)
- 1190 Companies Advised (Innovation & R&D)
- 28 Environmental Tech Transfer projects
- 3115 m² Floor Space created in above centres

- **Exploits the untapped reserves of patentable ideas from within Institutions for the benefit of the Welsh economy.**

The patent and proof of Concept (PPOC) supports the commercial exploitation of academic research. It provides support for all stages of the exploitation process with the effect of accelerating the process itself, and developing the ability of institutions to manage the commercialisation process.

- 46 projects funded with a total investment of £3M.
- 7 HEIs provided with Early Stage Development Funding to undertake technology evaluations prior to full PPOC applications

- Over 100 new technologies evaluated
- 10 Patents / Design rights Protected with ongoing licence opportunities explored

Combined KEF Exploitation projects have achieved:

- 265 Jobs created
- 322 Jobs Safeguarded
- 154 New companies created
- **Encourages the development and growth of entrepreneurship from within Welsh Higher and Further Education Institutions**
 - Over 650 scholarships funded (£3.4M) representing over 650 companies created
 - Every HEI and FEI (35) provided with an Entrepreneurship Champion (£5M)
 - 35 (HEI and FEIs) funded to develop a strategy for Entrepreneurship.
- **Enables Higher and Further Education Institutions, Sector Skills Councils, Assembly sector fora and industry associations to work together to ensure that the high level training in Science, Engineering and Technology (SET) necessary for business growth is accessible to companies**
 - An all Wales e-training network resource for all Welsh HEI and FEI to deliver high level SET skills to the Welsh SME base (£2M).
 - 8 industrial training consortia (£2.5M) developing and piloting high level SET skills.
 - 34 (FEI and HEI) funded to develop a strategy for innovation (£4.6M)

- 5 SME development grants funded to build the capacity of FEIs to work with industry (£.4M)
- Beneficiaries Objective (1) 2484 Objective (3) 873
Total = 3357
- Companies supported Objective (1) 1069 objective (3) 445
Total = 1514

Centres of Excellence (CETIC) Programme

An ambitious £3.5m programme launched with significant National Assembly (£1.77m) and European funding (Under Objective 1) to encourage and stimulate effective academia/industry collaborations and technology transfer.

The 2nd phase of the Programme features 18 research groups within academia in Wales, all of whom have been recognised for their facilities, leading edge research, and proven track record of successful collaborations with industry.

The Programme has helped fund the recruitment of commercial and technical staff dedicated to working with industry, and SME's in particular.

Knowledge Transfer Partnerships (KTP)

Formerly known as the Teaching Company Scheme and the College Business Partnership scheme – KTP allows for the facilitation of technology transfer via partnerships between industry and academia.

The scheme places Graduates and NVQ level 4 students - known as Associates - to spend up to 2 years or more in a company undertaking a project of significant strategic value.

The scheme has been in existence since 1975 and is sponsored by a number of bodies across the UK. WAG's Innovation and Technology department funds Welsh projects. The DTI Innovation Department are the lead sponsor. DTI also supports Welsh projects on a part funding basis.

Wales currently has a target of 110 programmes to be achieved by 2008. Current budget is £978k.

Although KTP does not have a direct job creation objective, previous reviews have noted its low cost-per-job figure. This means that the scheme actually created jobs for less expenditure than many other schemes with other explicit job creation objections.

Reviews have reported KTP has made HEIs more aware of the needs of businesses and nearly 80% reported an increase in the extent of their linking/networking with industry. And 80% of Associates take up jobs with their host firms as a result of their participation in KTP. Reviews have concluded the scheme was in economic terms “high” benefit and strongly recommended it’s should continuation and expand into other sectors.

In Wales we have taken forward the Review recommendations, by increasing the levels of funding and targets and continue to explore diverse ways of supporting KTPs outside the field of Technology Transfer, e.g. Tourism. We are also developing partnerships with other sponsors and last year developed a joint project support criteria with ESRC to fund social and economic KTPs in Wales.

There are also a number of KTP Centre’s in Wales based within individual Universities, such as Cardiff. Their aim is to promote the benefits of KTP and encourage local businesses to enter into collaborative projects with academia.

Wales has 3 dedicated KTP business advisors as part of the UK network.

Centres of Excellence (CETIC) 2004-2007

Aberystwyth Bio Centre - University of Wales Aberystwyth & IGER
www.aber.ac.uk/abc/

Centre for Advanced & Renewable Materials -
University of Wales Bangor & NEWI
www.carmtechnology.com

Centre for Advance Software & Intelligent Systems - University of Wales
Aberystwyth and Cardiff
www.aber.ac.uk/casis

Centre for Communications & Software Technologies –
University of Wales, Swansea
www.swan.ac.uk

Centre for Complex Fluids Processing – University of Wales, Swansea
www.swansea.ac.uk/chemeng/centre

Centre for Electronic Product Engineering – University of Glamorgan
<http://www.glam.ac.uk/soe/CEPE/>

Centre for Research in the Built Environment – University of Wales, Cardiff
www.cribe.uk.com/about/about.html

Manufacturing Engineering Centre – University of Wales, Cardiff
<http://www.mec.cf.ac.uk/>

Civil & Computational Engineering Centre – University of Wales, Swansea
www.swan.ac.uk/civeng

Materials Centre of Excellence – University of Wales, Swansea
www.swan.ac.uk/mateng

National Centre for Product Design & Development Research –
University of Wales Institute, Cardiff
<http://www.uwic.ac.uk/new/research/pdr.asp>

Wolfson Centre for Magnetic Technology – University of Wales, Cardiff
www.cf.ac.uk/engin/research/wolfson

Wound Research Healing Centre –
University of Wales, College of Medicine, Cardiff

Centre for Research in Energy, Waste & Environment –
University of Wales, Cardiff
<http://www.engin.cf.ac.uk/research/group.asp?GroupNo=39>

ICON – IBMM Joint Proposal (School of Informatics) –
University of Wales, Bangor
<http://www.iconphotonics.co.uk/>

Centre of Excellence in Manufacturing Technology Management –
University of Wales, Newport

Centre for Applied Marine Sciences – University of Wales, Bangor
<http://www.cams.bangor.ac.uk/>

Centre for Engineering & Environmental Applications –
University of Glamorgan

Knowledge Bank for Business (KB4B)

Currently, there is no formal link between KB4B and academia. The aim of KB4B is to work with individual high growth companies in Wales to develop tailored support solutions that will help them grow more rapidly. The KB4B team is working closely with stakeholders in the public and private sectors to build on existing synergies and further develop the support offering to ensure that it is fit for purpose and continues to meet business expectations. There will inevitably be interaction with academia but any activities will be on an ad hoc basis where there is a demonstrable economic benefit for KB4B companies. Such interaction will most likely be channeled through the Technology and Innovation Team, where the resource and expertise currently sits.

Review of Science in Wales (Technical Annex)

The information in this annex has been compiled by the Members' Research Service.

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1 Business R&D expenditure and employment in Wales

Table 1 below shows UK business expenditure on R&D from 2002-04, and R&D employment in UK businesses in 2004:

Table 1: Regional breakdown of R&D performed in UK businesses: expenditure and employment, 2004

Column	Expenditure £m			% of total 2004	Employment FTE (thousands)		
	2002	2003	2004		2002	2003	2004
UK	13,110	13,687	13,504	100.0	167	163	163
England	12,138	12,786	12,546	92.9	151	149	148
Wales	182	264	228	1.7	3	4	4
Scotland	640	521	614	4.5	11	7	9
N.Ireland	149	116	116	0.9	3	3	3

Source: Office for National Statistics, BERD Survey, 2005

2 Science Employment

Table 2 shows the proportion of the Welsh working age population with a Science or Engineering HE qualification in 2003, and how this compares to the GB proportions.

Table 2: Working age population with Science/Engineering HE Qualification, Wales, 2003

	All (000s)	With HE qual ⁽¹⁾ (000s).	Science or engineering HE qual ⁽²⁾ (000s)	% of working age population with Science or Engineering HE Qual.	
				Wales	GB
Wales					
Population of working age	1,741.8	257.8	98.9	6	6
<i>of which</i>					
Inactive	406.9	25.6	10.2	3	3
Economically active	1,334.9	232.2	88.7	7	7
Employed	1,267.6	229.2	86.1	7	7
Unemployed ⁽³⁾	67.3	-	-	-	4
Unemployed as % of labour	5.0				

Source: Labour Force Survey, Office for National Statistics
Working age includes men aged 16 to 64 and women aged 16 to 59.
⁽¹⁾ People who have obtained a Higher, First or Other degree or NVQ level 5
⁽²⁾ People who have obtained a HE qualification in a science or engineering subject
⁽³⁾ Unemployed as defined by the International Labour Organisation

The UK Government employed **21,255 R&D personnel** in 2003-04 (21,271 in 2002-03), of which 11,330 were employed by the Research Councils, 6,195 were employed by civil service departments and 3,730 were employed by the Ministry of Defence.¹

¹Office for Science and Technology, SET statistics:
<http://www.ost.gov.uk/setstats/8.htm>

3 Research in Welsh Higher Education Institutions (HEIs)

2001 Research Assessment Exercise

The Research Assessment Exercise (RAE) is carried out to enable higher education funding bodies to distribute research funding on the basis of the quality of the institution. The most recent RAE was conducted in 2001 and the next is planned for 2008.

The Higher Education Funding Council for Wales (HEFCW) has produced an analysis of the RAE² which shows that:

- the number of Welsh Higher Education Institutions receiving the highest 5*³ rating in the 2001 RAE has quadrupled from 3 in 1996 to 12 in 2001.
- 5 of these 5* ratings (42%) were given to science and engineering departments. These were:
 - Subjects Allied to Medicine, Psychology, Civil Engineering (Cardiff University)
 - Psychology (University of Wales, Bangor)
 - Civil Engineering (University of Wales, Swansea)
- 75% of researchers in Welsh HEIs now work in 5*, 5 and 4 rated departments producing work of "international excellence" – this compares with 52% five years before, and less than 30% nine years before.

²2001 Research Assessment Exercise: Outcomes for the Welsh Higher Education Sector:
[http://www.elwa.org.uk/doc_bin/he%20circulares/w0213he%20\(updated\).pdf](http://www.elwa.org.uk/doc_bin/he%20circulares/w0213he%20(updated).pdf)

³The 5* rating is awarded to "quality that equates to attainable levels of international excellence in more than half of the research activity submitted and attainable levels of national excellence in the remainder".

- The average rating for Welsh HEIs in 2001 was 5.16 (calculated on a 7-point scale, with 5* equating to 7); it was 4.36 in 1996. The rating for the UK as a whole is 5.42. However the difference between the average weighting for Wales and the UK is almost unchanged (around 0.25 in both RAEs).

UK Higher Education Research Yearbook 2005

Table 3 shows the ranking (within Wales) of Welsh HEIs, by source of research income for scientific subjects for the years 2000-04. This excludes research funding that has been granted for social and related science, visual and performing arts and humanities and languages, but includes funding for clinical medicine and dentistry, biological sciences, physical and mathematical sciences, engineering and technology and subjects allied to medicine. Table 3 shows that:

- Cardiff University ranks highest for all sources of research income; the largest difference occurs in the 'Research Grant and Contract Income', where Cardiff University received almost 5 times more funding over the four years 2000-04 than the second placed University (Swansea, which received £47.3m);
- University of Wales Lampeter, University of Wales Newport and University of Wales Institute, Cardiff are the HEIs that received the lowest overall amounts of research income in the years 2000-04;
- Research grant and contract income is the largest source of income for research in Wales, followed by research council funding and research income from charities;
- Cardiff, Bangor and Swansea Universities attracted the greatest amount of research income from Europe.

Tables 4 and 5: Wales data

Table 4 gives a regional total and ranking for staff engaged in scientific research during 2004. It shows that:

- Wales ranked 11th out of 12 UK regions in terms of the total number of academic staff engaged in scientific research in 2004, and 10th out of 12 for the total number of research active staff;
- Wales had 5% of the UK total of academic staff engaged in scientific research in 2004 (7% of the total excluding London and the South East). These figures were the same for research active staff.

Table 5 shows source of research income for science, by UK region. The key points from this table are:

- Welsh HEIs' primary source of scientific research income is research grants and contracts; this is the case across the UK.
- Wales receives a roughly equal percentage of total UK funding across all sources of income.

Table 3: Ranking of Welsh HEIs within Wales (total for 2000-04) by source of research income for scientific subjects

	Research Council Income		Research Income from Charities		Research Income from Industry		Research grant and contract income		Research income from Europe	
	£000s	Rank (within Wales)	£000s	Rank (within Wales)	£000s	Rank (within Wales)	£000s	Rank (within Wales)	£000s	Rank (within Wales)
Cardiff University	57,370	1	50,342	1	27,591	1	227,414	1	14,334	1
U of W, Aberystwyth	18,585	3	1,392	5	4,525	3	36,447	4	3,171	4
U of W, Bangor	13,351	4	3,032	2	3,013	4	39,382	3	7,684	2
University of Glamorgan	1,141	5	1,771	3	514	5	7,542	5	188	6
UWIC	1	8	55	7	74	7	3,339	6	33	8
U of W, Lampeter	0	9	18	8	8	9	0	9	16	9
U of W, Newport	171	7	0	9	11	8	224	8	46	7
U of W, Swansea	23,071	2	1,610	4	6,854	2	47,343	2	5,269	3
NEWI	513	6	493	6	391	6	2,705	7	427	5

Source: analysis of statistics in Evidence Ltd. Yearbook, 2005

Table 4: regional total and ranking for staff engaged in scientific research during 2004

UK region	Academic staff		Research active staff	
	No. of staff	Rank (UK)	No. of staff	Rank (UK)
Wales	2,113	11	1,170	10
London	8,890	1	5,375	1
Northern Ireland	1,088	12	646	12
Scotland	5,157	2	3,373	2
North West	4,748	3	2,292	4
North East	2,196	10	1,096	11
Yorkshire/Humber	3,908	5	2,041	5
West Midlands	3,090	6	1,359	9
East Midlands	2,824	7	1,639	7
East	2,719	9	1,860	6
South East	4,343	4	3,286	3
South West	2,742	8	1,423	8
UK total	43,818	-	25,560	-
Wales as % of UK	5	-	5	-
Wales as % of UK (excl. London/SE)	7	-	7	-

Source: analysis of statistics in Evidence Ltd. Yearbook, 2005

Table 5: Sources of research income for science, by UK region, 2004

UK region	Research Council Income		Research Income from Charities		Research Income from Industry		Research grant and contract income		Research income from Europe	
	£000s	Rank (UK)	£000s	Rank (UK)	£000s	Rank (UK)	£000s	Rank (UK)	£000s	Rank (UK)
Wales	22,840	10	11,779	11	8,917	10	72,919	10	6,240	11
London	132,515	1	197,061	1	48,066	1	516,855	1	32,735	1
Northern Ireland	6,419	12	5,764	12	3,067	12	34,775	12	4,993	12
Scotland	87,215	3	76,812	2	26,248	3	279,860	3	22,392	3
North West	61,969	5	35,137	6	13,235	7	159,318	6	11,583	5
North East	20,951	11	14,697	10	6,082	11	71,095	11	7,358	9
Yorkshire/Humber	56,079	6	36,601	5	18,866	4	161,278	5	14,660	4
West Midlands	35,200	8	20,320	8	10,463	8	95,937	8	7,368	8
East Midlands	44,631	7	19,076	9	18,440	5	115,285	7	9,133	7
East	65,041	4	46,953	4	15,201	6	164,375	4	11,426	6
South East	104,556	2	71,420	3	28,831	2	281,481	2	24,760	2
South West	33,122	9	20,387	7	9,127	9	88,737	9	6,821	10
UK total	670,538	-	556,007	-	206,543	-	2,041,915	-	159,469	-
Wales as % of UK	3.0	-	2.0	-	4.0	-	3.6	-	4.0	-
Wales as % of UK (excl. London/SE)	5.3	-	4.1	-	6.9	-	5.9	-	6.1	-

Source: analysis of statistics in Evidence Ltd. Yearbook, 2005

4 Economic Research Advisory Panel (ERAP)

An Assembly Government ERAP study on “Opportunities to strengthen innovation and diffusion in Wales” was planned for 2004-05. The specification for this work is still in preparation⁴.

5 Spin-off companies

5.1 Wales Spinout Programme

In 2005-06, overall expenditure on the Wales Spinout Programme from Finance Wales was £785,460 (for all 12 Welsh HEIs)⁵. This figure was £708,154 in 2004-05. As part of this overall expenditure, £18,624 was spent on promotional activities targeted at the 12 HEIs. Throughout the 2005-06 Programme, Finance Wales also invested £337,000 in Spinout Loans (£349,500 in 2004-05).

It is not possible to make direct comparisons with the amount spent on university spinouts in other UK regions as these are incorporated into each university's Third Mission Funding.

5.2 Higher Education-Business Interaction Survey

Information on spinout companies from HEIs is available in the HEFCE Higher Education-Business Interaction Survey 2004⁶. Data by individual institution are not available as all survey information is collected on the understanding that it will not be used at any point to identify individual HEIs.

5.3 HE Spin-off Activity

Tables 6-9 are based on information taken from the 4th Higher Education-Business Interaction Survey, 2004, and give information on spin-offs from HEIs in Wales.

⁴ERAP Forward Economic Research Programme, accessed July 2006

<http://www.wales.gov.uk/subiresearch/content/eru/forward-programme-e.htm>

⁵As part of this, £16,913 was spent on promotional activities targeted at the HEIs.

⁶No update is currently planned for the Higher Education Business Interaction Survey.

The 2004 Survey report can be seen at:

http://www.hefce.ac.uk/pubs/hefce/2005/05_07

Table 6: Spin-offs with some HEI ownership (2002-03)

	Number established	Number still active which have survived at least 3 years	Number of active firms	Estimated employment of active firms (FTE)	Estimated turnover of active firms (£000s)
England	147	383	665	4,218	167,862
Northern Ireland	6	31	49	737	46,000
Scotland	17	73	97	1,045	20,677
Wales	7	19	38	150	7,550
UK total	177	506	849	6,150	242,089
Wales as % of UK	3.9	3.8	4.5	2.3	3.1

Source: Fourth Higher Education-Business Interaction Survey, 2004

Table 7: Formal spin-offs from HEI Institutions, not HEI owned (2002-03)

	Number established	Number still active which have survived at least 3 years	Number of active firms	Estimated employment of active firms (FTE)	Estimated turnover of active firms (£000s)
England	11	40	61	5,900	84,216
Northern Ireland	0	0	0	0	0
Scotland	2	10	18	540	18,440
Wales	7	10	17	195	13,630
UK total	20	60	96	6,635	116,286
Wales as % of UK	35.0	16.6	17.7	2.9	11.7

Source: Fourth Higher Education-Business Interaction Survey, 2004

Table 8: Staff start-ups from HEI Institutions, 2002-03

	Number established	Number still active which have survived at least 3 years	Number of active firms	Estimated employment of active firms (FTE)	Estimated turnover of active firms (£000s)
England	66	107	107	1,750	31,001
Northern Ireland	0	4	4	25	1,500
Scotland	6	5	9	116	276
Wales	2	6	14	97	7,485
UK total	74	122	134	1,988	40,262
Wales as % of UK	2.7	4.9	10.4	4.9	18.6

Source: Fourth Higher Education-Business Interaction Survey, 2004

Table 9: Graduate start-ups from HEI institutions, 2002-03

	Number established	Number still active which have survived at least 3 years	Number of active firms	Estimated employment of active firms (FTE)	Estimated turnover of active firms (£000s)
England	386	278	559	1,284	98,898
Northern Ireland	0	2	2	15	1,000
Scotland	27	16	52	143	930
Wales	76	27	119	165	4,815
UK total	489	323	732	1,607	105,643
Wales as % of UK	15.5	8.4	16.3	10.3	4.6

Source: Fourth Higher Education-Business Interaction Survey, 2004

6 Collaborative research

Tables 10-12 are based on the Higher Education-Business Interaction Survey and show data on collaborative research involving public funding and funding from business, 2002-03.

Table 10: Collaborative research in HEIs involving public funding and funding from business, UK, 2002-03

Area	OST Research Councils (£000s)	Other Government depts. (£000s)	EU Government (£000s)	Other (£000s)	Totals (£000s)	
					2002-03	2001-02
England	162,061	90,422	80,205	44,034	376,722	355,242
Northern Ireland	6,928	12,471	2,991	5,321	27,711	23,765
Scotland	14,750	4,467	14,185	10,241	43,643	52,017
Wales	15,386	13,524	3,454	16,739	49,103	38,330
UK total	199,125	120,884	100,835	76,335	497,179	469,354
Wales as % of UK	7.7	11.2	3.4	21.9	9.8	8.2

Source: Fourth Higher Education-Business Interaction Survey, 2004

Table 11: Research contracts in HEIs, by UK region, 2002-03

Area	Number with SMEs	Total value with SMEs (£000s)	Number with other (non-SME) commercial business	Total value with other (non-SME) commercial business (£000s)	Total number of contracts	Total value of contracts (£000s)
Northern Ireland	62	935	62	2,032	124	2,967
Scotland	268	4,067	764	29,211	1,032	33,278
Wales	84	1,651	359	6,326	443	7,977
UK total	4,148	42,213	8,254	239,913	12,402	282,126
Wales as % of UK	2.1	3.9	4.3	2.6	3.6	2.8

Source: Fourth Higher Education-Business Interaction Survey, 2004

Table 12: Consultancy contracts in HEIs, by UK region, 2002-03

Area	Number with SMEs	Total value with SMEs (£000s)	Number with other (non-SMEs) commercial businesses	Total value with other (non-SMEs) commercial businesses (£000s)	Number with non-commercial orgs (£000s)	Total number of contracts	Total income (£000s)
England	6,685	17,990	3,328	37,982	5,434	15,447	125,823
Northern Ireland	229	943	25	102	127	381	1,516
Scotland	471	3,074	796	8,492	769	2,036	20,796
Wales	363	3,887	106	7,655	549	1,018	20,016
UK total	7,748	25,894	4,255	54,231	6,879	18,882	168,151
Wales as % of UK	4.7	15.0	2.5	14.1	7.9	5.4	11.9

Source: Fourth Higher Education-Business Interaction Survey, 2004

7 Higher Education Funding Council (HEFCW) funding for research

Welsh Universities and Colleges receive funding through the Science Research Investment Fund, a UK-wide scheme run jointly by the UK Office of Science and Technology and the UK Higher Education Institutions. Of the £46.7 million available for Wales over 2004-05 and 2005-06, £25.2 million came from the OST and £21.5 million from HEFCW. The Postgraduate Research Training Allocations are for postgraduate research students and are awarded to Departments meeting specific criteria in the Research Assessment Exercise.

Table 13 (over the page) shows HEFCW Research Investment Fund and Postgraduate Research Training Allocations, 2005-06:

Table 13: HEFCW Research Investment Fund and Postgraduate Research Training Allocation, 2005-06

Institution	Research Investment Fund	Postgraduate Research Training Allocations
University of Glamorgan	691,014	423,611
University of Wales, Aberystwyth	1,039,832	375,657
University of Wales, Bangor	464,695	518,914
Cardiff University	49,696	2,728,292
University of Wales, Lampeter	117,077	86,565
University of Wales, Swansea	1,231,388	888,034
University of Wales Institute, Cardiff	252,575	55,373
University of Wales, Newport	93,260	29,432
North East Wales Institute of Higher Education	120,202	8,593
Swansea Institute of Higher Education	81,218	6,898
Total	4,140,959	5,121,369

Source: Higher Education Funding Council for Wales

8 European funding for research

EU Structural Funds

Objective 1, Priority 2, Measure 3 provides support for the development of innovation and R&D in Wales. This Measure is now closed. To date 52 projects have been approved, (with a total EU grant contribution of **£107.7m**), which has resulted in the Measure being slightly over-programmed: there are a number of large-scale projects being supported under this Measure including the Technium Strategy. Post approval work is on-going.

Marie Curie fellowships

Marie Curie fellowships⁷ are European Commission-funded grants aimed at stimulating the training and mobility of researchers across the EU. At January 2006, 795 Marie Curie fellowships had been awarded in the UK, broken down as follows⁸:

England	692
Scotland	80
Wales	16
Northern Ireland	7
UK	795
Wales as % of UK	2

European Framework Programme funding: FP6 and FP7

The European Community Framework Programmes for Research, Technological Development and Demonstration are a collection of the actions at the EU level to fund and promote research. The Sixth Framework Programme (**FP6**), which runs from 2002-06, is the EU's main instrument for the funding of research in Europe. Proposed by the Commission and adopted by the Council and Parliament in co-decision, it is open to all public

and private entities, large or small. The overall FP6 budget is €17.5bn (an increase of 17% from **FP5**). The main focus of FP6 is the creation of a European Research Area as a vision for the future of research in Europe. It aims at scientific excellence, improved competitiveness and innovation through the promotion of increased cooperation, greater complementarity and improved coordination between relevant actors, at all levels.

Table 14 gives details of participation by Welsh organisations in FP6.

Table 15 shows the amount of funding secured by Welsh participants under FP6, as compared to the other regions of the UK. As a comparison at the European level, over the same period Germany had 3,918 participations, securing €1,127m of funding whilst France had 2,975 participations, securing €808m.

The data in Tables 14 and 15 were provided by the WDA⁹ and give an indication of the situation as at August 2005. The DTI has advised that it has concerns regarding the accuracy of this data and as such the figures may understate the degree of Welsh participation in FP6. Under FP5 (1998-2002), there were 339 successful bids from Welsh organisations.

The Commission has proposed that the maximum overall amount for Community financial participation in **FP7** should be €72,726 million for 2007-2013. According to the Commission, FP7 should be a key contributor to the re-launched Lisbon strategy. The new elements in FP7 include an emphasis on research themes rather than on "instruments", a significant simplification of its operation, and a Risk-Sharing Finance Facility aimed at fostering private investment in research.

⁷Marie Curie actions <http://www.cordis.lu/mariecurie-actions>

⁸Data supplied by the European Commission, March 2006

⁹The data were supplied by the WDA but are actually DTI figures based on information supplied by the European Commission.

Table 14: Participation by Welsh organisations in FP6 (to August 2005)

Participant	City	Activity Type ¹	Nos.
University of Wales, Cardiff	Cardiff	HES	27
University of Wales, Swansea	Swansea	HES	9
University of Wales, Bangor	Bangor	HES	7
University College of Wales, Aberystwyth	Aberystwyth	HES	2
University of Wales Institute Cardiff	Cardiff	REC	1
University of Wales College of Medicine	Cardiff	HES	3
University of Glamorgan	Pontypridd	HES	2
Welsh Development Agency	Cardiff	OTH	2
Rockfield Software Limited	Swansea	IND	2
Institute of Grassland and Environmental Research	Aberystwyth	REC	5
Techniquet Ltd	Cardiff	OTH	1
Login & Browning Surveys Ltd	Swansea	OTH	1
Thermomax Ltd	Bangor	OTH	1
Knownet Limited	Bangor	OTH	1
Velindre National Health Service Trust	Cardiff	OTH	1
Total			65

1. Explanation of abbreviations of Activity Type:

HES - Higher Education: Organisations only or mainly established for higher education/training

RES - Research: Organisations only or mainly established for carrying out research activities

IND - Industry: Industrial organisations private and public, both manufacturing and industrial services – such as industrial software, design, control, repair, maintenance

OTH - Others: Organisations not fitting in one of the above categories

Source: WDA

Table 15: Comparison of Regional Performance in FP6 (up to August 2005)

Region	Participations		Type of Activity			Funding secured		
	No.	As % of UK	HES	REC	OTH	IND	Total m	As % of UK
Wales	65	2	50	6	7	2	12.86	1
Scotland	249	8	189	26	19	15	57.87	7
NI	67	2	49	2	8	7	9.85	1
England	2802	88	-	-	-	-	796.15	91
UK	3183	100	1810	483	358	533	876.73	100

