ECONOMIC DEVELOPMENT & TRANSPORT COMMITTEE

Date: 16 November 2005
Time: 9.00 am to 12.20 pm
Venue: National Assembly for Wales, Cardiff Bay
Title: Federation of Small Businesses

Federation of Small Businesses in Wales

Innovation Nation?
A Response to the Economic Development & Transport Committee Consultation on a Science Policy for Wales

Wales Policy Office
Federation of Small Businesses in Wales
6 Heathwood Road
Birchgrove
Cardiff
CF14 4XF

Tel: 029 20521230
Fax: 029 20521231
Email: Ben.Cottam@fsb.org.uk

Federation of Small Businesses in Wales
Innovation Nation?
A Response to the Economic Development & Transport Committee Consultation on a Science Policy for Wales

Introduction

The Federation of Small Businesses is the UK's largest business representative organisation with over 190,000 members in the UK and some 8,500 of that number located in Wales. As such the FSB exists to promote and protect the interests of all who own or operate their own business.

The FSB in Wales very much welcomes the decision of the Economic Development & Transport Committee to institute a policy review into the possible adoption of a science policy for Wales. This decision answers a call for such a review made in the FSB's manifesto for the 2003 Assembly election.

The timeline of the institution of the National Assembly for Wales has run alongside the rejuvenation of the Irish economy. Many references have been made in various ways by Assembly politicians – both Cabinet Ministers and opposition members - of the desire to emulate the success of the Irish economy

It is widely recognised that a key component of the 'Irish phenomenon' has been the adoption of a policy to enhance and promote the development of the indigenous science base in assisting its development within schools and universities and setting out a clear desire to further promote research and development (R&D) and make Ireland an attractive location for R&D activities.

Ultimately however, we feel that any strategy adopted in Wales needs to identify long-term goals, which would require full cross-party support. Developing a healthy, productive and robust strategy for driving up R&D spend, increasing student participation in science and increasing the range and level of HE and private sector activity all require defined, long-term measures.

The FSB feels strongly that in order to obtain the above consensus, we need to be sure of the reasons for adopting a science policy in Wales. Our view is that such a strategy is needed to help identify and promote existing strengths, help to nurture centres of excellence, develop networks and provide the

wherewithal for SMEs and universities engaged in research and development to develop and commercially exploit that research among other things.

Following the inclusion of a call for a science policy for Wales in our manifesto, representatives of the FSB have visited a number of countries and regions to see examples of best practice in Knowledge Transfer (KT), engagement of SMEs and more broadly, the impact of political science policies. A number of these examples are detailed later.

Once identified, we must be serious about the need to move towards a knowledge-based economy and certain of its place in driving up GVA in Wales, which remains at the lowest level of all the regions of the UK.

It is important to acknowledge from the outset that the Welsh Assembly Government has been far from idle in creating policy to encourage R&D and innovation and Wales is far from suffering a poverty of innovation capacity.

The Knowledge Exploitation Fund (KEF), SMART Cymru and the Technium Programme have all played a part in raising awareness and encouraging innovation but, as will be shown, there is a need for a refocusing of existing schemes and policies under an overarching policy vision.

The Welsh Assembly Government's economic development strategy *A Winning Wales* itself sets down the gauntlet at the outset identifying the need:

To achieve a prosperous Welsh economy that is dynamic, inclusive and sustainable, based on successful, innovative businesses and highly, well-motivated people.[1]

The FSB in Wales believes that it is now time to formulate specific policy, which seeks to effectively deliver on this vision.

The Need for an Innovative Economy and the Importance of the Small Business Sector

Wales exists within a rapidly changing world with new technologies and more sophisticated products being constantly introduced and with more businesses now having to compete in global markets. The ability of individuals, businesses and institutions to adapt positively to these changes – to be innovative – will, to a large extent, determine Wales' future economic success. As such, it is worth noting that over 64 per cent of innovative ideas come from the world of small firms[2].

By innovation, we mean the successful exploitation of new ideas, be that in terms of creating new or improved products or introducing new or improved methods of producing them. Innovation is about looking forward and

[1] *A Winning Wales – Welsh Assembly Government*
[2] *Federation of Small Businesses UK Manifesto - Constraints on Business Growth*

developing new ideas to satisfy market demands. However, innovation doesn't always involve high technology and new inventions. Innovation also encompasses new ways of working and new forms of relationships between individuals and between organisations. For many organisations, innovation entails incremental improvements to the way things are done.

An innovative firm, through developing new goods or services or introducing more efficient production processes, can expect to enjoy improvements in its competitiveness. Whilst the incentive for firms to innovate is larger profits, there are benefits too for the economy as a whole, with the level of income and the number of quality, well-paid jobs increasing. Innovation is therefore one of the key ingredients in the development of a prosperous and dynamic economy.

Increasing the pace of innovation within a company, and within the economy more generally, involves making more effective use of the resources that are available, where resources include not only physical assets such as land and machinery, but also intangible assets such as knowledge, creativity and expertise. In fact, more and more, it is the use that is made of these intangible resources that determines how innovative and successful an economy is and, so much so, that policymakers now emphasise the importance of developing a 'knowledge-driven' economy. Innovation is at the heart of the UK government's industrial policy agenda, with a range of policies being introduced to assist companies in improving their productivity and in developing new products and services.

Being innovative and maximising the returns from the available knowledge and expertise requires good communications and relationships between firms, educational institutions, and the economic development organisations within the economy. Thus the extent to which Wales will become more innovative increasingly depends on the ability of individuals and organisations to collaborate with each other and learn from each other's experiences. With good co-operation at the local level, Welsh companies are better able to engage in high quality, high value production, thereby helping them to compete more successfully in global markets.

A Winning Wales realises the importance of innovation and technology transfer and contains a number of measures for encouraging innovation and seeks to enable:

The successful commercial exploitation of good new ideas from wherever they emerge.[3]

We feel strongly that an important part of any science policy review is to analyse and test how effectively policy designed to encourage innovation has been implemented.

[3] *A Winning Wales – Welsh Assembly Government*

The aim of any science policy must be to encourage the driving up of R&D spend in both the public and private sectors. R&D spend is proportionately low in Wales and has remained stubbornly so for a number of years.

The most recent statistics from the Office for National Statistics (ONS) for 2003 identify that Wales accounted for less than twp per cent of UK research and development[4]. This is a disappointing statistic and does not bode well for the future development of the 'knowledge economy' that the Welsh Assembly Government has stated a number of times it desires to see.

In terms of R&D conducted within business, government and higher education, Wales lies only above Northern Ireland. Although this marks an improvement on previous years, it is clear that there is little evidence of substantial increase in R&D spend, driven or inspired by policy initiatives emanating from the Assembly.

Although recent extension of the UK Government's R&D tax credits scheme is very much welcome, this does not make Wales any more competitive in comparison to other UK countries and regions and therefore it is clear that additional support and development is needed in Wales, particular to Wales, to encourage an increase in spending. However, it is important that as part of this process, an analysis is undertaken of the impact of R&D tax credits.

With the well-pronounced downturn in manufacturing in Wales, R&D levels have inevitably suffered. The downscaling or complete withdrawal from Wales of companies such as Sony, Panasonic and LG has been a particular blow to high-tech manufacturing and R&D activity.

Manufacturing is responsible for 75% of business R&D in the UK[5] and so any desire to raise levels of spending in this area must be matched by a desire to consolidate existing manufacturing operations and boost opportunities within the manufacturing sector. In addition, with every job in manufacturing being linked to two jobs in related services[6], it is yet more important that the important role of manufacturing in the innovative process is not ignored.

Despite relative under-performance statistically, Wales is still a viable and potentially productive location for R&D activities and there is much evidence of some of the world-class R&D being undertaken such as that being conducted by *Biocatalysts* in Cardiff and at the School of Biosciences in Cardiff University among many others.

However, the success of companies like *Biocatalysts* displays the need to not only have a focus on attracting the R&D operations of large multinationals as has been evidenced in Ireland, but also a commitment to the development and assistance of smaller-scale R&D within SMEs and a strategy to support their growth.

---

[4] *Research and Experimental Development (R&D) Statistics, Office for National Statistics 2005.*
[5] *http://www.dti.gov.uk/manufacturing/index.htm*
[6] *Manufuture: A Vision for 2020 – European Commission 2004.*

The FSB feels strongly that this cannot be done in a piecemeal way relying on perhaps well meaning but disjointed initiatives but must be led by an overarching and agreed vision detailed by the National Assembly for Wales and the Welsh Assembly Government.

The Need for Political Will

In our manifesto for the 2003 Assembly elections, the FSB explicitly called for the Welsh Assembly Government to define and adopt an extensive, dynamic science policy for Wales. Until this point, the stated position of the Economic Development and Transport Minister has been that he has decided against the adoption of such a policy asserting that he has yet to be convinced that a science policy would add sufficient effort to the work already being undertaken in Wales to be worth the effort[7].

However, it is noticeable that our Celtic cousins in both Scotland and Ireland *have* sought to define their visions for the development of successful scientific innovation and research and development in the form of science policies and there is every indication that these efforts have been thus far, been highly successful.

In both cases, specific policy has been used to co-ordinate such activity, maximise domestic economic exploitation and co-ordinate the efforts of both the public and private sectors. It has also assisted in the drawing up and allocation of substantial and targeted funding from government.

During the early stages of devolution in 1999, the then Minister for Enterprise and lifelong Learning for Scotland, Henry McLeish identified science as key issue to be addressed across the Scottish Executive[8]. This recognition was reflected in the creation of a post of Scottish Minister for Science.

It was considered that a defined science policy would 'provide a focus for science matters across the Executive, ensuring that the cross-cutting nature of science is exploited fully'[9]

In the formulation of this policy, Henry McLeish invited a group of independent and distinguished scientists:

To identify the questions that need to be addressed in order to put in place a Science Strategy for the Scottish Executive; and to identify what additional mechanisms would be required to answer these questions and to implement such a strategy[10].

[7] *Jones Evans, D in IWA Agenda Magazine Summer 2003 edition*
[8] *Scottish Executive: A Science Strategy for Scotland 2001*
[9] *Scottish Executive: A Science Strategy for Scotland 2001*
[10] *Scottish Executive: A Science Strategy for Scotland 2001*

Key to the strategy was the overriding vision that Scotland should promote and uphold its reputation as a key destination for scientific research and investment within the international economic and scientific community.

Although the strategy identifies areas of Scottish Executive policy, which were already working to promote R&D activity and support for innovation, it also contained several new and important measures which included not only taking full advantage of UK Foresight exercises, but also initiating such exercises within Scotland to identify future opportunities for the development of science. Essentially, this amounted to a process to identify future areas of growth.

In addition, the strategy realised and acknowledged the vital and intrinsic role of SMEs to the development of the policy and its objectives, recognising that they play a key role in the application of science-based research to produce highly-competitive products and processes.[11]

Scottish Enterprise has also sought to create an effective global network (globalscot) to exploit international links with businesses and businessmen with an interest in investing in Scotland. This has been highly successful in selling Scotland as a high innovation economy as well as attracting scientific expertise (including a number of expatriates)

'Globalscot invests in developing global relationships; accessing world class business knowledge and expertise and growing a resource to advance Scotland's economic development. It is a strong network of over 700 influential individuals who have an affiliation for Scotland and who want to contribute to and share in its economic success'.[12]

Following years of economic decline, the Republic of Ireland seized the opportunity to define a desired path for the establishment of a high-tech business base both within higher education and within the private sector.

The result of this was a cross-party consensual vision that Ireland should become one of the key destinations for large and small-scale research and development activities. This consensus has given flexibility to strategy and policy making and has meant that this stated vision survives.

In 1998, the Minister for Science, Technology and Commerce, Noel Treacy TD requested that the Irish Council for Science, Technology and Innovation (ICSTI) initiate a large-scale Technology Foresight exercise.

Technology Foresight Ireland was created and drew together key members of the political, scientific and business communities in order to consider the likely social, economic and market trends that would affect Ireland in the medium to long term and the developments required in science and technology to best address future needs.[13] Two of the key areas identified were biosciences and ICT, both of which are now cornerstones of the Irish economy and have been

[11] *Scottish Executive: A Science Strategy for Scotland 2001*
[12] *Globalscot.com*
[13] *ICSTI website*

vital to its resurgence and placing it as one of the most productive and dynamic Western economies.

The project identified that the Irish economy needed to be completely repositioned in order to be properly recognised as a knowledge economy. It also suggested a model for constructive partnership between higher education, industry, government and society at all levels working to the identified plan.

The key recommendations were:

1. That all government departments and agencies utilise the Foresight exercise in future planning exercises.

2. That Ireland becomes a centre of excellence in ICT and biotechnology.

3. That Government policies be more proactive in the creation of an environment conducive to technological innovation and specifically in relation to regulatory and fiscal issues.

4. That the Government establish a Technology Foresight Fund totalling IR£500million over five years. (c GBP£417,700,000)

Following the Technology Foresight Ireland exercise, the Irish Government set up Science Foundation Ireland (SFI) as an executive sub-board to administer the corresponding Technology Foresight Fund.

Now a separate legal entity, SFI is responsible for investing over €646 million between 2000-2006 in academic researchers and research teams most likely to generate new knowledge, leading edge technologies and competitive enterprises in the fields of biotechnology and information communications technology.[14]

In April 2005, the role of ICSTI was taken over by the newly-formed Advisory Science Council (ASC). It is tasked with the delivery of a coherent and effective national strategy on Science, Technology and Innovation (STI).

These structures and actions represent an almost aggressive determination by the Irish Government to make Ireland one of the leading European locations for R&D.

The FSB feels strongly that the Assembly Government should, as part of any future Science Policy, institute an independent foresight exercise for Wales bringing together our leading academics and industrialists and drawing upon the expertise of the Technium programme to identify Wales' areas of scientific specialism with a view to the targeting of significant funding and infrastructure improvements.

[14] *SFI Website*

We believe that Welsh universities should seek to create proactive links with research institutes around the globe with a view to promoting suitable partnerships to allow the transfer of ideas and academic expertise.

In addition the FSB feels that the Welsh Assembly Government should create a Junior Ministerial post of Minister for Science, Technology and Innovation to spearhead any policy.

Information Problems: R&D in Wales

A major challenge for such a policy is posed by the lack of information about R&D activities in Wales. Few businesses will be forthcoming about the nature and extent of R&D work being undertaken in Wales because of their desire to protect intellectual property.

As a consequence, very little information is available on the level and nature of R&D activity. In addition, little information has been gathered as to why businesses both large and small choose not to conduct R&D in Wales.

If we are to attract greater levels of high-intensity research and development or encourage smaller businesses to engage in partnerships to undertake such activity, we need to have a definite idea as to why this is not already so and we would hope that the preparatory work on the science policy would involve a mapping exercise drawing on the information gleaned by the WDA from businesses within and outside the Technium programme for example, as well as an assessment of work being carried out based on applications for research funding.

Although there is much effective R&D work being undertaken within businesses in Wales, much of this currently seems fragmented. The result of this is that we have comparatively few areas of significant strength.
Only by carrying out a mapping exercise can we begin to have an idea where the gaps are, where areas of R&D can be further boosted or what to sell as significant strengths.

We would also hope to see more business in Wales taking better advantage of what support is already on offer via schemes such as SMART Cymru and the new Welsh Assembly Government Knowledge Bank and see these as integral to any future strategy.

Technium

The Welsh Assembly Government's Technium concept (previously led by the Welsh Development Agency) was initiated in response to the challenges set out in *A Better Wales* and *A Winning Wales* and will have been the target of more than £150million of committed investment by 2005/6.[15] Given the

[15] *Technium website.*

traditionally poor level of private sector investment in R&D, this investment is very welcome.

However, FSB is concerned that the scarcity of R&D operations, networks and support outside the Technium means that there is a danger of successful companies choosing to leave Wales once they leave the Technium. This obviously offers very poor if any return on public investment.

In addition, concern has been expressed to the FSB by a number of those we have met about the rationale for the location of the various Technium centres. Because of the understandable desire to generate economic growth within some of the more deprived areas of Wales and the use of Objective 1 funding for the programme we have incubators situated in areas, where there is no supporting business infrastructure and little room for businesses to spin out locally and thrive or be supported within a business network.

A good illustration is the location of the Technium Auto, which is located some way away from Wales' main site of automotive development and research at Ford in Bridgend.

In short, we feel that it is essential that those businesses, which spin out of Technium do so into a physical environment that offers support and opportunity.

Overall, it is obvious that if a formal science policy were to be adopted in Wales, Technium would be one of the key drivers in promoting and boosting the level of R&D and providing Wales with the base of innovative firms that would be needed to exploit such a policy.

The FSB recognises and welcomes the effort and vision that has gone into the formulation of the Technium programme but we urge that this programme needs to be adjusted and expanded and suitable funding allocated.

Problems with Technology Transfer between the HE Sector and SMEs in Wales

There are a number of fundamentally important reasons for focusing on the links between universities and SMEs as part of the concept of a successful local economy. Traditional regional economic development policies and approaches are based on a set of assumptions about the desirability and relative permanence of capital investment and capital formation as the main drivers of economic development. However, as modern industrial and post-industrial economies shift towards knowledge-based economies, these assumptions are increasingly less relevant.

According to Thomas (1997)[16], in the future the factors for success in regional development will include three main categories:

1. Innovative capacity: This is generally given to mean the continual changing by companies of products, processes and systems to become more competitive, but at its most basic level innovative capacity can be thought of as a willingness to take risks and to be willing to fail occasionally in order to succeed. For both companies and the individual, this requires a willingness to learn and a willingness to re-skill when the need or opportunity arises. For universities, local government and central government, innovative capacity is concerned with encouraging, recognising and even rewarding risk takers in their organisations.

2. Networking capacity: This can refer to a relatively complex system of clustering, at the regional level, to develop systematic networking. However, in its simplest form, it is a willingness to interact with and absorb knowledge from others. Companies learn best from each other and this lesson can also be extended to universities. While this basic premise holds true, it must also be recognised that it is essential to bring in new ideas from outside the network. Networks, by definition, should be continually modifying themselves and need to be regenerated with new ideas.

3. A capacity to transfer knowledge: One of the functions of networking is knowledge transfer, but networks need to be open in order to accept knowledge from outside and to 'trade' in knowledge with others.

To examine the role that universities can play in this process, we must consider how they match up against the three success factors described above. In two areas, those of 'innovative capacity' and 'expertise in networking', it can be argued that universities achieve fairly well. The other area, however, can appear to be one in which universities are not so expert.

Innovative capacity within universities

Universities deal in research, in creating or interpreting new knowledge. There are great demands on UK universities to make their research work more economically relevant. The opportunity to research, analyse and interpret work which has economic relevance needs to be embraced, and innovative abilities in economic development is a key area of expertise which universities can pass on and share.

Networking capacity within universities

It is well recognised that academics as a group thrive on networking and often use academic conferences as a vehicle for the exchange of ideas and knowledge. However, universities need to open up their networks to the wider economic community.

[16] *Meirion Thomas; Productive connections: the links between universities and regional development agencies; 1997*

We feel that there is an advantage to the creation of a pan-university network with the private sector to help create a lasting network, to help better co-ordinate efforts. A result of such a network might be a 'meet the buyer' event where academic departments have the opportunity to meet those businesses seeking to engage in a partnership for R&D.

Knowledge transfer capacity in universities

Universities do not enjoy the reputation of being good at transferring their knowledge. The images and metaphors of the ivory tower still ring true in far too many universities.

Science and technology are the vital underpinnings of the knowledge economy – in which comparative advantage will increasingly lie in the generation of knowledge and its exploitation to create innovation. The level of R&D in the economy is a crucial determinant of innovation. But the UK's innovation performance is relatively weak.

Firms' propensity and capacity to invest in R&D are critical to the innovation process. But publicly funded science research provides an essential underpinning, principally by:

- Producing people with knowledge: trained scientists and engineers who generate knowledge in the science base and apply their expertise to developing new products and processes for industry.
- Generating and disseminating new knowledge: scientific and technological developments with applications which can lead to new products and processes. Tracking and interpreting the outputs of the 95% of world science conducted outside the UK is also of critical importance.

There is an increasingly recognised role for universities in contributing to national and regional economic growth and competitiveness through:

- Attracting and nourishing high-tech clusters through research partnerships with major industrial players and the output of trained people;
- Acting increasingly as the 'research arm' of large corporations which are reducing their in-house research capacity;
- Spinning out new companies and licensing technology;
- Enhancing business competitiveness by transferring technology and people, problem-solving for firms, and helping to build up self-reinforcing networks of firms, scientists and financiers; and
- Acting as advocates for local and regional economic development alongside Government agencies.

The above issues combine to form a problem, which although more general, is one of the greatest obstacles to effective knowledge transfer – that of cultural differences.

A number of Universities in Wales are recognised as centres of research excellence and in many cases, their rating in this field has improved over recent years. However, commercialising some of this research can be the greatest hurdle. The differing cultures of the world of academia and the private sector often means that few within academia have the knowledge or expertise to create the necessary number of spin-out opportunities for research in terms of licensing and commercial application.

We certainly recognise that this is not always the case, however, but feel that where there have been successes, the reasons for that success should be analysed and used as best practice indicators.

In short, we have to recognise as a first step that we cannot expect this link to develop naturally but rather we must act to create this link by adopting effective knowledge transfer arrangements.

Although Wales does have a number of Knowledge Transfer Partnerships (KTPs), mainly located within Universities, many of these are small scale and because of funding restraints, the majority of businesses will be unaware of their existence or the benefits of entering into such a partnership.

In short, it is important that we seek to create a more entrepreneurial climate within universities, among their graduates and in the business community more generally recognising that there are limits to the focus of Government policy and funding on direct commercial spin-offs.

In the UK the University Challenge and Science Enterprise Challenge schemes have been helpful in encouraging commercialisation by providing supporting infrastructure, and promoting an enterprise culture, rather than distorting incentives. Further support of this sort is likely to be particularly fruitful, against a background of improved personal incentives offered by the Government in its more general tax changes.

Universities have welcomed the Science Enterprise Challenge scheme as a means of helping to embed an entrepreneurial culture. There is clearly further to go in this direction. Universities emphasised the importance of personal incentives for staff as an agent of culture change – in particular allowing time to engage in knowledge transfer, and ensuring suitable recognition, and reward – including career progression – for this work.

Contract research for industry, charities and Government departments is well established and a substantial source of income for many universities. Some institutions are now marketing themselves aggressively to increase and diversify their sources of contract income. Universities vary in their success at ensuring they are fully remunerated for contract work. Government departments and charities do not contribute to indirect costs, which is a source of difficulty and frustration for some universities. Industrial clients are generally – but not universally – more prepared to meet full costs.

Universities are also engaged in a variety of other work with and for firms, particularly SMEs, which includes research; problem-solving; the transfer of technology, people and expertise and the fostering of networks of firms and those who support them (advisers, venture capitalists, business angels, etc). The Government review was impressed by the efforts of some universities in this arena, and has noted a number of key features of this work:

- It delivers wider economic benefits, contributing significantly to regional economic growth and competitiveness, and cluster development;
- Universities' expertise, independence and strong brands can give them particular advantages in delivering support to firms alongside Government agencies;
- The work is generally not fully self-financing for universities, some of which explicitly see this as a 'public duty' function.

Public funding has therefore been crucial for making these activities happen. The source of most relevance to universities has been:

- European Structural Funds – in areas where these are available;
- The Teaching Company Scheme and LINK schemes, which universities in particular have praised;
- Generic Research funding which supports research collaborations with no single beneficiary and where the university retains the intellectual property.

A small number of flagship schemes seem to have significantly engaged universities, and been positively received. These are: University Challenge, Science Enterprise Challenge (which were one-offs), TCS, LINK, HEROBC and Faraday Partnerships. Other schemes by and large do not appear to have much impact. This adds weight to the argument that a broader rationalisation of schemes is needed which offers the possibility of greater impact through consolidation.

The FSB believes strongly that we need to look at instituting recognised and well-branded KTP processes within Wales to effectively help facilitate and nurture this relationship.

In looking at the possible future structure of knowledge transfer and R&D operations in Wales, we feel that it is essential that we look to areas of best practice. Representatives of the FSB have visited a number of locations around Europe, which have been carrying out such successful programmes and operations and some of these are listed below. The first, which is covered in some detail, is the highly successful Steinbeis Institute.

Model 1 Germany – Steinbeis (Stuttgart)

The plan to establish "Fachhochschulen" (universities of applied sciences) in the years 1960 - 1970 also gave rise to another idea: to establish a central service agency to supply know-how to small and medium-sized enterprises (SME). To fulfil this purpose, the Steinbeis Foundation for Economic

Promotion was established in 1971. It was named after Ferdinand von Steinbeis, one of the foremost promoters of business in Württemberg in the last century.

The Steinbeis Foundation as a private company was founded in 1971 with five so-called Technical Consulting Centres. The Centres, headed by professors from technical colleges, worked as general points of contact for technology-orientated questions and problems, particularly from SMEs.

In 1982 the then Minister President of Baden-Württemberg created the post of a Government Commissioner for Technology Transfer. Since the work and the duties of the new Government Commissioner closely matched the work of the Steinbeis Foundation in many aspects, it was logical for the two to work together. Thus the Baden-Württemberg Technology Transfer Model was born.

Prof. Dr. J. Löhn was appointed Government Commissioner for Technology Transfer, and since that time has managed the business operations of the Steinbeis Foundation as its Chairman of the Board of Directors. He added to the existing 16 facilities of the Technical Consulting Services a network of Steinbeis Transfer Centres and other sources of expertise.

As a rule, each of these Steinbeis Transfer Centres specialises in a specific topical focus. Consequently, in accordance with the needs of the economy, the Steinbeis Foundation too has changed from a pure supplier of technology to a holistic problem solver.

The Steinbeis network is now a well-established service for the transfer of technology and expertise and is based on a global network of 650 Steinbeis Transfer Centres undertaking an impressive number of projects every year (over 21,400 in 2003). The network also includes a wide range of joint venture and project partners.

Transfer centres help to innovative companies and access centres for state-of-the-art technologies like microelectronics and microsystems engineering, information and telecommunications technology, production technology, biological process technology and genetic engineering, as well as corporate management.

Steinbeis has also considerably expanded its activities as assessors for companies and banks. The main focus here is on evaluating technologies, markets, companies and their technological creditworthiness. An important role is also played by regional business promotion and the internationalisation of transfer activities.

The growth of demand in the training sector through the foundation also confirms the important role which knowledge and specialist expertise play in maintaining competitiveness. The Steinbeis University in Berlin became involved in a new undertaking: in collaboration with partner institutions in Germany, the USA and Japan, a Master’s degree course in project competence was set up. The Steinbeis network also set up “virtual

academies" focusing on topics such as management, development, design and electronic commerce.

The annual turnover of the Steinbeis Foundation amounts to almost €90million (over £61million) – without any form of institutional subsidy whatsoever. More than 21,400 projects have been carried out, involving 4,014 academics, administrative and project-related staff.

Steinbeis Transfer Centres are located in virtually every part of Germany. The total transfer network also includes a number of Transfer Centres abroad, and turnover is generated in a total of 50 countries across the world. The motto of the institution is: "Don't complain – compete!"[17]

Promoting innovation, providing momentum, and implementing new ideas is the role Steinbeis see themselves playing as advisors and partners for companies in all sectors of industry, as well as for private and state institutions of all kinds. Some of the Steinbeis Transfer Centres offer specific subject specialisms, while others are famous for their "interdisciplinary" approach. They aim to provide a bridge between academia and industry, offering an unusually wide range of services for all aspects of modern technology and management: consultancy, evaluation reports, further training measures – right down to research and development projects. The ethos is to undertake a holistic approach covering the entire process from the initial idea to its final implementation.

If research results are to be successfully converted into competitive products and processes, an independent transfer structure is needed which focuses exclusively on the benefits for the customer – in other words the requirements of the market.

One of the keys to the success of Steinbeis has been its absolute focus on technology transfer realising that it pursues goals which are different from those of basic research.

The network is organized on a decentralised basis with flat hierarchies. Each individual transfer centre is run as a separate profit centre, with its director free to operate independently in close conjunction with the customer.

One of the notable focuses of Steinbeis (which mirrors closely an ethos adopted by Scottish Enterprise's High Growth Start-up scheme) is that the service is based on the provision of personal advice and the exchange of specialist information with the right person tasked to deal with a specific problem. The emphasis therefore is 'grafting on' the right person for the right operation.

The research and development aspect involves specific, direct transfer of technology and/or information. Here the Steinbeis network offers Transfer Centres covering all fields of technology and management Their professionals

[17] *Steinbeis Foundation report 2003.*

– engineers, computer specialists, natural scientists and a host of other experts – take on the task of “applied project development” for new or optimised processes and systems, pilot projects and prototypes, new, market-orientated products and innovative ideas.

The main focus of the Foundation’s work is on bridging the gap between the latest R&D results and their application in a business context. With its Transfer Centres, the Steinbeis network offers access to the entire range of leading-edge technologies, which is a uniquely valuable source of information and expertise.

In addition to its own eight foreign-based Transfer Centres, the Steinbeis Foundation has developed an international network of partnerships in a large number of countries throughout the world, which it uses to offer comprehensive support – whether the business is looking for potential markets, seeking merger or project partners, wishing to set up new operations abroad, or just having questions answered about subjects such as importing, exporting, licensing etc.

As globalisation spreads, small and medium-sized companies are increasingly having to meet new challenges. Steinbeis aims to help to enhance businesses competitiveness and consolidate their position on international markets. It is within this collaborative partnership arrangement that the FSB sees an opportunity for Welsh academia and businesses.

Model 2: Germany - Fraunhofer- Gesellschaft (Munich)

Established in the 19th century by Joseph von Fraunhofer Gesellschaft is world-renowned for its innovative approach to technology transfer and research and development.

Its emphasis is on securing innovative concepts and using research funding only for products, which have a practical application – essentially, products, which can be licensed and sold.

Much like Steinbeis, Fraunhofer has a significant number of sub-institutes – 58 in total – across Germany and the world. The billion-euro budget comprises the Institute’s own funding, funding from larger companies including multi-nationals and a notable proportion of funding from contracts emanating from the European Union. However, the central emphasis remains on independence and the private sector.

Although all divisions are autonomous, they work together on theme-related subjects and jointly market their products. By far the largest customer section is industry, with some work undertaken for defence and public customers.

Research undertaken is directly aimed at promoting industrial performance. Its clear focus on application-oriented research and practical implementation distinguishes Fraunhofer and Steinbeis from many other large research

institutes around the world, a number of which are involved with pure or basic research.

All research is patented, and large companies join a project after initial research has been carried out by the Institute itself. Once a successful application is achieved, the large company pays a licence fee for exclusive use.

This process certainly does not ignore the need for involvement by and development of a dynamic small business sector. What might be referred to as ‘spill over’ research and non-competitive applications can be made available at a much lower cost.

Significantly, a large percentage of the work undertaken involves small companies. In fact, businesses with fewer than 100 employees use the Institute as much as larger companies.

To ensure that the requirements of SMEs are met, only one person is responsible for s specific customer. In research terms, this is the perfect one-stop-shop. Key areas of speciality are microelectronics, materials and components, life sciences, surface technology and photonics.

The Fraunhofer’s approach to staffing is based upon time-limited working periods rather than life-long employment. They provide close interaction and exchange with partner universities. Students are keen to gain ‘work experience’ and then move on to large companies where they will propagate the emphasis on application. Although a high staff turnover may not sound politically amenable in terms of supplying sustainable employment, the opposite is in fact true. High staff turnover ensures a new input of new ideas and also ensures a healthy supply of highly trained researchers within the economic landscape.

At least one of the three directors in each institute holds a chair in a university, while at the same time concentrating on commercial aspects as much as research. The institute is involved at all political levels, to ensure that research and development is taken in the right direction to the service industry rather than universities in order to increase competitiveness.

Steinbeis and Franhofer might not seem such immediately obvious models for research and development in Wales as both have developed over a number of years and involve well established and dynamic internal and external networks. Indeed it is true to say that Wales is far too small a country to sustain such models in their entirety but could benefit substantially from selling itself as a possible location for one of the constituent institutes for such a model.

However, what is most important, especially in the case of Franhofer, is the emphasis on research application and the opportunities that such a structure presents for involvement by the SME sector.

Developing Networks

What is evident from looking at some of the more effective centres of R&D in the UK and Europe is that the most innovative and successful businesses thrive on and exist alongside well established and dynamic networks.

Not only is there a need for effective networks within the academic community and for business interaction with the academic community but there is also a need for more effective and better defined business-to-business (B2B) networks within Wales.

Many such networks in England obviously occur around or spin out from natural 'high intensity' centres of R&D such as science parks or centres of R&D excellence such as Oxford and Cambridge. Oxford for example has many dynamic networks with links into all sectors.

Where networks exist such as Cardiff University's Innovation Network for example, these need to be expanded and made yet more accessible to the private sector and businesses need to be encouraged to interact.

Conclusion

This paper has briefly highlighted some of the areas of best practice within the UK and Germany in an attempt to stimulate debate about the possible direction of science, innovation and research and development as well as identifying some of the structural issues that stand in the way of increasing R&D spend and operations and encouraging the commercialisation of technologies developed within the HE sector.

The FSB feels strongly that although there are obvious areas of significant expertise within Wales, these are at best sporadic and have little linkage to the overall strategic promotion of a defined Welsh knowledge economy and that there is therefore a requirement to bring together such operations to target investment, encourage further innovative development and to spearhead the drive for wealth creation.

We feel that there is an intrinsic need to encourage the creation of effective networks to nurture and develop innovation, create portals for higher education into the private sector and allow SMEs the opportunity to interface with larger businesses already conducting R&D in Wales.
The Welsh Assembly Government has stated its desire to push for the creation of such a knowledge economy but we feel that actions thus far although innovative and, in some cases radical, have been fragmented.

We need to make Wales an obvious and irresistible location for large-scale investment by multinationals seeking to locate R&D operations and, if necessary, ring-fence substantial funding support specifically for this purpose. To do all this requires the creation of the right environment including physical

infrastructure and dynamic interaction between businesses and higher education.

In addition to this, we need to make sure that SMEs are properly encouraged and supported to undertake R&D through access to targeted and responsive funding, incubator support where appropriate and access to a network of knowledge technology transfer schemes.

Higher education in Wales needs to be more proactive in its interaction with the private sector and there is a need to build links between the two sectors not only to service the needs of HE and the private sector but also to allow for the commercialisation of research conducted within universities. The cultural gaps that are currently so evident are stifling the ability to properly commercially exploit research.

We feel that the WAG should institute a high-level foresight scoping exercise drawing on the experience of our top academics and businesses and where we identify areas of specialism within Welsh businesses and universities, we should seek to create centres of excellence, which would draw investment and businesses to feed of this expertise. It is of great importance that such an exercise be independent from government.

All the above requires political vision and strategy as the starting point. We need to re-task existing policies and create new and dynamic policies as part of such a vision. We have identified some of the measures that the Assembly might adopt, but guiding this should be a vision, adopted at the highest levels for Wales to be a natural location for innovation, research and development and one of the most attractive knowledge economies in Europe.

Wales Policy Office
Federation of Small Businesses in Wales
September 2005.