

The prospects for public sector led regional innovation systems: lessons from Wales

Gillian Bristow
School of City and Regional Planning
Cardiff University
King Edward VII Avenue
Cardiff CF10 3WA

E-mail: Bristowg1@cardiff.ac.uk

Dylan Jones-Evans
Centre for Advanced Studies
Cardiff University
44-45 Park Place
Cardiff CF10 3BB

E-mail: enlli@btconnect.com

Paper for the Regional Studies Association (RSA) Annual Conference, Regions: The
Dilemmas of Integration and Competition

May 27th-29th 2008

University of Economics Prague, Czech Republic

Draft paper: not to be quoted without permission of authors

Abstract

Regions with a low innovation base face a huge challenge in developing an effective innovation policy, and there is increasing recognition that effective regional innovation policy needs to reconcile top-down and bottom-up approaches, and supply-side and demand-side perspectives. There is also the inevitable problem of absorptive capacity and the regional innovation paradox i.e. the apparent contradiction between the comparatively greater need to spend on innovation in lagging regions and their relatively lower capacity to absorb public funds earmarked for innovation and related activities. Wales represents an interesting case study in which to explore these questions given recent large-scale Objective One European Structural fund programme which, for first time, has been administered through a devolved regional government with a distinct approach to animating the regional innovation system. One of the key objectives of this programme was to develop a high quality, job-creating, innovative and knowledge-driven economy. In order to do this, projects would be supported to exploit the potential of new technologies, to develop new industries and improve the competitiveness of existing ones. As part of that strategy, priorities were established to directly support innovation and R&D within the Objective 1 region of West Wales and the Valleys. These activities aimed to develop funds to support the development of high technology businesses, support research and co-operation between business, colleges and universities and improve training in higher level skills. This paper will examine how this funding has been spent to increase the rate of innovation and, more importantly, whether it has succeeded in making a difference. The data suggests that there has been no real evidence of a step-change in innovation capacity and performance within Wales which may be due to the failure to address disconnectivity between public sector funding and private sector interests.

1. Introduction

The pursuit of innovation has become a central feature of regional economic development policy in recent years, although policy approaches have undergone significant change. Since the 1990s, there has been a shift away from the traditional linear approach to understanding innovation which focused on infrastructure provision, support for firms and technology transfer. More recently, regional policy has been driven by the belief that regional economic growth is dependent upon the creation of successful regional innovation systems (RIS). The systems approach posits that innovation is an evolutionary, non-linear and interactive process requiring intensive communication and co-operation both amongst firms, and between firms and other pertinent institutions (Edquist, 2005). In this context, the institutions referred to are both 'hard' (encompassing innovation relevant organisations such as universities, research institutes, educational institutions, financial organisations and government agencies), and 'soft' (referring to the rules, routines and norms characterising firms and other actors) (Todtling and Trippl, 2005).

Innovation is regarded as a cumulative and interactive learning process such that innovating firms benefit from the existence of strong inter-relationships between government, business and universities – the so-called triple helix model of innovation (Leydesdorff, 2000). The regional scale is perceived to be particularly important for

the development of innovation systems since the networks of governance, knowledge spillovers and exchange which are understood to lie at the heart of successful innovation tend to be spatially bound (Cooke, 1998; Howells, 1999; Cooke et al, 2000; Morgan, 2004a). In short, regional innovation is a function of the regional business and institutional environment such that regional innovation systems are “essentially social systems composed of interacting sub-systems” (Autio, 1998; p. 135).

The RIS concept has played a powerful role in sedimenting the notion that regional innovation outcomes are driven by the effectiveness and efficiency of the knowledge building, flows and spillovers among the different constituent parts of the system, including individual firms, sectoral or value chains or clusters, business service providers, technology transfer centres and university departments. This has powerful implications for regional innovation policy which, it follows, should aim to develop the scope for enhancing the interfaces and synergies among regional innovation actors (Oughton et al, 2002). However, there is considerable debate as to the most appropriate policy approaches for dynamising a regional innovation system. Howells (2005) articulates five broad sets of challenges which confront policy-makers across regions in Europe. These are how to marry top-down national and European Union (EU) policy programmes with indigenous bottom-up incentives; whether to place investment in public or private research and innovation capacity; whether to adopt ‘best practice’ policies or develop more bespoke interventions; how to allow sufficient time for innovation policy to be effective; and how to balance interventions which address both the demand for and supply of innovation in the region.

For weaker regions the difficulties raised by these policy challenges may be even greater. As Howells (2005; p. 1225) observes, “regions “have to work with what they have got” and it is increasingly recognised that regions with a low innovation base are confronted with particular constraints on their ability to reconcile these conflicting demands successfully compared to more advanced regions (see, for example, Morgan, 2004b; Benneworth and David, 2005). Typically, studies of regional innovation systems to date have overwhelmingly focused on those regions which have been successful innovators in the past or have adapted effectively to economic change and thus which offer potential ‘best practice’ solutions. As a consequence, “the dynamics of less successful places are underdeveloped – both in theoretical and in policy perspectives” (Benneworth and Hospers, 2007; p.779).

The RIS and triple-helix approaches to understanding regional innovation suggest that strengthening the relationships between government, business and universities is critical to improving innovation in lagging regions. There has been particular growth in interest in exploring the specific role universities play as key institutions in regional innovation success (see, for example, Benneworth, 2006; Gunnasekara, 2006; Huggins et al, 2008). These studies have emphasised the potential for universities to plug particular gaps in regional innovation systems, but have also pointed towards the need for greater strategic support for and co-ordination of their activities in regional innovation systems, particularly in regions with innovation deficits. This begs the question as to what role regional government can play in catalysing new, more synergistic relationships in regional innovation systems. To date this question has received limited attention. Yet, as Oughton et al (2002) suggest, regional government has the potential to increase the capacity of low innovation regions to absorb

investment funds through both its strategic policy interventions and investment in innovation, and its capacity through leadership to better match innovation needs and knowledge priorities and forge new links between institutions.

The principal aim of this paper is thus to examine this question using the case of Wales. Wales represents an interesting context for study given its typically low innovation base and history of regional innovation policy interventions. It was indeed one of the first recipients of dedicated EU Regional Technology Plan assistance in 1994 for the development of its regional innovation system (see Cooke, 2003). More recently, it has benefited from a large-scale EU Objective One programme which, as well as identifying specific priorities to directly support innovation, for the first time has been administered through a devolved regional government. Indeed, the institutional restructuring associated with devolution coupled with the significant injection of funding for innovation has encouraged the development of a distinct and strongly public-sector led approach to the animation of the regional innovation system.

Seven years on from the start of the Objective One programme, and after an expenditure of £284 million on innovation policy, this paper will critically examine how this funding has been spent and what impact it has had on innovation capacity and performance. More specifically, examination of the ‘interventionist’ regional innovation system developed in Wales (Cooke, 2003) allows us to explore the following three questions: firstly, whether strong public sector governance of innovation support improves the match between innovation needs and priorities; secondly, whether public-sector leadership of the innovation system helps forge new, more synergistic and ultimately productive relationships between government, business and universities; and thirdly, whether strong public-sector intervention in innovation support helps dynamise private sector investment thereby improving a region’s absorptive capacity for innovation funds.

The paper begins by exploring the challenges confronting policy-makers seeking to develop effective policies for regional innovation systems in regions with a low innovation base. This analysis suggests there is a clear contradiction between the comparatively greater need to spend on innovation in those regions lagging behind, and their relatively lower capacity to invest in and absorb public funds earmarked for the promotion of innovation – a situation referred to as the so-called ‘regional innovation paradox’ (Oughton et al, 2002). The paper then examines the nature and impact of the public-sector led, interventionist approach to developing the regional innovation system in Wales using evidence gleaned from the Objective One programme which ran between 2000 and 2006. The findings suggest that there is no real evidence of a step-change in innovation capacity and performance within the poorer parts of Wales reflecting, potentially, a failure to address the existing disconnect between public sector funding and private sector interests.

2. Regional innovation systems: key policy challenges

In practice, closing regional innovation gaps between prosperous and lagging regions is made difficult by the so-called regional innovation paradox (Oughton et al, 2002). This refers to the situation whereby the more innovation is needed to maintain and enhance the economic performance of firms in poorer regions in an increasingly

global economy, the more difficult it is for them to invest effectively and absorb public funds for the promotion of innovation. The problem is explained by weaknesses in the institutional characteristics of lagging regions: “In short the regional innovation system is fragmented and lacks either the necessary interfaces and co-operation mechanisms for the supply of innovation inputs to match firms’ demand, or the appropriate conditions for the exploitation of synergies and co-operation among regional innovation actors which could eventually fill gaps and avoid duplications in service provision” (Oughton et al, 2002; p. 102). Weak governance structures can compound these problems. Some regional governments in less developed regions suffer from a lack of credibility in the eyes of the private sector and lack political stability and awareness in respect of innovation. They also often lack a multi-disciplinary approach to innovation. In these circumstances, a considerable increase in the quantity of public funds targeted on innovation is required in order to trigger a parallel increase from private funds (Michie and Oughton, 2001; Oughton et al, 2002).

The available literature suggests there are a number of basic principles which are critical to the development of a successful regional innovation policy and the encouragement of effective regional innovation systems (see Todtling and Trippl, 2005). These include the need for understanding the broad array of components that constitute effective systems, networks and clusters; the need for associational forms of governance capable of brokering collaborative networks between the key players in the triple-helix; strategies based on picking winners and understanding regional strengths; and linking different policy arenas and tiers of governance.

Studies of European regions have tended to find that in practice, regional innovation policy rarely succeeds in meeting these principles (Cooke et al, 2000) with a major weakness being the tendency to apply generic policy approaches derived from what are perceived to be best practice regions or those which have successfully adapted their innovation capacities and subsequently re-invented themselves (Morgan, 2004b). As Hospers (2006; p. 11) observes: “the particular structural and cultural tissue found in these regions renders their area-based policies a unique flavour that cannot be transferred easily to other places”. In short, there is no ‘ideal model’ for innovation policy as innovation activities and needs differ significantly between central, peripheral and old industrial regions (Todtling and Trippl, 2005). This implies the need for a differentiated innovation policy approach based upon firstly, a comprehensive understanding of each region’s particular innovation needs, barriers and challenges, and secondly the development of strategic interventions which are tuned into and build upon existing knowledge bases and institutional capacities.

In relation to understanding regional innovation needs, Todtling and Trippl (2005) argue that different regional types suffer more prominently from particular forms of innovation systems failure and have thus developed a typology of lagging regions. This distinguishes between peripheral or geographically remote regions which tend to be blighted by organisational thinness; old industrial regions, which are more likely to suffer problems associated with being locked-into mature technological trajectories and rigid networks; and weaker metropolitan regions which tend to be more prone to problems of fragmentation of networks and a lack of interactive learning. Thus, peripheral regions require an emphasis on strengthening and upgrading existing innovation systems and networks and their external links. Old industrial regions, on

the other hand, require an emphasis on upgrading the knowledge base and renewing old industrial sectors, whereas metropolitan regions or those suffering fragmentation of support require policies targeted at enhancing communication, collaborating and shared learning. The clear imperative for policy-makers is thus a detailed understanding of the specificities of their particular region and its specific innovation dynamics and challenges.

This is further reinforced by the notion of related variety which implies that the long-term growth and development of regions depends on their ability to diversify into new applications and new sectors whilst building on their current knowledge base and competences (Boschma, 2004). This concept emphasises that it is regional history that determines how regions adapt and move into new directions or start new growth paths (Lambooy and Boschma, 2001). This therefore implies that it is the existing knowledge and institutional base in a region that should determine the region's innovation policy and the priorities for broadening the region's sector base. This will ensure the development of policy approaches which are more effectively embedded in their spatial settings, geared towards specific potentials, and focused on tackling particular bottlenecks in regions. This essentially means that innovation policy should be aimed at capitalising on region-specific assets, rather than selecting from a portfolio of specific policy models and recipes that developed their success in different environments.

Furthermore, it is increasingly acknowledged that there are different types of regional innovation system. Cooke et al (2004) distinguish between two distinct types of RIS: the Institutional RIS and the Entrepreneurial RIS. The first type is heavily based on public knowledge generation and exploitation through institutions such as universities, business incubators and organisations focused on technology transfer. In the second type, innovation is driven by entrepreneurs and venture capitalists and is less dependent on public support. Lambooy (2005) makes a similar distinction between governance and self-organising systems. The first case is characterised by governance, regulation and co-ordination of the various components of research, education, SME locations and sometimes exports, usually by a regional government. The second case, in contrast, is a self-organising system in which firms play a dominant role and organise themselves with universities, research institutes and other participants in networks or via markets to respond to perceived needs and opportunities.

Regions with strong institutions such as science parks or universities and research institutes with the capacity for developing commercial spin-offs can animate themselves (Löfsten and Lindelöf, 2002) although there may be some limitations on what they can achieve, given that their role in stimulating regional economies is secondary to their core mission of research and teaching. As a consequence, other public institutions such as regional governments may be required to provide the impetus to innovation. Indeed, there is evidence that regional innovation systems work more effectively where there is a higher degree of regional autonomy (see Morgan, 2004b), whilst the devolution literature points towards the advantages regional governments have in understanding regional economic needs and developing tailored policies and services to fit them (Goodwin et al. 2005).

As well as greater specificity in innovation policy, the RIS policy literature also points strongly towards the need for lagging regions to build up their institutional capacities and to foster webs of co-operative networks and collective learning processes among firms, universities and research institutes, financial organisations and governments (see, for example, Oughton et al, 2002; Doloreux and Parto, 2005; note add more refs). In this regard, networks are more than simply market-based relations, but also embrace non-market relations shaped by trust, experience and history that evolve between institutions and firms (Lambooy, 2005; Todtling and Trippl, 2005). In particular, networks which succeed in connecting the results of research carried out in universities and other research institutes with the application-orientated activities of small or large enterprises are seen as particularly significant (Klofsten and Jones-Evans, 2000; Cooke, 2001). Such successful networks are, however, inevitably difficult to effect through government policy.

Regional government can play the role of catalyst to strengthen government-industry-university links and regional learning and is best placed in terms of political legitimacy and economic powers. This includes its ability to eventually use the carrot (as the coordinator of industrial policy and arbiter of the Structural Funds allocation and the stick (through its regulatory powers and public procurement policies). It is also best placed to facilitate the articulation of the regional innovation system through its ability to link regional actors (firms, technology centres, universities and business service providers) and develop complementarities among the different actors, policies and sub-systems (Oughton et al, 2002). Taken together, this creates a strong case for a bottom-up approach to regional innovation policy and a strong metagovernance role for regional government.

3. Innovation in Wales: Context and Strategy

The supply of research excellence in the private and academic sectors is vital for the development of a strong regional innovation system. Unfortunately, with regard to the Welsh economy, the evidence suggests that it currently lags behind most of the rest of the UK in terms of research and development indicators.

According to the most recent Government figures on private sector R&D expenditure released (ONS, 2007), the total amount of R&D performed by businesses in the UK amounted to £14.3 billion in 2006 or 1 per cent of GVA. In Wales, private sector businesses spent £222 million on R&D in 2006, representing an increase of 54 per cent since 2000 (table 1). Wales now accounts for 1.55 per cent of total business R&D undertaken within the UK as compared to 1.25 per cent in 2000.

Table 1. Private Sector Research and Development Expenditure (UK, Wales) 2000-2006 (£millions)

	2000	2001	2002	2003	2004	2005	2006
UK	11,510	12,336	13,110	12,677	12,668	13,410	14,306
Wales	144	136	170	207	226	231	222
Wales as % of UK	1.25%	1.10%	1.30%	1.63%	1.78%	1.72%	1.55%
R&D in Wales as % of GVA	0.45%	0.41%	0.48%	0.56%	0.57%	0.57%	0.52%

Source: National Statistics, 2007

This reflects a long-term trend in the low level of private sector R&D carried out in Wales relative to the rest of the UK, with comparative spending relative to other regions remaining low, with only Northern Ireland businesses spending less on R&D in 2006. Private sector R&D accounted for 0.53 per cent of GVA (Gross Value-Added) in 2006. However, the trend since 2004 has been one of declining R&D spending in Wales by private business. More significantly for the Welsh Assembly Government's economic development strategy, the target of reaching 1 per cent of GVA by 2010 seems remote unless there are major investments during the next two years.

In addition to the private sector, universities are seen as the key to the development of technological innovation within poorer areas in receipt of European Aid, such as West Wales and the Valleys. In order to fully utilise the potential of technology transfer as an economic force for development, it is vital that research – both basic and applied – is adequately resourced. There have been various reviews of higher education in Wales which have recognised the need to increase R&D within universities (National Assembly for Wales, 2002; Welsh Assembly Government, 2002) which have proposed that the regional government works alongside the universities to produce a world class research base, establish centres of excellence and recognise the contribution of applied research. This mission becomes even more important given that the amount of R&D income and expenditure within Welsh universities is considerably less than for Scottish and English academic institutions.

The Higher Education Funding Council for Wales (HEFCW) currently provides direct research funding via a combination of formula and initiative funding. In 2005/06, the funding provided in this way will amount to £63.6 million, although additional funding is also provided to institutions for the training of postgraduate research students and for capital investment in research equipment and facilities (HEFCW, 2005). In addition, Welsh universities received £121.32 million in research grants in 2005-2006, an increase of 71.0 per cent since 1999-2000. Cardiff University attracted 63.3 per cent of all Welsh research income. As Huggins et al (2008) note, the apparent dominance of Cardiff University could impact substantially on the development of a regional innovations system across Wales covering government, business and higher education actors, especially given Cardiff's investment in commercialisation. With regard to the human resource activity in academic institutions, the HESA statistics indicate that a total of 5720 academic members of staff were employed across all Welsh universities in 2005-2006 as compared to approximately 3000 research staff within the private sector in Wales (ONS, 2007).

Having discussed the quantity of research in Welsh academic institutions, it is worth noting the quality of research as well, using data generated by the RAE for 2001 (Jones-Evans, 2002). Wales did better than expected, with eight HE institutions improving their overall research rating since the last exercise in 1996. Of importance to the development of a science and technology infrastructure (and hence any R&D that may flow into industry as a result of this), it is worth noting that thirty-five science, engineering and medicine departments [at the Universities of Wales Swansea, Bangor and Aberystwyth, Cardiff University, the University of Wales College of Medicine and the School of Computing Science at the University Of Glamorgan] were recognised as having levels of international excellence in their subject areas

during the latest research assessment exercise in 2001. This represents an increase of 40 per cent since 1996, with five departments rated at the highest level of 5*.

In comparing the overall RAE data, Welsh academic institutions have apparently performed well compared to the UK – whilst Wales represents only 5% of the total research-active pool in the UK, a recent study indicates that research quality is higher in the rest of the UK in more than one third of the subject areas, including psychology, town and country planning and civil engineering. However, whilst the improvement in humanities and social sciences is to be welcomed, this will do very little in supporting a strong science and technology infrastructure within the Welsh economy. The same study suggests that there are major areas of weakness within the Welsh academic structure in areas which form the foundation for important high technology industries such as aerospace, optoelectronics, biotechnology and pharmaceuticals, sectors in which the majority of R&D is undertaken within the UK. These include key scientific disciplines such as Biological Sciences (30% below the UK RAE average), Chemistry, (14% below the RAE average) and mechanical, aeronautical and manufacturing engineering (10% below the UK RAE average). Only earth sciences, environmental sciences, computing sciences and pharmacy in Wales are above the RAE average for the UK. There are also serious weaknesses in pure mathematics, applied mathematics and physics, where we have only 3.2% of the total number of active UK researchers. The low number of researchers within Wales is major issue in developing the science and technology infrastructure that is vital to a nation's competitive future and this may be particularly pronounced within the more peripheral areas of the UK such as Objective 1 regions.

However, the development of a strong regional innovation system is not possible greater interaction between actors in the system (Cooke, 2003). In that respect, Wales has actually improved its research record during the last few years in terms of collaborative research involving both public funding and funding from business (HESA, 2007, 2006, 2005). Since 2003, this has increased by 32.8 per cent to £65.2 million in 2006, as compared to 26.7 per cent increase for the UK. However, there are doubts whether this research funding has benefitted all of Wales, particularly its poorer regions, as 88.7 per cent of this collaborative research was concentrated in two universities – Swansea and Cardiff – with less than £13.6 million begin generated for research across the rest of the Welsh university sector in 2005 and 2006.

In terms of contract research with business, Wales performs relatively poorly compared to the UK, and there has been a reduction of £9.6 million in the value of non-government research contracts awarded to Welsh institutions, from £33.3 million in 2003 to £23.6 million in 2006 (or a decline of 29.1 per cent). Encouragingly, research contracts undertaken with SMEs in 2006 was £1.52 million across 116 projects, representing a slight increase of 4.0 per cent since 2003.

4. Innovation and the Objective 1 programme in Wales

This paper will examine the impact of European Structural Funding on the development of innovation within the West Wales and the Valleys, a NUTS II region within Wales. In 1999, this region was awarded Objective 1 status by the European Commission for the period 2000-2006. This would result in the region receiving £1.2 billion from the Structural Funds programme, which would be matched by a further

£1.3 billion from the public, private and voluntary sectors (Bristow and Blewitt, 2001). Further details of the development of the programme can be found in Boland (2004).

According to the Single Programming Document (Welsh Assembly Government, 2000) which acts as the overall strategy for the Objective 1 programme, there were three overall targets for the programme, namely to raise per capita GDP in the region from 73 per cent to 78 per cent of the UK average; to create around 43,500 net additional jobs; and reduce the number of those who are economically inactive by 35,000. These would be achieved through developing projects under six key priorities, namely (1) Expanding and developing the SME base; (2) Developing innovation and the knowledge-based economy; (3) Community economic regeneration; (4) Developing people; (5) Rural development and the sustainable use of natural resources; and (6) Strategic infrastructure development.

This paper focuses on the outcomes from priority 2, namely “Developing innovation and the knowledge-based economy”. Its aim was to improve the competitiveness of the region through the acquisition and use of knowledge and new technologies through five broad objectives, namely creating a culture of innovation; diversifying the economic base by growing more technology and knowledge driven firms and improving their links to the knowledge base.; increasing investment in R&D; stimulating increased demand for, and adoption of, ICTs; and improving environmental performance through the adoption and use of clean technologies.

As part of this strategy, two measures were established to directly support innovation and R&D within West Wales and the Valleys. The first measure was that of support for the development of innovation and research and development (Measure 2.3). Its aim was to create an environment which supports innovation, R&D and improves Wales’ competitiveness in a global market place through developing existing clusters and new R&D potential around higher and further education institutions. This would be achieved by supporting commercialisation of the knowledge base and the development of new products, processes and services. It was expected that the final recipients of support under this measure would be companies operating predominantly in high technology sectors. The projects to be supported would include the provision of a comprehensive innovation and technology support infrastructure for business, the development of long term R&D capacity in the region and increased competitiveness through improved linkages between the academic base and businesses. It would also aim at embedding a culture of innovation throughout the region for all sectors, including those predominantly located in rural areas which do not have a strong history of innovation, and support the development of networks and clusters of technology-based companies.

The second measure was focused on skills for innovation and technology (Measure 2.4). As a European Social Fund (ESF) measure, this programme would provide financial support towards the running costs for vocational training schemes, guidance and counselling projects, job creation measures and other steps to improve the employability and skills of both employed and unemployed people. In this respect, it would enhance skills and boost human potential in research, science, technology and innovation, with the final recipients of this measure being managers, the current and potential workforce of small firms, trainers and commercial managers. The type of projects to be funded under this programme could include the interchange of

personnel between academic and research institutions and business, graduate retention programmes; high-level skills training for employees of growth companies to support research and development.

Table 2 shows that, during the period 2000-2006, £130,904,284 of European Structural Funds were awarded to 34 different Welsh organisations, predominantly in the public sector. A total of 105 projects were funded, with an overall value of £283,682,925. Capital and revenue projects accounted for 81.9 per cent of those funded under this programme, with only 18.1 per cent being allocated to skills and training programmes.

The main beneficiary from the innovation strand of Objective 1 funding has been the university sector in Wales, which has received £65,158,394 of aid for 59 projects with a collective value of £138,739,942. This equates to 49.8 per cent of all European Structural funding awarded for innovation projects within the Objective 1 area of Wales. Two universities - Swansea University (£23,356,243) and the University of Wales Bangor (£14,509,643) – account for over 58.1 per cent of the funding for innovation by higher education in the Objective 1 region of Wales.

Both universities are managing a total of 32 projects with an overall value of £81,870,192. Swansea University has largely focused on the development of major research infrastructure projects such as the Institute of Life Science (ILS) and the Institute of Advanced Communications (IAC). For example, the ILS is a £17,009,000 project is a partnership between Swansea University, the Welsh Assembly Government and the Swansea NHS Health Trust which aims to co-locate a number of life-science related research centres of excellence in one high-quality multi disciplinary research environment, as well as developing an appropriate business support structure and an incubator for micro-companies.

The University of Wales Bangor has concentrated focused on developing its core areas of expertise such as agri-food, optoelectronics, software, marine technologies and chemistry. It has also hosted two major training projects – worth a total of £9,829,582 - to enable individuals to develop the skill to contribute to research as professionals. Cardiff University – which is based outside the Objective 1 region – has been awarded grants of £13,558,229 for five projects with a combined value of £26,670,126. These include grants for a £10,840,544 Geo-environmental Science Park in Neath-Port Talbot region and the development of the £15,358,024 Supporting Innovation Product Engineering and Responsive Manufacture (SUPERMAN) project which assists SMEs in applying innovative and advanced manufacturing technology. The University of Wales Aberystwyth has only drawn down funding of £4,106,452 for only one project, namely the Centre of Excellence for Visualisation in Wales with a total cost of £9,897,498. This will provide an innovative, world-class virtual reality environment which will be used by SMEs across the Objective 1 region to enhance their competitiveness and profitability through solving complex problems and create new products through imaging technology.

Table 2. Objective 1 innovation project recipients, 2000-2006.

Sponsor Name	Total grant £	Total project cost £
Welsh Assembly Government	49,573,805	105,615,382
Swansea University	23,356,243	53,383,773
Bangor University	14,509,643	28,486,419
Cardiff University	13,558,229	26,670,126
Aberystwyth University	4,106,452	9,897,498
Neath Port Talbot County Borough Council	2,203,811	8,659,119
University of Glamorgan	3,829,547	8,143,653
TWI Ltd	3,206,671	7,157,743
Swansea Institute of Higher Education	3,393,435	7,057,045
Ceredigion County Council	2,319,287	4,381,976
HEFCW	1,670,775	3,481,147
Arena Network	1,530,194	3,185,080
Cyngor Gwynedd Council	1,222,505	2,578,980
Pembrokeshire College	799,348	1,775,894
Bic Eryri	465,755	1,763,321
Pembrokeshire County Council	697,520	1,393,020
The Wales Environment Trust Ltd	618,000	1,315,000
The CADCENTRE (UK) LTD	489,420	1,200,000
Sarvari Research Trust	349,303	999,882
Carmarthenshire Recycling Research Centre Ltd	528,386	977,144
University of Wales Lampeter	389,028	902,393
Pontypridd College	276,758	733,806
Trinity College	345,042	717,888
William Battle Associates	294,740	604,740
The National Botanic Garden of Wales	278,431	520,820
Engineering Education Scheme in Wales	160,183	493,909
Groundwork Bridgend	229,562	433,220
Cyfle Cyf	170,677	352,906
Neath Port Talbot College	30,207	169,000
West Wales ECO Centre	79,250	163,831
City and County of Swansea	52,623	131,211
Royal National Eisteddfod of Wales	59,500	119,500
Gorseinon College	55,624	114,999
Darwin Centre for Biology and Medicine	54,330	102,500
TOTALS	130,904,284	283,682,925

Source: Authors derived from WEFO databases

The new university sector within the Objective 1 region, comprising of Swansea Metropolitan University and the University of Glamorgan, has been awarded £7,222,982 of grants to predominantly support training projects, including a programme for upskilling ICT Business Advisers to full accreditation against Institute of Management's Technology Means Business Standards, and high level skills training for SMEs in engineering, technology and ICT. No new university located outside the Objective 1 region has successfully applied for project support. Further

education colleges received only £1,161,937 of grant funding for six projects, all of which were specific education programmes such as training in marine technology or courses in advanced composites manufacturing.

The second largest recipient of funds is the Welsh Assembly Government (WAG), attracting £49,573,805 of grants for 15 projects worth a total of £105,615,382. The largest part of this funding has gone towards the construction of a range of new incubator facilities known as Techniums, with buildings constructed across Wales in Swansea, St Asaph, and Bangor at a total project cost to WAG of £49,991,906. Overall, the Technium project has attracted European grants to the value of £32,219,636, with the majority of local authority funding for innovation being awarded to two Technium projects in Pembrokeshire and Neath Port Talbot.

Another key recipient of funding via WAG has been the university sector, albeit for third mission work. For example, the Centres of Excellence for Technology and Industrial Collaboration (CETIC) - academic research groups based in one or more Higher Education Institutes (HEIs) in Wales - was awarded £3,563,000 to assist in areas of collaborative research, technology and knowledge transfer, technical problem solving and testing for small firms. The Assembly Government also funded the Knowledge Exploitation Fund's Strategy for innovation to support all Further and Higher Education institutions in the Objective 1 area to commercialise and transfer their knowledge and technological expertise to small firms. This attracted an overall grant of £14,464,298 for a total project cost of £29,367,310. Only 17.9 per cent of WAG's innovation programmes were targeted directly at supporting the private sector. These include the SMART R&D programme - which received £1,998,175 of grant funding to encourage and support SMEs to undertake innovative research and technological development with commercial potential - and the Technology Exploitation Programme, which was awarded £6,001,107 to provide grants to encourage the more widespread use of technology and the provision of appropriate technology services and expertise and introduce them to the company.

Given the perceived importance of the private sector in developing innovation in Wales, it is disappointing to find that only 5 per cent of the innovation funds (or £6,515,166) has gone to seven projects developed by the private sector with a total value of £14,888,028. None of the projects were funding innovation development directly within the businesses that were awarded the funding. Instead, the grants were financing innovation support projects such as the establishment of a Non Destructive Testing (NDT) Validation Centre for industries using pressure equipment; a strategic and co-ordinated programme to encourage business to improve their environmental performance; and mentoring programmes for technology-based businesses. Charities and not for profit organisations attracted only 1.5 per cent of the total grants awarded.

The outputs from the two measures of the Objective 1 programme directly related to innovation are examined in detail in table 3. This shows that the majority of the activities to be undertaken by the programme have been met in terms of the companies assisted by the projects under measures 2.3 and 2.4. However, there has been a considerable shortfall in the number of employees helped through the programme. To date, 6,203 individuals (or 41 per cent of the programme target) have been assisted, although this is estimated to rise to 7,844 (or 52 per cent) of the target by December 31st 2008.

Table 3: Outputs from Priority 2 Measure 3 and 4, Objective 1 programme, 2000-2006

Measure	Output	Programme Complement (PC) Target (2000-06)	Outputs at 31/01/2008			
			Forecast		Actual	
			No	% of PC Target	No	% of PC Target
Activities						
2.4	No of employees helped	15,000	7,844	52%	6,203	41%
	Companies assisted of which:	15,000	32,119	100+%	35,594	100+%
2.3	Companies receiving advice on innovation and R&D	2,000	13,928	100+%	15,474	100+%
2.4	No of companies helped	3,000	3,633	100+%	3,190	100+%
Results						
2.3	Gross new jobs	5,000	1,192	24%	1,607	32%
2.3	Gross new indirect jobs	-	1,657	-	994	-
2.3	Gross new jobs in high-tech sectors	3,000	2,692	90%	1,653	55%
2.2	Gross jobs safeguarded	2,570	7,999	100+%	2,666	100+%
2.3	Gross new jobs safeguarded	7,230	9,034	100+%	10,891	100+%
2.4	Gross jobs safeguarded through ESF support	600	753	100+%	98	16%
2.3	Gross new companies in high-tech sectors	2,000	598	30%	399	20%

Source: Authors derived from WEF0 databases

In terms of the results, only the target related to the number of safeguarded jobs has been successfully achieved. In terms of priority 2.3, the target of 5,000 gross new jobs by the end of the programme looks unlikely to be reached, with only 24 per cent of the target (or 1192 new jobs) have been created. For priority 2.4, only 98 jobs out of a target of 600 have been safeguarded through ESF support up to January 31st 2008. With all programmes to be completed by September 30th 2008, it is unlikely that the target will be reached.

With regard to gross new companies in high-technology sectors, a target of 2,000 was established for the programme, although only 399 (or 20 per cent of the programme target) have been created to date. Given the comment from Huggins et al. (2008) that Wales should prioritise knowledge-driven entrepreneurship, the efforts to date have been unsuccessful and there needs to be a re-examination of whether the programmes being developed are appropriate.

Therefore, the programme has failed to achieve some its key targets in raising the innovation potential of West Wales and the Valleys. Certainly, it can be argued that some of the capital projects, such as the Technium programmes, are long term investments that will help develop a stronger innovation infrastructure linking

university and industry. That may well be the case, but given that a key focus of the structural funds programme is the creation of higher quality jobs within the poorest areas of Wales, the failure to achieve the jobs target should concern policymakers.

In addition, the failure of the programme in reaching its human capital targets is extremely worrying. Whether this is a result of inadequate learning initiatives is uncertain but any regional innovation system cannot operate effectively without the necessary quality in the people who are developing innovation within the public and private sectors. This issue was recognised in the Mid Term Review of the programme (CRG Research, 2003) which stated that priority 2, measure 4 appears to have been used to fund generic high-level training which has little formal link to the research and development base. According to the report, the very low numbers of managers and employees who actually received training in innovation suggests that funding was not used to provide training which is supportive of the intention of the measure. In addition to concerns over training, the review also highlighted concerns over a number of the outputs for both measures 3 and 4, especially in terms of employment creation and the number of gross new high technology companies. Surprisingly, no action was taken to address this, as evidenced by the final output data in Table 3. Increasing the capacity of businesses to develop their own capability in managing innovation successfully is a major element of successful regional economies. The focus on achieving business support targets rather than improving the quantity and quality of innovation employment could affect the capacity of West Wales and the Valleys to successfully improve its innovation potential during the future.

5. Conclusions

This paper has examined the development of innovation within Wales through the utilisation of European Structural Funding within West Wales and the Valleys. The findings suggest that there is no real evidence of a step-change in innovation capacity and performance within Wales. Whilst £283.7 million of innovation support projects have been supported, the key programme targets in terms of new jobs, upskilling and new businesses were not achieved. This reflects the failure to address the disconnectivity between public sector funding and private sector interests. It may also be the result of over-governance of the regional innovation system, although further research is required to examine this.

For policymakers, one of the key lessons to be learnt from the development of innovation potential within the previous Objective 1 programme is that there needs to be far greater engagement with the private sector in any future innovation strategy for the new convergence funds that will run from 2007-2013. Whilst important, creating a greater knowledge-base within universities will not, in itself, enable the Objective 1 areas of Wales to take a jump in innovation performance and there will be an urgent need for the new programme of European funding to engage far more with business to improve its R&D performance and the overall innovation potential within Wales.

Part of this may approach may require the creation of better incentives to encourage industry to invest in the research base in Wales to stimulate higher education institutions to respond to the needs of the industrial and service sectors in the interest of wealth creation and employment in Wales. However, Huggins et al (2008) have argued that the apparent demand from the business community to interact and make

use of the knowledge-based services of the higher education sector is weak. Therefore, there must be a greater effort in ensuring that programmes focus on building both research capacity in both the academic and private sectors whilst enabling better relationships between the two sectors.

The economic development strategy document “A Winning Wales (Welsh Assembly Government, 2005) confirms that it is necessary to “encourage and finance more high calibre research and development with commercial potential and work to increase existing collaboration between universities and colleges and companies in Wales”. To achieve this, there must be a different approach to supporting innovation and not just repeating the same policy initiatives which have largely failed to attain the targets within the previous Structural funding programme. In particular, the various projects need to work more closely together as part of an innovation system and not operate in isolation or, even worse, in competition, if Wales is to improve its innovation performance over time.

References.

Autio, E. (1998) ‘Evaluation of R&TD in regional systems of innovation’, *European Planning Studies*, vol. 6 (2) pp. 131-140.

Benneworth, P. (2006) ‘Seven samurai opening up the ivory tower? The construction of Newcastle as an entrepreneurial university’, *European Planning Studies*, vol. 15, no. 4, pp. 487 – 509.

Benneworth, P. and David, C. (2005) ‘University spin-off policies and economic development in less successful regions: learning from two decades of policy practice’, *European Planning Studies*, vol. 13, no. 4, pp. 537 – 557.

Boland, P. (2004) Wales and objective 1 status: learning the lessons or emulating the errors? *European Planning Studies*, vol. 12, No 2, pp. 249 - 270

Boschma, R. (2004) ‘Competitiveness of regions from an evolutionary perspective’, *Regional Studies*, vol. 38, no. 9, pp. 1001 – 1014.

Bristow, G. and Blewitt, N. (2001) "The Structural Funds and additionality in Wales: devolution and multilevel governance" *Environment and Planning A*, Vol. 33(6) pp.1083 -1099.

Cooke, P. (1998) ‘Global clustering and regional innovation: Systemic innovation in Wales’, in Braczyk, H-J., Cooke, P. and Heidenreich, M. (eds) *Regional Innovation Systems*, Routledge: London (pp. 245 – 262).

Cooke, P. (2001), Regional Innovation Systems, Clusters, and the Knowledge Economy, *Industrial and Corporate Change*, vol. 10, no 4, pp. 945-974

Cooke, P. (2003) ‘The regional innovation system in Wales: evolution or eclipse?’ in Cooke, P., Heidenreich, M. and Braczyk, H. (eds) *Regional Innovation Systems*. London: Routledge (second edition).

Cooke, P., Boekholt, P. and Todtling, F. (2000) *The Governance of Innovation in Europe*, Pinter: London.

CRG Research Ltd (2003) Mid-term evaluation of the objective 1 programme for West Wales and the valleys - final report, June 2003

Doloreux, D. and Parto, S. (2005) 'Regional innovation systems: Current discourse and unresolved issues', *Technology in Society*, vol. 27, issue 2, pp. 133 – 153.

Edquist, C. (2005) 'Systems of innovation – perspectives and challenges' in Fagerberg, J., Mowery, D. and Nelson, R. (eds) *The Oxford Handbook of Innovation*, Oxford University Press, Oxford; pp. 181-208.

Goodwin, M., Jones, M. and Jones, R. (2005) 'Devolution, constitutional change and economic development: Explaining and understanding the new institutional geographies of the British state', *Regional Studies*, vol 39, no 4, pp. 421-436.

Gunasekara, C. (2006) 'Universities and associative regional governance: Australian evidence in non-core metropolitan regions', *Regional Studies*, vol. 40, no. 7, pp. 727 – 741.

HEFCW (2005) *Recurrent Grant 2005/06- W05/12HE*, HEFCW, Cardiff

HESA (2007) *Higher Education – business and community interaction survey 2006*, HESA, London

HESA (2006) *Higher Education – business and community interaction survey 2005*, HESA, London

HESA (2005) *Higher Education – business and community interaction survey 2004*, HESA, London

Hospers, G.J. (2006) 'Silicon Somewhere? Assessing the usefulness of best practices in regional policy', *Policy Studies*, 27 (1), pp. 1 – 15.

Howells, J. (1999) 'Regional systems of innovation?' in Archibugi, D., Howells, J., and Michie, J. (eds) *Innovation Policy in a Global Economy*, Cambridge: Cambridge University Press.

Howells, J. (2005) 'Innovation and regional economic development: a matter of perspective?', *Research Policy*, vol. 34, pp. 1220 – 1234.

Huggins, R., Jones, M. and Upton, S. (2008) 'Universities as drivers of knowledge-based regional development: a triple-helix analysis of Wales', *International Journal of Innovation and Regional Development*, vol.1, no. 1, pp. 24 – 47.

Jones-Evans, D. (2002) *Research and Development in Wales*, Paper to the National Assembly for Wales's Economic Development Committee EDC 17-02.

Klofsten M. and Jones-Evans D.(2000) Comparing Academic Entrepreneurship in Europe –The Case of Sweden and Ireland, *Small Business Economics*, vol 14, no 4, pp. 299-309

Lambooy, J. and Boschmas, R. (2001) ‘Evolutionary economics and regional policy’, *Annals of Regional Science*, vol. 35, no. 1, pp. 113 – 133.

Lambooy, J.G. (2005) ‘Innovation and knowledge: theory and regional policy’, *European Planning Studies*, vol. 13, no. 8, pp. 1137 – 1152.

Leydesdorff, L. (2000) ‘The triple-helix: an evolutionary model of innovation’, *Research Policy*, vol. 29 (2), pp. 243 – 255.

Löfsten, H. and Lindelöf, P. (2002) Science Parks and the growth of new technology-based firms—academic-industry links, innovation and markets, *Research Policy*, vol. 31, no 6, pp. 859-876.

McGregor, P. and Swales, K. (2005) Economics of devolution/decentralization in the UK: some questions and answers, *Regional Studies* vol. 39, no 4. Pp.477–494

Michie, J. and Oughton, C. (2001) ‘Regional innovation strategies: Integrating regional, industrial and innovation policy’, *New Economy*, vol. 8, no. 3, pp. 164 – 169.

Morgan, K. (2004a) ‘The exaggerated death of geography: learning, proximity and territorial innovation systems’, *Journal of Economic Geography*, vol. 4, pp. 3 – 21.

Morgan, K. (2004b) ‘Sustainable regions: governance, innovation and scale’, *European Planning Studies*, vol. 12, no. 6, pp. 871 – 889.

National Statistics (2007) *UK Business Enterprise Research and Development 2006*, National statistics, London

Oughton, C., Landabaso, M. and Morgan, K. (2002) ‘The regional innovation paradox: Innovation policy and industrial policy’, *Journal of Technology Transfer*, vol, 29, pp. 97-110.

Shutt, J., Colwell, A. and Koutsoukos, S. (2002) Structural Funds and Their Impact: Signed and Sealed, But Can We Deliver? *European Planning Studies*, vol. 10, no 1, pp 113 - 130

The National Assembly for Wales (2001) *Policy Review of HE, Education and Lifelong Learning Committee*, National Assembly for Wales, March 2002

Todtling, F. and Trippel, M. (2005) ‘One size fits all? Towards a differentiated regional innovation policy approach’, *Research Policy*, vol. 34, no. 8, pp. 1203-1219.

Welsh Assembly Government (2005) *Wales: A Vibrant Economy - The Welsh Assembly Government’s Strategic Framework for Economic Development*, November 2005.

Welsh Assembly Government (2000) *Objective 1 Single Programme Document for West Wales and the Valleys* WEFO, Cardiff.

Welsh Assembly Government (2002) *Reaching Higher. Higher Education and the Learning Country – a strategy for the higher education sector in Wales*, National Assembly for Wales, March 2002