Impact of Research and Innovation Networks on Regional Competitiveness: The Role of HEIs

1. Background

Unquestionably the role of the university has changed over the past twenty five years. Government funding of universities has shifted from an emphasis of capitalising knowledge assets, towards a greater focus on building ties between the Higher Education Institution (HEI) sector and the rest of the economy, particularly the business sector (CEC 2003; DfES 2003a). Such moves have been associated with the development of the notion of ‘third mission’ activities by higher education and the professionalization of the technology transfer operations of universities associated with the expansion of Technology Transfer Offices (TTOs; formerly Industrial Liaison Offices (ILOs)). Thus, the recent White Paper, The Future of Higher Education (DfES 2003b) points out that in the knowledge-based economy the UK economic competitiveness and improvements in quality of life depend on the effectiveness of knowledge sharing between business and higher education, whilst Innovation Nation (DIUS 2008, 46) report notes “…universities are now increasingly making economic impact a core part of their mission, and accordingly providing incentives.”

Recognition of the widening role of universities in innovative activities is also now well established in the academic literature (Lundvall 1992; Nelson 1993; Etzkowitz and Leydesdorff 1997; Goddard and Chatterton 1999; Morgan 1997). Terms such as the ‘engaged university’ (Holland 2001), the ‘entrepreneurial’ university (Etzkowitz 1983; Clark 1998) or the ‘connected university’ (Kitson et al. 2009) have been used to reflect this more active role of universities in promoting direct and active transfer and engagement of academic research. However, recent policy objectives (such as those reflected in the Lambert Review) still fail to fully acknowledge the diversity and complexity of university activities and thus not fully understand their different roles and degree of engagement in regional development. Both policymakers and researchers should be careful not to treat universities as homogeneous entities and not to underestimate the risk of conflicting incentives and expectations among the main stakeholders (Howells and Nedeva 2003). Determining the particular mixes of institutions, activities and disciplines that would best contribute to the economic development of different regions emerges as a key policy challenge in the face of relatively scarce empirical evidence. Further research is needed to better understand these issues, their alignment or ‘embeddedness’ with the other core missions of universities (Nedeva and Boden 2006; see also Hatakenaka 2005), and to better measure their impacts.

The contribution of universities to regional economic development has been studied in relation to a number of, partly interrelated, dimensions such as: direct economic contribution as employers and buyers of products and services (Harris 1997; Keane and Allison 1999; Macfarland 2001; Armstrong 1993; Robson et al. 1995), their contribution to upgrading the human capital stock by attracting, developing and retaining of graduates in the region (Asteriou and Agiomirgianakis 2001; Petrakis and Stamatakis 2002). However, until recently, less attention has been given to the impacts of universities and other HEIs on research, innovation and technology transfer, even though their significance had long been recognised (Rosenberg and Nelson 1993). It is now

1 As revealed by, for example, the Lambert Review (2003) as well as recent strengthening of third mission activities (HEROBC/HEIF) programmes and a number of related initiatives and schemes operating at the national level (CASE, Knowledge Transfer Partnerships, Smart, Faraday Partnerships, etc.)
acknowledged that as knowledge producers, universities contribute to increasing regional competitiveness and attractiveness through a range of activities, including research collaboration, technology transfer and licensing. Beside the contribution of universities to broader regional regeneration agendas, such as cultural development and creativity (Florida 2002), a key issue has become the creation, circulation and utilisation of knowledge as a result of the interplay between universities and businesses and the optimal policy tools to foster virtuous development cycles (Mowery and Sampat 2005). With some notable exceptions (Kitson et al. 2009) the debate has still largely been informed by the US experience (Geiger 1993; 2004; Hatakenaka 2004) especially in the context of the ‘Ivy League’ Universities and the national and regional effects of the introduction of the Bayh-Dole Act which encourage universities to take a more active role in extracting revenues from the new knowledge they nurtured.

2. Objectives

HEIs perform many functions within socio-economic systems. At their core, they are platforms for the development of a wide-range of competences and capabilities through education and training. With respect to direct spending and employment they have become key economic actors in the UK (Universities UK, 2006). In relation to their contribution to economic growth and development, they generate invaluable new basic and applied knowledge. Furthermore, and increasingly, they act as facilitators for knowledge transfers at the regional, national and international levels (Charles and Howells 1992; Howells 1986). In the UK context, recent surveys have started to track industry-academic links in greater detail (see, for example, Howells et. al. 1998; Charles and Conway 2001; Lambert Review 2003; HEFCE 2006; Cosh et al. 2006). However, given the prominent national focus of the surveys, the impact of universities on firm performance and competitiveness within regions remains largely uncharted. This project has therefore sought to identify the various avenues through which universities interact with local firms, businesses and other specialist intermediaries in relation to research and innovative activity and how this, in turn, influences firm performance and the overall competitiveness of a local economy and region.

The aim of the research is therefore to develop a deeper empirically based understanding of the impacts of universities and other HEIs2 on the innovativeness and competitiveness of regional economies. The research was based on gathering new data and metrics on university-industry links, as it relates to knowledge, research and innovation, across three ‘regions’: Wales, the North West and the East of England.

The research has three research elements. Firstly there is a demand-led, user survey of firms’ industry-academic collaboration and innovation. The second perspective takes universities as the unit of analysis and explores how HEIs manage and organise business interactions. Lastly, the project then takes a regional perspective and explores how firms interact within the surrounding industrial environment to uncover the character of regional innovation network relationships, the dynamics of their emergence, the effectiveness of the mediating role of regional institutions and barriers to regional innovation performance.

The research has therefore three main academic and conceptual ambitions to investigate:

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2 Note the words universities and HEIs are used largely in an interchangeable way in the text; however the study in its secondary analysis (such as HEBCIS) does include some specialist HEI colleges, such as the Institute of Education in London, which are not fully formed universities in legal terms.
1) in detail the nature of firm interaction with universities and other higher education institutions. This has a number of elements within which the project has sought to unpick in greater detail and analysis:
   i) modes of interaction;
   ii) links and (intermediate) effects in terms of innovative performance and productivity; and,
   iii) economic impacts in terms of growth and profitability.

2) the changing structure, operation and management of universities, focusing on its third mission activities, in particular:
   i) changing strategies and structures of university administration dealing with third mission activities;
   ii) new organisational forms and practices associated with industry interaction; and,
   iii) more general data on the TTO operations and company engagement.

3) the university-interactions at a regional level, using data from firm, demand level analysis and supply-led analysis of university operations and strategy, including:
   i) general variations in the level and nature of firm links with universities and other knowledge providers within the three regional settings;
   ii) more specific regional differences in university-firm interactions; and,
   iii) evaluation of differences in the effect and impact of such interactions

From the above the set of analyses, the research is also seeking to develop a set of implications and policy insights on industry-academic links on regional growth and performance

3. Methods

3.1 Structure
As noted in Section 2, the project employed a three pronged approach to the analysis which targeted different units of analysis involving: 1) a demand-led, user survey of firms; 2) a university level, supply-driven analysis; and, 3) a region-wide perspective investigating the interaction between the firms, universities and the wider regional economy.

3.2 Timing
All interviews took place between April and December 2008. The pilot of the postal survey occurred during June to August 2008 and the full survey (2 rounds) took place between June 2008 and February 2009. This was delayed due to major institutional reorganisation at the time; but the survey period was also longer due to the recession adversely affecting response rates.

3.3 Sampling and Responses
   a) Selection of Universities:
Eighteen universities across the three regions were selected for the interview process. The selection was determined by a clustering analysis of the population of universities using HEBCI Survey and HESA data. For each region, 6 universities were selected such that the sample included at least a minimum of three different types based on the 7
clusters that emerged. (Table 4.4). Table 3.1 shows the number of universities by region and the distribution by the cluster classification.

<table>
<thead>
<tr>
<th>Region/Class</th>
<th>No. Univer</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
<th>Type 5</th>
<th>Type 6</th>
<th>Type 7</th>
<th>UC**</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW</td>
<td>14</td>
<td>0</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Wales</td>
<td>12</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

* includes Open University
** Unclassified under the cluster procedure due to missing data

b) Selection of Firms:
   i) The number of firms in each region was determined by using UK Businesses: Activity, Size and Location (ONS 2008). In each region, one percent of firms by economic activity contributed to the sample. This resulted in a selection of around 2,400 firms each from North West and East of England and 1,200 firms from Wales.
   ii) Based on the distribution derived above, for each region, a random sample of firms stratified by economic activity and size was drawn using the FAME database.
   iii) Table 3.2 shows the distribution of valid returns by region and the relative response rates.

<table>
<thead>
<tr>
<th>Region</th>
<th>North West</th>
<th>East of England</th>
<th>Wales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sampled</td>
<td>2437</td>
<td>2381</td>
<td>1182</td>
</tr>
<tr>
<td>Less Post Office Returns</td>
<td>49</td>
<td>59</td>
<td>32</td>
</tr>
<tr>
<td>True Sample (1)</td>
<td>2388</td>
<td>2322</td>
<td>1150</td>
</tr>
<tr>
<td>Valid + ceased trading (2)*</td>
<td>162</td>
<td>199</td>
<td>89</td>
</tr>
<tr>
<td>(2) / (1) **</td>
<td>7%</td>
<td>9%</td>
<td>8%</td>
</tr>
</tbody>
</table>

*Ceased Trading (or dormant): The questionnaire has been returned with an accompanying note indicating that the firm is no longer operational.
**The overall response rate is 8%.

3.4 Analysis
a) Qualitative Methods:
Qualitative information was obtained by conducting 43 interviews across the eighteen selected universities. Three tiers of interviews were scheduled: high level or strategic, operational management and data; although for some smaller universities one or more of these levels were collapsed over.

b) Quantitative Methods
Several quantitative methods were used to inform the analysis, namely:

a) Cluster analysis was used to explore the underlying structure of the population of universities. Data for 13 variables from HEBCI Survey and HESA related to the broad categories of: size, teaching and research characteristics of institution, third stream activities and social inclusion and accessibility were used in a K-means clustering process (Stata). The Caliński index (Caliński and Harabasz 1974) was used to determine the most efficient cluster size. This calculates the ratio of total variation between clusters versus total variation within clusters. The highest Caliński score (pseudo-F score 32.67) gave only 3 clusters and was not considered to be sufficiently disaggregated for more sophisticated analysis.
Instead the next highest score of 25.36 provided 7 clusters. Table 4.3 shows the
typology of the selected universities.

b) For the most part, questions were structured to provide binary/multiple choices
information. Such categorical information determined the range of statistical
techniques and econometric methods that could be used to analyse the data. This
format enabled us to employ a range of statistical methods to facilitate univariate
and multivariate analysis including chi-squared tests, graphical techniques
(riskplot analysis), log-linear methods and multivariate analysis.

4. Results

4.1 Introduction
The quantitative research has produced a number of initial research results around three
sets of areas:
- the firm;
- the university; and,
- the region.

Each of these will now be briefly considered in turn.

4.2 HEI Collaboration, Performance and Innovation: A Firm Perspective

On the basis of analysing 371 firms from the postal/web based questionnaire, a number
of important observations can be made about the nature of industry collaboration with
universities and other collaborative partners. These are:

1. Universities as Information Sources and Partners: The study confirms that universities
remain poor status providers as sources for information on innovation and as
collaborative partners in the innovation process, confirming earlier studies using
CBR/IPC (Cosh and Hughes, forthcoming) and CIS data (see, for example, Freel et al.
2009). Thus universities were ranked 11th out of 12 as information sources on
innovation.

2. University Collaboration on Firm Innovativeness: Collaborations by firms with universities
and other higher education institutions were found to have a positive and significant
effect on innovation for all regions together (Table 4.1). Thus, using separate logistic
regression models, the odds of a firm being innovative for product and process
innovations were increased by six and five times, respectively, if they were collaborating
with a university, the second (product) and highest (process) effects of all types of
collaborators. The effect on organisational innovation was less, but still significant with
an odds ratio of 2.8.

As such, although universities may not be the initial favoured collaborators in numerical
terms for firms; when collaboration does occur with a university it has a significant and
appreciable influence on innovative performance.
Table 4.1 Impact of Collaboration on Innovation

<table>
<thead>
<tr>
<th>Impact of Collaboration on Innovation (Logistic Regression Analysis) *</th>
<th>Prod/Svs</th>
<th>Proc</th>
<th>Org. mthd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public R&amp;D institutions</td>
<td>8.6</td>
<td>4.2</td>
<td>4.6</td>
</tr>
<tr>
<td>Universities/HEIs</td>
<td>6.0</td>
<td>5.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Suppliers</td>
<td>3.6</td>
<td>3.2</td>
<td>4.6</td>
</tr>
<tr>
<td>Customers</td>
<td>4.4</td>
<td>3.1</td>
<td>3.3</td>
</tr>
<tr>
<td>Partner companies</td>
<td>3.9</td>
<td>4.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Competitors</td>
<td>2.9</td>
<td></td>
<td>3.0</td>
</tr>
</tbody>
</table>

*: results presented as odds ratios
Note: all results shown are significant at 5%
Note: missing cell = insignificant odds ratio

3. University Collaboration on Firm Performance: In the survey data, firm performance (employment and turnover) was not sufficiently differentiated between two time periods (2002 and 2007) to facilitate an analysis that yielded significant results. Thus we are unable to observe statistically valid effects of the relationship between university collaboration and firm performance. However, the survey also asked more specific questions about the effects and impacts of collaborating with firms and these are outlined in Figure 4.1.

Figure 4.1 Impact of Collaboration on Innovation

Distribution of Impacts for Firms with University Collaboration

Rather surprisingly, given its lack of significant association at the innovation level, the most numerically important benefit of working with universities is in the development of new methods, skills and techniques. However, there are also important impacts arising from such collaboration and this is notably improved profitability and market share. Universities relationships also acted as wider conduits for firms to networking relations and in terms of enhanced productivity, but these associations varied quite considerably depending on regional location (see below).

4. Regional Differences on University Collaboration and Types of Innovation: Bivariate analysis showed no significant regional differences on collaboration and innovation. Although the percentage of process innovation for East of England was lower than the other regions. The significance of this was examined in a loglinear model between process innovation, region and university collaboration with interaction effects between region and innovation (Table 4.2).
Table 4.2 Loglinear Regression Results on Collaboration and Innovation

| Coef. | Std. Err. | z   | P>|z| [95% Conf. Interval] |
|-------|-----------|-----|---------------------|
| EoE   | 0.2       | 0.149 | 1.26 | 0.207 | -0.1 | 0.5 |
| Wales | -0.6      | 0.186 | -3.23 | 0.001 | -1.0 | -0.2 |
| Uni collab | -3.0   | 0.512 | -5.90 | 0.000 | -4.0 | -2.0 |
| Process Inno | -0.7  | 0.191 | -3.62 | 0.000 | -1.1 | -0.3 |
| EoEXUC | 0.4       | 0.644 | 0.58 | 0.565 | -0.9 | 1.6 |
| WalesXUC | 0.6     | 0.731 | 0.82 | 0.412 | -0.8 | 2.0 |
| EoEXProc.Inno | -1.1  | 0.325 | -3.29 | 0.001 | -1.7 | -0.4 |
| WalesXProc.Inno | -0.2  | 0.334 | -0.51 | 0.613 | -0.8 | 0.5 |
| UCXProc.Inno | 1.5      | 0.631 | 2.39 | 0.017 | 0.3 | 2.7 |
| EoEXUCXProc.Inno | 0.8   | 0.832 | 0.96 | 0.338 | -0.8 | 2.4 |
| WalesXUCXProc.Inno | -0.4  | 0.960 | -0.44 | 0.663 | -2.3 | 1.5 |
| Constant | 4.4      | 0.110 | 39.90 | 0.000 | 4.2 | 4.6 |

The results showed that compared with the North West, Wales was less likely to have process innovation – a statistically significant result, whereas the difference between the North West and the East of England (in terms of firm numbers) is not significant. Figure 4.2 shows the riskplot of the log of frequencies by process innovation, university collaborations and region.

Figure 4.2 Riskplot: Process Innovation, University Collaborations and Regions

Logistic regression was used to analyse a more detailed model in which the probability of innovation was regressed on university collaboration, region and firm characteristics including age, sector, size and various interaction effects (Table 4.3).
Table 4.3 Logistic Regression Results on Collaboration and Innovation

| Inno          | Odds Ratio | Robust S.E. | z     | P>|z| [95% Conf. Interval] |
|---------------|------------|-------------|-------|----------------------|
| Process       | 0.90       | 0.164       | -0.60 | 0.549                | 0.626 | 1.283 |
| Org. method   | 0.90       | 0.164       | -0.60 | 0.549                | 0.626 | 1.283 |
| EcE           | 1.02       | 0.281       | 0.06  | 0.954                | 0.591 | 1.748 |
| Wales         | 1.19       | 0.368       | 0.56  | 0.578                | 0.647 | 2.181 |
| Uni collab    | 4.30       | 1.105       | 5.66  | 0.000                | 2.594 | 7.112 |
| Formal        | 4.33       | 1.420       | 4.47  | 0.000                | 2.279 | 8.239 |
| Informal      | 4.36       | 1.390       | 4.61  | 0.000                | 2.331 | 8.143 |
| Size (In emp) | 1.37       | 0.104       | 4.17  | 0.000                | 1.182 | 1.590 |
| Age (young<=5)| 1.17       | 0.295       | 0.62  | 0.535                | 0.713 | 1.917 |
| Sector - S    | 0.72       | 0.165       | -1.43 | 0.153                | 0.461 | 1.129 |
| ProcXEoE      | 0.46       | 0.132       | -2.70 | 0.007                | 0.263 | 0.810 |
| ProcXWales    | 0.66       | 0.190       | -1.43 | 0.152                | 0.378 | 1.163 |
| OrgXEoE       | 0.69       | 0.191       | -1.33 | 0.185                | 0.405 | 1.190 |
| OrgXWales     | 0.92       | 0.243       | -0.30 | 0.764                | 0.552 | 1.548 |

Table 4.3 shows there are no significant differences either by types of innovation or by region. Firms with university collaboration are four times more likely to innovate compared to those without. A separate analysis (results are in italics) that distinguishes between formal and informal (such as conferences, meetings and workshops) university collaborations show that both are significant in terms of influencing innovation outcomes, with the latter appearing to be equally important to the former. Size is also significant with the odds ratio suggesting that the larger the firm the more likely it is to innovate. In addition, no statistical significant differences were found between younger (firms aged 5 and less) and older firms or between firms in the service sector or manufacturing. Finally, the results show the interaction between East of England and process innovation is significant but the odds ratio (OR=0.46) implies the probability of innovation is reduced.

4.3 HEI Collaboration, Performance and Innovation: A University Perspective

On the basis of the analysis, some 18 universities were selected across the three regions for in-depth case study survey work and this was supplemented and supported by secondary data analysis of the HEBCI Survey and HESA databases. A number of important observations can be made about the nature of collaboration by universities with firms and other collaborative partners, their strategies towards industry and third mission activities and how they organise and structure themselves. These are:

1. **Universities as Differentiated Actors**: As noted in Section 2, recent policy objectives concerning university interaction have generally failed to fully acknowledge the diversity of universities and the variation and complexity in their university structures and activities. As part of this process the team undertook a cluster analysis and this identified seven distinct university cluster categories (Howells et al. 2008; see Table 4.4 for allocation of the survey universities to these groups; see also Table 3.1):

   Cluster 1 - Research Peculiars: generally large, international, and highly research-intensive HEIs with high knowledge exploitation and enterprise orientation in...
terms of IP and consultancy income generation, but exhibiting generally low
growth (apart from teaching growth).

Cluster 2 - Local Access: These generally small HEIs exhibit high levels of access in
terms of ratio of students from low participation neighbourhoods and high state
school participation, low overall growth in terms of university and college funds,
but high research growth, although from a low base.

Cluster 3 – Research Majors: These are universities, which are large, internationally
oriented and research intensive universities. Although this group of universities
exhibited the fastest income growth rate of the seven clusters, their research
growth is below average.

Cluster 4 - London Metropolitan Specialists: This group of institutions based in and
around London recorded the highest research income growth rate (although they
are generally less oriented towards knowledge exploitation and enterprise
orientation).

Cluster 5 - Third Mission Biased, High Teaching Growth: These institutions exhibit the
highest rate of student growth rate between 2002/3-2005/6, average overall
growth and below average size, slightly above average research income, but low
research growth.

Cluster 6 - Research Oriented, Teaching Growth: These are generally large, research
intensive institutions, enterprise focused, with above average high student
growth, but below average research growth.

Cluster 7 - Open: This ‘cluster’ is represented by one single institution, the Open
University, a unique very large, high access, domestic focused university (for this
reason has no close associate in terms of institutional profile).

2. Universities Devising New Structures for Interaction: Universities in the UK face increasing
pressure for increased efficiency and change, often necessitating radical changes in
structure and operation, such as Gibbons’ et al. (2004) ‘hollowed out’ core-periphery
university model. Others, however, have suggested that despite all the talk the pace of
change has been considerably slower than current higher education and science policy
debate suggests (Krucken 2003, 333); whilst much university-industry interaction remains
informal and uncharted (Kitson et al. 2009). Certainly universities continue to
experiment more generally in both structure and operation (for example, in terms of the
internal trading of research and teaching; Coaldrake 2001, 11), but equally universities
tend to remain highly conservative institutions. None of the universities surveyed in the
three regions displayed radical departures from form or activity, although many had
undergone more general change through merger (Manchester) or change of status or
both. All the universities have undergone substantial growth and this has been
accommodated by having more formalised structures, often in terms of more
hierarchical, control-oriented structures (see also De Boer et al. 2007, 39-40).
Table 4.4  Cluster Analysis Results for the Three Regions

<table>
<thead>
<tr>
<th>Universities</th>
<th>Typology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranfield University</td>
<td>4</td>
<td>London Metropolitan Specialist</td>
</tr>
<tr>
<td>Open University</td>
<td>7</td>
<td>Open</td>
</tr>
<tr>
<td>University of Cambridge</td>
<td>3</td>
<td>Research Majors</td>
</tr>
<tr>
<td>University of East Anglia</td>
<td>5</td>
<td>Third Mission Biased, High Teaching Growth</td>
</tr>
<tr>
<td>University of Hertfordshire</td>
<td>2</td>
<td>Local Access</td>
</tr>
<tr>
<td>Writtle College</td>
<td>2</td>
<td>Local Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>North West</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lancaster University</td>
<td>5</td>
<td>Third Mission Biased, High Teaching Growth</td>
</tr>
<tr>
<td>Manchester Metropolitan University</td>
<td>2</td>
<td>Local Access</td>
</tr>
<tr>
<td>University of Bolton</td>
<td>2</td>
<td>Local Access</td>
</tr>
<tr>
<td>University of Liverpool</td>
<td>3</td>
<td>Research Majors</td>
</tr>
<tr>
<td>University of Manchester</td>
<td>3</td>
<td>Research Majors</td>
</tr>
<tr>
<td>University of Salford</td>
<td>2</td>
<td>Local Access</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wales</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiff University</td>
<td>3</td>
<td>Research Majors</td>
</tr>
<tr>
<td>University of Glamorgan</td>
<td>2</td>
<td>Local Access</td>
</tr>
<tr>
<td>University of Wales Institute, Cardiff</td>
<td>6</td>
<td>Research Oriented, Teaching Growth</td>
</tr>
<tr>
<td>University of Wales, Aberystwyth</td>
<td>5</td>
<td>Third Mission Biased, High Teaching Growth</td>
</tr>
<tr>
<td>University of Wales, Bangor</td>
<td>2</td>
<td>Local Access</td>
</tr>
<tr>
<td>University of Wales, Newport</td>
<td>2</td>
<td>Local Access</td>
</tr>
</tbody>
</table>

nc= not classified due to missing values

Most universities had a core knowledge exchange, industry and enterprise support service (equivalent but not always to Technology Transfer Offices; TTOs) to provide support for all types of enterprising activity across the university. Such central ‘hubs’ then have faculty ‘spokes’ from which the activities of the university are then more effectively operated with the ‘hub and spoke’ model ending up being quite hierarchical even within medium sized universities, such as Salford or Swansea. For smaller universities and higher education colleges, such as Bolton or Writtle College, they have much smaller, more fragmented operations with a central hub and spokes (or rather fragments – ‘gems’) located within specific departments or research centres. However, there does seem to be an emerging counter-balancing trend towards lead ‘centres of excellence’ which allows these centres more autonomy and freedom to operate but also potentially more resources as well. This may be seen as part of a wider process of decentralisation and giving more autonomy to schools and department.

3. **Universities Devising New Modes of Interaction:** There appear to be a number of new types of relationship building with businesses. This includes:

1. **Single Client Relationship Management** - Manchester has been perhaps, par exemplar, the lead university in developing such types of new relationship. For each firm it sets up a single client relations management team comprising: high level academic(s); high level business contact within firm; a steering group; and administrative and entrepreneurial support (it also has sector specific dedicated a Business Relations Teams)
2. Centres of Excellence Lead Relationship - This is more of an informal, emergent relationship mechanism developed by a number of universities, especially smaller and newer ones. Here the principle is to effectively support a limited number of centres of excellence in both research and knowledge exchange. This is something that Lancaster, Salford and the University of East Anglia are seeking to develop. With Salford this is around what has been called ‘pinnacles of excellence’ which act in terms of research centres of excellence and for 3rd mission outreach, which bring things together in an integrated way.

3. The Innovation ‘Factory’, ‘Lab’ or ‘Space’ – Developments are emerging right across Europe in relation to this model, however a good example is that of the University of Bolton’s Innovation Factory, which is a facility where industry can come in and use equipment and gain access to staff. It also runs innovation courses and seminars in there and it has facilities that companies use, we have academic staff that use the facilities in conjunction with companies on design work and then we have students who work on commissions from companies like design projects.

4. Regional Consortia - On university to university collaboration in terms of industry links, these have been fairly recent. Thus in the case of the East of England, the East of England Development Agency (EEDA) runs i10 as a doorway and entry point to universities in the region. More recent examples in the North West, however, include the Manufacturing Innovation and Design (MID) Partnership and IDEAS3.

4.4 HEI Collaboration, Performance and Innovation: A Regional Perspective

The focus so far has either been on the firm or the university, but viewing these interactions within a regional context is also important. The region represents an important ‘task environment’ from which both firms and universities operate and can constraint, or help stimulate, growth within these organisations. Equally, from a systems of innovation perspective, regions and nations (in the case of Wales) form their own regional and national systems of innovation with different institutional structures, agencies and regulations but also different economic, competitive and sectoral profiles. Most notably, Wales has its own national assembly and its own higher education funding body, HEFCW, which is separate from HEFCE and in the way it manages and operates the higher education sector in the principality.

1. Regions as Arenas for Interaction: Knowledge Rich, Knowledge Poor? One of the most basic, but important observations at the regional level was the variation in knowledge and networking richness that the three regions exhibited. At one end, was the East of England, which exhibited high(er) levels of university-firm interaction together with public research establishment links and indeed all forms of interaction between firms and other forms of partner. At the other end, Welsh firms had much lower levels of knowledge interaction4, with the North West somewhere in-between these levels. Nonetheless there were some notable exceptions, with Welsh firms actually recording

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3 http://www.ideasdaresbury.co.uk/
4 There was also some indication of displacement activity by Welsh firms which seemed to make more compensatory use of external consultants than other types of knowledge collaborators (due to sparsity and access?) compared with East of England and North West firms.
higher levels of interactions with universities and much higher levels with public sector R&D than the North West region. On a more generalised level, whether it remains to refer to Wales being an ‘innovation poor’ system environment, the North West with intermediate status and the East of England an ‘innovation rich’ system remains open to question (however see 3 below).

2. Regions as Arenas for Interaction: Differences in Collaborative Form: Although generally there was little variation (and no statistically significant differences) between firms in the regions in terms of innovation (percentage of occurrences) and performance (percentage of occurrences), there was one notable exception here. The level of process innovation in East of England firms was statistically lower than for either Wales or the North West. How much this is a sectoral difference for the East of England compared with the UK norm, or the above average orientation of Wales and the North West in process industries is difficult to determine and is still subject to analysis by the study team.

3. Regions as Arenas for Interaction: The Stray Dog Syndrome? An important and interesting feature of the regional analysis was that Welsh firms seem to value university contacts and perceived impacts much more highly in terms of perceived profitability, productivity, environmental impacts, improved market share and improvements to business systems (‘stray dog syndrome’) compared with North West firms (in the middle in terms of appreciation) and East of England with the lowest levels of appreciation (Figure 4.1). This may represent some indication of marginal return effects on levels of interaction. Thus, when Welsh firms do use universities and other types of collaborative partner they seem to value them more even if their actual impact is much more marginal. By contrast, East of England firms appeared to be the most pro-active of the three regions in initiating the university contacts (Figure 4.3). A simple, but important policy conclusion from this is that policymakers should be careful in not linking simple quantitative measures of collaboration with the quality of such links in terms of effects and outcomes.

Figure 4.3 How was University Collaboration Initiated?
5. Activities
The IRIN research team have been involved in a range of activities associated with project. These can be grouped under three main headings:

1. Paper presentations: at conferences, workshops and seminars. These are outlined in Table 5.1; a total of eleven have so far been presented or planned with a six being organised over the next six month period.

2. Organising conference and workshop events: so far two have been planned with high level support from the Welsh Assembly, HEFCW, CIHE and NWDA amongst others. The project team also supporting a workshop with the UK Innovation Research Centre at Cambridge earlier in November (Table 5.2).

3. Advice: either to individual policymakers, agencies or firms (or groups of firms, such as EIRMA) on aspects of the research

6. Outputs
The researchers will upload their dataset at the ESDS depository by the end of the year. The Society Today return includes all our relevant outputs so far. The team have three papers so far submitted or accepted in refereed journal.

7. Impacts
There are three main kinds of impacts the research has so far produced.

1. Academic and Conceptual Impact:
Longer term the project will hopefully have an impact through the academic literature. Some of our working papers have already been cited and some interim work on the project also fed into the NESTA ‘Connected University’ project.

2. Policy Impact:
Involved in policy debate and strategy formulation with the following organisations:

   1. The ‘Connected University’ agenda and report
   2. Engagement with HEFCW and HEPCE
   3. Engagement with NWDA, Welsh Assembly and EEDA.
   4. North West Universities Association (NWUA), Northern Way and 4NW.

3. Utilisation of Ideas through Direct Engagement and Collaboration with Firms and Industry:
This can be seen in a number of ways:

   1. Research ideas and experiences of collaboration feedback through work with:
      - high tech SMEs in IDEAS at Daresbury and, shortly, Harwell; and
      - other firms in the three ‘regions’, such as Shell.
   2. Direct involvement with industry groups, such as EIRMA.
   3. Firm level interactions at Daresbury through IDEAS and specifically our ERDF funded work
   4. Manchester Innovation Fund and Manchester Science Park advice and projects

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Note: A request has been made to ESRC to directly circulate this End of Award Report to EIRMA members.
<table>
<thead>
<tr>
<th>Date:</th>
<th>Location:</th>
<th>Title of Conference/Workshop/Seminar</th>
<th>Title of Paper</th>
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<tr>
<td>10-11 October 2007</td>
<td>Glasgow</td>
<td>ESRC Impact of Higher Education Institutions on Regional Economies Workshop</td>
<td>Impact of Research and Innovation Networks on Regional Competitiveness: The Role of HEIs</td>
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<td>13 March 2008</td>
<td>Milton Keynes</td>
<td>Open University, IKD Seminar Series</td>
<td>Higher Education Institutions Impacts on Regional Systems of Innovation: A Review of the Evidence</td>
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<td>17 June 2008</td>
<td>Cardiff</td>
<td>Universities, Graduates and Innovation – the Regional Impact of Higher Education</td>
<td>Impact of Research and Innovation Networks on Regional Competitiveness: The Role of HEIs</td>
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<td>30 April 2009</td>
<td>London</td>
<td>The Connected University</td>
<td>The Connected University: Driving Recovery and Growth in the UK Economy</td>
</tr>
<tr>
<td>26 November 2008</td>
<td>Newcastle</td>
<td>KITE, Newcastle University, Seminar</td>
<td>The Universities as Actors within Innovation Systems: Their Changing Role and Management</td>
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<td>4-5 June 2009</td>
<td>Cambridge, UK-IRC</td>
<td>UK-IRC Workshop on University-Business Interactions</td>
<td>University-Industry Networks, Innovation and Knowledge Transfer: A Demand-Led Perspective</td>
</tr>
<tr>
<td>31 August –2 September 2009</td>
<td>Gothenburg, Sweden</td>
<td>Swedish Presidency of the European Union</td>
<td>The Role of Universities in Regional Growth. The Knowledge Triangle Shaping the Future of Europe.</td>
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<tr>
<td>16 September 2009</td>
<td>Manchester</td>
<td>Open Innovation: How Does It Work In Practice? EIRMA Workshop</td>
<td>Open Innovation and Knowledge Interaction: A University Perspective</td>
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<tr>
<td>4 November 2009</td>
<td>London</td>
<td>Making an Impact: Universities and the Regional Economy Conference</td>
<td>University-Industry Networks, Innovation and Knowledge Transfer</td>
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Table 5.2 Conference and Workshop Events

<table>
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<th>Location:</th>
<th>Title of Conference/Workshop</th>
<th>Comments</th>
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<tbody>
<tr>
<td>November 2009</td>
<td>Cambridge,</td>
<td>Workshop on University-Business Interactions</td>
<td>In collaboration with BIS, CIHE, UK-IRC, CBR and MBS</td>
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<td>UK-IRC</td>
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<td>30 November 2009</td>
<td>Cardiff</td>
<td>Workshop</td>
<td>In collaboration with HEFCW and the Welsh Assembly</td>
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<td>25 March 2009</td>
<td>Manchester</td>
<td>Conference</td>
<td>In collaboration with CIHE and the NWDA and EEDA.</td>
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</tbody>
</table>

8. Future Research Priorities
The researchers are currently exploring new funding opportunities with a number of funding bodies including NESTA and ESRC.
Appendix 1

References:


Cosh, A. and Hughes, A. (forthcoming) Never mind the quality feel the width: university-industry links and government financial support for innovation in small high technology businesses in the UK and the USA. *Journal of Technology Transfer*, 35


