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**THE ROLE OF EDUCATION IN INNOVATION: RECENT EXPERIENCE FROM THE  
UNITED KINGDOM WITH PARTICULAR FOCUS ON CAMBRIDGE, WARWICK  
AND EAST LONDON**

Kathrin Peters

SQW Limited

Enterprise House, Vision Park, Histon, Cambridge CB4 9ZR

E-mail: [kbpeters@sqw.co.uk](mailto:kbpeters@sqw.co.uk)

Internet: <http://www.sqw.co.uk>

**ABSTRACT**

This paper describes recent developments in the further and higher education sector in the United Kingdom and how they have impacted on the innovation potential of the country as a whole, individual regions and localities. It starts with a general analysis of national and regional trends and then provides more detailed information on three localities and their universities: Cambridge in England's Eastern Region, Warwick in the West Midlands and the University of East London.

## CONTENT

The information on which this paper is based on recent consultancy projects in the three featured locations.

### **Recent Policy Shifts in The United Kingdom**

During the 1990s, higher and further education institutions in the United Kingdom generally increased their commitment to the locality they were operating in. The awareness of local needs had been submerged by a more national and international orientation prevailing in the 1970s and 1980s, partly in response to different central level demands on the quality of teaching and research imposed through regular and rigorous comprehensive teaching and research quality assessments. Greater awareness of the institution's responsibility for its locality was further encouraged through a stronger commitment to 'regionalisation' promoted by the new Labour government since taking office in May 1997.

This commitment to the locality was further strengthened by central level policies concerned with supporting science and engineering. The 2002 public spending review announced the largest sustained growth in science expenditure for a decade, a total of £1.25 billion extra per year as of 2005-06.<sup>1</sup> This increase was intended by government to address a substantial productivity gap between the United Kingdom on the one hand side and European competitor countries (in particular France and Germany) on the other. It was argued that improving economic performance in the longer term required action across a range of areas including competition, enterprise, innovation, skills and investment which would be vacuous without a parallel strategy to use science and technology to address economic deficiencies. This brought to the fore the role of innovation which was seen as the major conduit to translate science and technology spending into economic prosperity.<sup>2</sup>

Innovation can most broadly defined is "the successful exploitation of new ideas".<sup>3</sup> It is influenced by research and development expenditure but is much more than that. It encompasses a wide range of activities including the introduction of new products, processes and systems and their diffusion to firms and individuals.

### **Research and technology funding**

The funding of university research in the United Kingdom is organised through three streams. The first stream originates from the Higher Education Funding Councils in England, Scotland, Wales and Northern Ireland and is based on the quality of research undertaken by research departments, assessed through regular Research Assessment Exercises (RAEs); the second funding stream is delivered by the thematic Research Councils<sup>4</sup> (for which they are free to decide which research will best address their objectives). The third stream is outside this dual funding system and originates from charities, industry and other government departments, all important providers of research funding.

One of the key reasons for the increase in funding allocation to universities by government was an assessment of the state of infrastructure in UK universities as being poor and in urgent need

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<sup>1</sup> DTI, HM Treasury, Department for Education and Skills : Investing in Innovation. A strategy for science, engineering and technology. July 2002.

<sup>2</sup> Ibid page 9

<sup>3</sup> Ibid page 10

<sup>4</sup> Medical Research Council (MRC), Biotechnology and Biological Sciences Research Council (BBSRC), Natural Environment Research Council (NERC), Engineering and Physical Research Council (EPSRC), Particle Physics and Astronomy Research Council (PPARC), Economic and Social Sciences Research Council (ESRC) and Council for the Central Laboratory of the Research Councils (CCLRC); these are listed above in descending order of their research budget.

of upgrading; deficiencies were highlighted by Lord Dearing's report into the state of higher education in 1997 (Dearing Report) and Sir Gareth Roberts' report covering the supply of scientists and engineering in 2001 (Roberts Report). The funding problem had been identified soon after the Labour government took office and two temporary funds were launched in quick response, the Joint Infrastructure Fund (JIF) and the Science Research Investment Fund (SRIF).

### **Knowledge transfer**

While investment in research provides much of the foundation for innovation, the potential can only be achieved if there are in place effective processes and systems for knowledge transfer. Innovation involves complex interactive processes between researchers and businesses and there is no one single model which encapsulates the multitude of links. Therefore, the most appropriate policy framework has to encourage maximum flow.

The key channels between the research base and industry are through the movement of trained researchers and from the publication and patenting of research results. Communication between industry and the research base can be supported through a variety of channels and mechanisms:

- Capacity building in universities so that links with businesses can be easily formed
- Relationships between the research base and SMEs which often lack the time and energy to engage in meaningful contacts
- Support for research in areas with long term potential.

To address the need for effective linkages, a number of knowledge transfer mechanisms were either reaffirmed or put in place including:

- The LINK programme and the Faraday Partnerships which encourage joint strategic and applied research between universities and businesses in a wide range of application areas including more 'leading edge' technologies as well as more 'traditional' fields
- The TCS (formerly Teaching Company Scheme) which encourages companies to accept student placements on supervised research projects
- The University Challenge Fund designed to encourage competitive bids from universities (or groups of universities) to put in place structures that will allow research results to be progressed into commercial propositions through proof of concept and prototype funding
- Science Enterprise Challenge designed to encourage the emergence of a culture open to entrepreneurship
- Higher Education Innovation Fund (HEIF), a programme following on from a previous programme called Higher Education Reach Out to Businesses and the Community (HEROBEC) designed to help universities put in place effective transfer mechanisms.

A recent analysis of the impact of the various initiatives reported the following achievements on a number of key indicators:

- in the period 1999/2000, 199 spin-off firms were created (compared with 26 in 1997)
- in 1999/2000, total patents filed by universities rose by 22% from the previous year to a total of 1,534
- more than 90% of universities employed specialist staff to support commercial work
- one spin-off firm was identified for every £8.6 million of research expenditure in UK universities in 1999/2000 compared to one for every £53.1 million in the US.<sup>5</sup>

The future of higher education in the United Kingdom was shaped further by the publication of a White Paper on higher education by the Department for Education and Science in February 2003. The implications of this new statement of government policy will emerge over the next 12 to 18 months but the following key principles:

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<sup>5</sup> Investing in Innovation, page 71

- more targeting of investment in research-intensive institutions and consortia
- more effective links between universities and their surrounding economies with a key role for Regional Development Agencies
- third stream funding from enterprises and other third party funders to become part of the core-funding package to ensure that universities' local remit becomes part of their core mission
- so-called knowledge exchanges to be established in less research-intensive institutions to enable them to focus on disseminating skills and experience rather than pursuing blue sky research; a target of 20 knowledge exchanges to be established across the UK
- sector skills councils are proposed to ensure that employees in particular sectors have the relevant technical skills to ensure that their sector remains competitive in the longer term.

### **Universities and their impact on localities**

The links between universities and their local economies are varied. A comprehensive report studying the role of universities in their regional economies commissioned by the Higher Education Funding Council (HEFCE) in 2001 identified the following seven 'themes' for the regional role of educational institutions:

- Regional business competitiveness : where higher education plays an increasing roles in supporting businesses to get establish and grow
- Lifelong learning and employability: where education helps to place young people and update employees over a wide range of skills
- Health and social wellbeing, particularly through the importance of research and teaching in the healthcare field
- Culture and sport, provided by educational institutions for their own staff but also for the benefits of the wider community
- Regional governance, where educational institutions have played an increasing role, through participation in regional assemblies, to shape regional strategies
- Urban and regional regeneration, where educational institutions play a comprehensive role both through all the above activities as well as their role in physical regeneration, through building activity for teaching, research and halls of residence.

All of these aspects are important but regarding innovation, it is the impact on business competitiveness and knowledge transfer which is crucial.

### **The role of educational institutions in business competitiveness**

The key mechanisms through which educational organisations impact on business competitiveness are as follows:

- Commercialisation of knowledge through patenting and licensing
- Basic, strategic and applied research inputs and consultancy
- Company spin-out activities
- Role in cluster activities

#### Commercialisation of knowledge through patenting and licensing

There has been rising pressure on the higher education sector to commercialise knowledge and ownership of intellectual property has become increasingly important. During the 1980s, there were some changes in the policies concerning the routes through which intellectual property could be exploited. Prior to 1985, rights of first refusal went to the National Research and Development Corporation (NRDC, later to become British Technology Group (BTG)); royalties were split between the individual university and BTG. With the removal of the BTG

right of first refusal, universities became free to adopt their own strategies. To support commercialisation strategies, many universities have pursued supporting strategies of establishing industrial liaison officers and science and technology parks.

#### Basic, strategic and applied research inputs

The 1998 White Paper on 'Building the Knowledge Driven Economy' gave higher education a strong role in national policies to support innovation and competitiveness. It challenged businesses "to turn into commercial success the technological knowledge in our universities ... to form collective partnerships with suppliers, customers, schools and universities to build networks and clusters of excellence to win competitive advantage."

Linkages have been formed with the encouragement of national policies and include the national Faraday Partnerships (linking universities and small businesses) and TCS.

#### Entrepreneurship Creation

The 1998 White Paper announced the extension of the Young Enterprise Schemes into Higher Education with first eight (and later 12) 'New Enterprise Centres' in universities. These were designed to equip engineers and scientists with entrepreneurial skills. These Centres were further supported by the University Challenge Fund and established jointly by the Treasury, the Wellcome Trust and the Gatsby Foundation.

These strategies were also supported by the 'Higher Education Reach Out Fund which support universities for strategies and activities which enhance interaction with businesses, promote technology and knowledge transfer, strengthen higher level skills development and improve student employability.

The latest White Paper on Enterprise Skills and Innovation further focuses on higher education as a driver of education and economic development and launches another set of initiatives, in particular the University Innovation Centres and New Technology Institutes.

#### Company spin-out activity

The higher and further education sector in the United Kingdom has emerged as one of the key determinants for the start-up and growth of high technology companies. This has been supported by a range of national, regional and local policies. Policies at the central level (University Challenge Fund) are being supported by initiatives at regional level and by individual universities.

#### The role of Higher Education in Clusters

Higher and further education plays a key role in cluster activity. "Higher education cluster engagement can be either reactive, responding to the needs of an existing focal point, or proactive, building localised expertise in the hope of stimulating cluster activity."<sup>6</sup> The impacts which higher education can permeate all dimensions of cluster models:

- Research and development activity helps companies to stay at the leading edge of their technology and business processes
- Higher education has positive impacts on the provision of skills and labour
- These labour market effects are supported by the role higher education can play in promoting a positive cultural and leisure environment
- There can be positive infrastructure impacts including high capacity telecommunications.

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<sup>6</sup> HEFCE : The regional mission. The regional contribution of higher education. The national report. Page 32

To illustrate the role education institutions can play for the innovative potential of their localities, three case studies of institutions have been chosen. These institutions are addressing completely different needs of their local economies and are characterised by different characteristics and features but they bring out some key pointers.

### **Cambridge University and related research institutions**

The University of Cambridge is one of the oldest universities in the world and has a reputation for outstanding academic achievement. It consists of 100 departments, faculties and schools plus a central administration; however, despite this it is a relatively small university with some 11,000 undergraduate and some 4,500 graduate students. In terms of research strengths, however, it is a substantial force.<sup>7</sup> On the basis of various UK league tables comparing research and teaching quality, Cambridge scores top or within the top three to five institutions in the UK.

#### Commercialisation of knowledge through patenting and licensing

The treatment of IP has undergone a sea change since the first Cambridge Phenomenon study was published in 1985. The Wolfson Industrial Liaison Office is responsible for commercialisation of IP. Until recently, the Department's main role was concerned with dealing with approaches from academic colleagues and only a limited amount of time was devoted actively to search out expertise and IP with potential for commercialisation. However, towards the end of 1998, additional roles were created for so-called 'ferrets' searching out opportunities. With the success of the University in accessing University Challenge Fund (UCF), the opportunities to 'mine' IP proactively have become much stronger.

#### Basic, strategic and Applied Research inputs

The University of Cambridge is engaged in a wide range of research activities with businesses. One of the most characteristic models is that of the 'embedded laboratory'. In essence, the idea is for a team of scientists from a firm that is engaged in serious research to co-locate with an academic department. There is likely to be collaborative work and this may lead to joint publications; equally, the commercial research team will also undertake research under conditions of closely controlled confidentiality.

#### Entrepreneurship Creation and Company Spin-out Activity

SQW's two Cambridge Phenomenon studies explored the role of the University and associated research establishments in the process of developing Cambridge as one of the premier concentrations of high technology businesses in the United Kingdom and indeed in Europe. At the time of updating the Phenomenon in 2000, it was estimated that there were a total of about 1,400 high technology companies in and around Cambridge.

While the University is by no means the only determinant of Cambridge's emergence as one of the major high technology agglomerations, there is little doubt that the mixture of research, the quality of individuals attracted to the University and the attitudes on establishing high technology companies have contributed to shaping the entrepreneurial impact of the university. "A ... set of general preconditioning factors began to operate in the 1970s. These were to do with the increasingly favourable national environment for small firms ... which fortuitously coincided with certain technological developments especially in computing. Massive strides were made in electronics and computer design, resulting in steep fall in hardware costs. This in turn made it easier for small firms to enter the burgeoning fields of computer applications and new hardware development."<sup>8</sup>

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<sup>7</sup> Segal Quince Wickstead : The Cambridge Phenomenon Revisited. June 2000

<sup>8</sup> Segal Quince Wickstead: The Cambridge Phenomenon, The Growth of High Technology Industry in a New University Town. Cambridge 1985, p 51

## **University of Warwick**

The University of Warwick has emerged as one of the leading business-facing universities in the United Kingdom. It plays a crucial role for the development of thriving businesses in the West Midlands as well as further afield.

### Basic, strategic and Applied Research inputs

One of the key research groups is the Warwick Manufacturing Group, headed by Professor S K Bhattacharyya, which works with a range of small and large manufacturing groups, helping them to achieve their potential.

### Commercialisation of knowledge through patenting and licensing

Warwick Ventures spearheads the mission of the University to maximise the commercial application of research for the regional and national economy. More than a dozen companies are already trading and the University has developed an impressive portfolio of patents and patent applications, many of which are licensed to national and international companies.

### Entrepreneurship Creation and Company Spin-out Activity

The University of Warwick was one of the first universities in the United Kingdom to realise its role in fostering spin-out companies and as early as 1983 started to develop Warwick Science Park designed to support both spin-out companies as well as indigenous and in-moving medium-sized and large companies. The success of this scheme has prompted the University and the Science Park to get involved in the development of a network of science and technology park initiatives across the sub-regional economy.

The University has continued its positive stance towards the creation of spin-out companies and has set itself an ambitious target of creating at least ten new spin-off companies per year.

## **The University of East London**

The University of East London (UEL) is a new university (designated in 1992). It was formed from a number of institutions which themselves looked back on a long tradition as technical colleges (West Ham Technical Institute, the South East Essex Technical College and School) and the North East London Polytechnic.

UEL is operating within an area of London which has experienced rapid change over the last twenty years, with the demise of some traditional manufacturing and dock-related industries and a change in the demographic profile of its catchment population with a high and rising proportion of ethnic minorities. UEL sees itself as a modern, dynamic university at the forefront of academic innovation. It has 12,000 students and three campuses at Docklands, Barking and Stratford.

The University puts strong emphasis on its interface with local and regional companies. The Thames Gateway Technology Centre (TGTC) was established by the University, supported by its partners in the public and private sphere, to use a multitude of channels to transfer knowledge, expertise, invention and technology. The TGTC is an integral part of the Docklands Campus and combines a business-facing interface with a technology incubator.

### Basic, strategic and Applied Research inputs

The University has ten schools in predominantly applied areas. It scored well in the last 2001 RAE; in particular Cultural and Innovation Studies were rated highly. It is with respect to cultural and innovation studies that UEL is emerging as a key player within its local and regional catchment area. Strong links have been formed with media and creative industries companies to engage in joint projects.

#### Commercialisation of knowledge through patenting and licensing

UEL is not currently engaged in much research which could lead to patenting and licensing opportunities. However, the University is keeping a watching brief on developments in this field and is prepared to move, either on its own or with partner institutions, once patenting and licensing will reach a more critical stage.

#### Entrepreneurship Creation and Company Spin-out Activity

The University is planning significantly to scale up its activities in this area. It has recently identified entrepreneurship creation as a key focus of its activities and is assembling an array of supporting initiatives to create a continuous flow of start-up companies.

### **CONCLUSION**

The conclusion of this paper is that national policies have strengthened the role universities can play in their localities; the shape and form of this influence depends crucially on the nature of the university and the characteristics of its surrounding area.