

REGIONAL INNOVATION POLICIES IN THE UNITED KINGDOM: THE NEW INDUSTRY-HEIS RELATIONSHIP AND THE ROLE OF SCIENCE PARKS ¹

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Abstract: This paper aims at examining regional innovation policies at present in place in the United Kingdom, with particular attention to the new Industry-Higher Education Institutions (HEIs) relationship and the role played by science parks. After a thorough description of the governance structure of innovation policies in the UK, it follows a brief analysis of the Industry-HEIs relationship after the implementation of the new science framework 2004-2014, and the main instruments available. Then I investigate English science parks as pivotal innovation infrastructures for Academic-Industry networks for innovation.

In the latest years, the government has increased its support for enterprise associated with science parks, but there are some criticism and doubt persists on their effective work. Results highlight that there is significant potential for the UK science parks to play a bigger, more enhanced role in the UK knowledge economy in the future, and in supporting the delivery of the innovation agenda. In this context, emphasising innovation and creativity, universities and science parks have a key role to play and results highlight that this new policy is already beginning to produce results.

Keywords: Innovation / R&D / Regional innovation policy / Technology transfer / Science parks policy.

POLÍTICAS REGIONALES DE INNOVACIÓN EN EL REINO UNIDO: LA NUEVA RELACIÓN ENTRE LA INDUSTRIA Y LAS INSTITUCIONES DE EDUCACIÓN SUPERIOR (HEI Y EL PAPEL DE LOS PARQUES CIENTÍFICOS)

Resumen: Este trabajo pretende examinar las actuales políticas regionales de innovación del Reino Unido, dedicando una especial atención a la nueva relación entre las instituciones de educación superior (HEI) y la industria, y al papel que desempeñan los parques científicos. Después de una completa descripción de la estructura del Gobierno relacionada con las políticas de innovación en el Reino Unido, se realiza un breve análisis de la relación entre la industria y los HEI tras la implementación del nuevo sistema científico en el marco 2004-2014 y de los principales instrumentos disponibles. Posteriormente, se investigan los parques científicos ingleses como infraestructuras de innovación fundamentales para la red académico-industrial relativa a la innovación.

En los últimos años, el Gobierno ha incrementado su apoyo a las empresas asociadas a los parques científicos, aunque son muchas las críticas y las dudas sobre su efectividad. Los resultados destacan que existe un potencial significativo en los parques científicos ingleses para desempeñar en el futuro un papel más importante y de mayor amplitud en la economía inglesa basada en el conocimiento, así como de apoyo a la creación de la agenda de innovación. Dentro de este contexto de fomento de la innovación y la creatividad, las universidades y los parques científicos tienen un papel clave que desempeñar y resulta evidente que la nueva política ha comenzado a producir resultados.

Palabras clave: Innovación / I+D / Política regional de innovación / Transferencia de tecnología / Política de parques científicos.

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1. INTRODUCTION

Innovation is a key driver of productivity growth in the United Kingdom. The innovation challenge has been a clear theme of policy-making since 1997. The result was the publication of three White Papers in 1998, 2000, 2001³ and then of *Investing in Innovation: A Strategy for Science, Engineering and Technology* in 2002 and the more recent *Science and Innovation investment framework* which cover a period of ten years since 2004.

This new policy first of all aims at modifying deeply the previous innovation policies approach, by according more attention to the needs of businesses and the partnership with the university sector. The UK government has recognised the fact that a more collaborative approach between university and industry and the consequent establishment of networks among them, is pivotal to the improvement of the system⁴. Besides, qualified skills and competencies are required⁵: this means that the education field needs to look after training and courses more oriented to business requirements in order to create a workforce well prepared and competitive. In the latest years, fewer students in the UK are choosing to study many science and engineering disciplines. One of the government priorities is to increase the supply of science and engineering skills, through making more attractive these studies.

Secondly, the UK government decided to review the system of schemes available to businesses in the innovation field. The excessive number of schemes was replaced by a few one, in order to take into account firms needs of more clarity and rapidity in grants concession.

Last but not least, the UK assisted to a shift towards the regions in terms of delivery. The UK Government has pursued an active regional policy since 1997, believing strongly that regional needs are best targeted by regional solutions. The introduction of a regional development agency (RDA) in each of the English regions, based on the model of the Welsh and the Scottish agencies, and the establishment of the Welsh Assembly and the Scottish Parliament, was the first step in delivering power and responsibilities in economic development. The government's aim is that policy is led at the appropriate level, either national or regional.

In this context, science parks play a key role as important mechanisms in facilitating business success and economic growth.

³ *Our Competitive Future – Building a Knowledge Driven Economy* (1998); *Excellence and Opportunity – A Science and Innovation Policy for the 21st Century* (2000); *Opportunity for All in a World of Change – Enterprise, Skills and Innovation* (2001).

⁴ “These new policies are already beginning to produce results. For example, since 1997 we have seen a significant cultural change in the relationship between the university sector and industry. In 2000/2001 there were 248 spin-off companies from British Universities compared with 203 in the previous year and 70 a year, on average, in the 5 years before that” (DTI, 2003, p. 11).

⁵ “The evidence suggests that low levels of skills are one of the main barriers that UK firms face when trying to become more innovative” (DTI, 2003, p. 23).

The paper is structured as follows: after a general description of the governance structure, it's analysed the Industry-University relationship after the implementation of the new science framework 2004-2014, stressing the importance of a support policy for the interaction between these actors, and the main schemes available. It follows a deep investigation of the role of English science parks and their importance for economic development and wealth creation.

2. THE MOST IMPORTANT ACTORS IN THE FIELD OF INNOVATION POLICIES IN THE UNITED KINGDOM

Essentially, the main actors of the English system are: Government and Departments, responsible for policy setting, implementation, funding; the Science and Engineering Base, largely comprising the Higher Education sector but which also includes the remaining government laboratories and the research council institutes, and which undertakes the majority of basic and strategic research in the UK; and the Business Enterprise sector, which funds and undertakes the largest share of UK R&D. To these may be added the independent research and technology organisations (European Trend Chart on Innovation, 2004).

Figure 1 provides a first overview of the actors involved at the moment in the governance of innovation.

The Treasury has to provide a stable macroeconomic environment and a supportive fiscal framework.

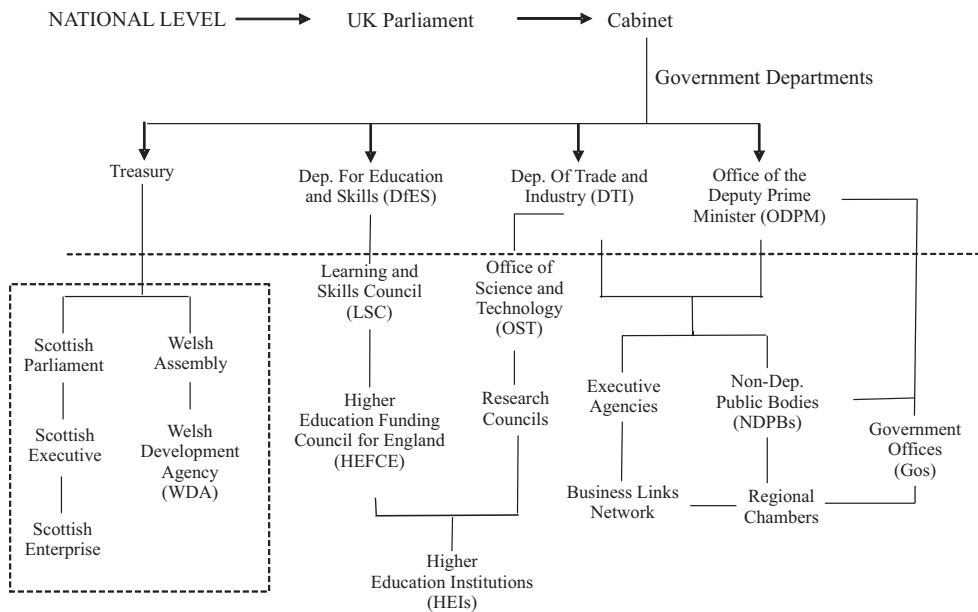
Ultimately, however, it's the responsibility of the Department of Trade and Industry (DTI) to "institutionalise" industrial policy, to develop a clear strategy and to provide the institutional mechanisms for ensuring the implementation of that strategy (Harding, 2001, pp. 170-174). So, at the hub of the UK system of innovation governance is the Department of Trade and Industry, which influences UK innovation through a variety of channels.

With regard to science and science policy, the Office of Science and Technology (OST)⁶, located in the DTI, is responsible for the funding of basic research both within, but largely via, the Research Councils. Although OST is located within the DTI, it enjoys an independent status, since the Science Budget is "ring-fenced". That is, once decided as such, DTI cannot shift any part of it for other purposes. Another function of OST is dealing with scientific issues that involve more than

⁶The Office of Science and Technology was formally established in April 1989. Its members were representatives from both Houses of Parliament as well as a number of distinguished scientists and engineers. Initially, it was set up as a "pilot" project for a period of four years, with the purpose of establishing the need for Parliamentary science and technology assessment. On April 1, 1993, it became an integrated office of the Houses of Parliament and is now funded by both Houses. It reports to a Board of Parliamentarians and experts and provides information to Parliament, Parliamentary select committees and the House library as appropriate. (Harding and Harding, 2003, p. 40).

one department and coordinating S&T policy across government departments (Harding & Harding, 2003).

Figure 1.- Overview of UK system of governance of innovation



The DTI is the lead body for UK innovation policy implementation. Actually, the DTI is giving greater priority to innovation and has established a new Innovation Group headed by a Director General for innovation and technology. To help secure a strong business voice in the allocation of R&D support, the DTI has now established a business-led Technology Strategy Board, comprising senior business representatives (HM Treasury, 2004b).

Whilst the DTI is the key government actor in UK innovation policy, a number of other departments and ministries undertake innovation related activities. Furthermore, the UK Government aims to operate a policy of “joined-up government”, which attempts to ensure that policy decisions and implementation are coordinated across all government departments and agencies. Of particular relevance is the Department for Education and Skills (DfES), which has responsibility for all issues relating to education in England. DfES also oversees the Further Education Funding Council for England and Higher Education Funding Council for England (HEFCE), which provide funding for staff and infrastructure in institutes of further and higher education respectively (European Trend Chart on Innovation, 2004).

The Office of the Deputy Prime Minister (ODPM) has oversight of sustainable economic development in the English regions, in collaboration with the Regional Development Agencies (RDAs) and the Government Offices (GOs).

Besides the DTI, in England the RDAs⁷ are emerging as key players in innovation policy. In the latest years the DTI's been working more effectively with the RDAs. They are one of the most important body in facilitating innovation networks and diminishing asymmetric information problems. According to Hassink (1992), it's crucial that one agency, which can be a political party, a regional development agency, or a trade association, dominates the institutional scene, so that this agency cements consensus in the region.

The RDAs have been given increased funding and flexibilities. RDAs are best placed to identify mismatches between regional industrial strength and relative research weakness, or vice versa, and in facilitating knowledge transfer in their regions. Some of these mismatches can be addressed by coordination from the RDAs, bringing together business and universities to secure agreement to common regional innovation objectives. Along the lines of those in the North West and North East, each RDA established in 2004 a regional Science and Industry Council to provide local leadership in strengthening regionally based innovation and high-level advice from businesses and universities on regional science priorities. It's too early to evaluate the new Councils' work.

Since April 2002, all DTI regional innovation funding has been combined into the RDAs "single pot" budget. The Government has a broad agenda for the delivery of regional and local economic policy and the RDAs form a cornerstone of this framework, particularly with regard to the delivery of the DTI's innovation policies.

When RDAs were set up, the Government made separate funding streams available to them to support innovation. The main tool available since 2001 to RDAs to assist in realising their Regional Innovation Strategy is the Regional Innovation Fund (RIF) in support of business incubation and regional/local innovative clubs and networks, including promoting the development of clusters (encouraging the setting up of science parks and incubators). RIF was first used to fund new incubator space, to facilitate networks and to encourage clusters, as well as to deepen knowledge of the region's strengths and weaknesses. With RIF funding, RDAs initiated a total of 91 incubator and science/business park development projects; and the Government made £30 million available in 2001 to establish five University

⁷ During the process of political reorganisation, eight regional development agencies have been introduced in England. These English Regional Development Agencies operate since the 1st of April 1999, while the London Development Agency was born on the 3rd of July 2000.

The RDAs were created as creatures of Central Government, but also in a typically British way, they were created as "new wine in old bottles", revenue-neutral, bringing together existing organisations and their spending programmes into a single organisation which added value through strategic integration (Benneworth, 2001).

The main competencies of the agencies are the following: support to SMEs, investments and competitiveness; education and employment; sustainable development and start-up. Each agency has to elaborate a Regional Economic Strategy (RES) for its area.

Innovation Centres across the UK. These endeavour to develop top class, long-term research partnerships between major business interests and the universities in industry sectors which are of strategic importance to the regions. The RDAs have now adopted this partnership model using their own resources.

Another important governance actor is the executive agency Small Business Service. The SBS⁸ has a major role in raising the innovation performance of SMEs in England, working with a range of partners including RDAs and public, private and voluntary sector service providers with access through Business Link. Business Link network in England and its equivalent in the devolved administrations act as points of contact for many of the Government's innovation support schemes. The SBS has an office in each town and business advisers to support companies local to their office. The service is open to everyone so science park companies can also access this support. Anyway, the activities of SBS, RDAs and Business Link need to be better coordinated to maximise SMEs access to technology support. Through close engagement with the RDAs, in particular on regional priorities, the SBS will ensure that services brokered by Business Link are properly integrated into Regional Skills Partnerships to create a better fit between Business Link services and RDA sector and cluster development plans, skills and labour market support.

3. THE INDUSTRY-HIGHER EDUCATION INSTITUTIONS (HEIS) RELATIONSHIP IN THE NEW INNOVATION POLICIES GOVERNMENT STRATEGY

The UK government identifies five productivity drivers (Figure 2): innovation, enterprise, skills, competition and investment. Innovation is just one of the five, but all are related.

In 2003 the UK government commissioned the Lambert Review of Business-University Collaboration (DTI, 2003b) to examine the barriers that might hold back business demand for universities' knowledge and skills outputs, and the ways in which universities and business might increase their collaborative efforts, and decided to introduce policy reforms in this field. Specifically, the Review called for more cooperation between firms and universities, to boost knowledge transfer, innovation and economic growth (Frenz, Michie and Oughton, 2004).

OECD indicators (2002, 2002b) indicated that Higher Education Institution (HEI)-business interaction in the UK was quite strong. Industrial funding as a share of total research grew, especially in applied disciplines, such as engineering and

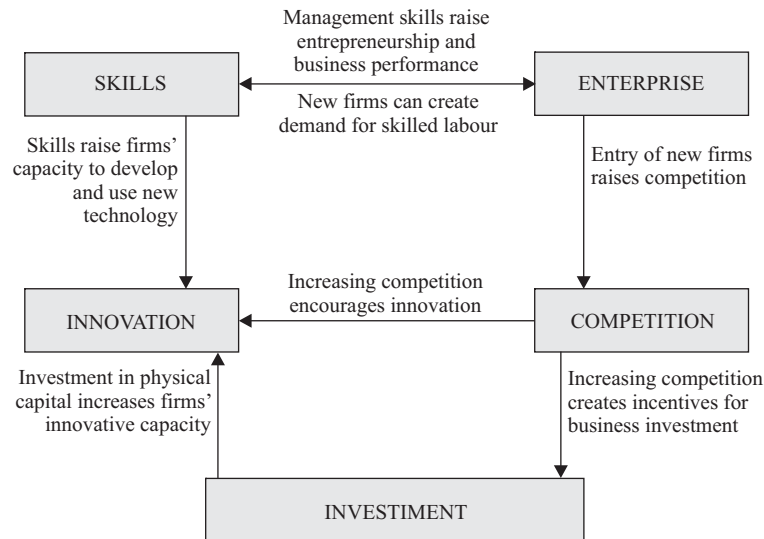
⁸The Small Business Service is an executive agency of the DTI and it has been introduced in April 2000. It operates in England with the aim of promoting entrepreneurship particularly among disadvantaged groups. It also aims at improving the quality of SMEs support. By analysing SMEs needs, the SBS agency has to guide Government strategies to elaborate the best policy for SMEs. (cfr. Curran and Storey, 2002; Wren, 2001).

The Small Business Service is responsible for the most important government support programs for SMEs and it is indirectly responsible for the setting of national priorities.

Cfr. Curran and Storey. (2002, pp. 163-177) and Wren (2001, pp. 847-860).

business and management. Constraints on University funding probably encouraged this change. Furthermore, Universities are also engaging in licensing activity and creating spin-off firms.

Figure 2.- Important linkages between the drivers of productivity



SOURCE: HM Treasury, ODPM (2004).

The *Lambert* report on the partnership between Industry and University confirmed this revolution, underlining the cultural change in the UK's universities over the past decade. Most of them are actively seeking to play a broader role in the regional and national economy. The quality of their research in science and technology continues to compare well against most international benchmarks (DTI, 2004). Much more attention is being paid to governance and management issues. Business is changing too. Growing numbers of science-based companies are developing across the country, often clustered around a university base. New networks are being created to bring business people and academics together, often for the first time (DTI, 2003b).

The review has concluded that although there is much good collaborative work underway already, there is more to be done. According to the *Lambert* review (DTI, 2003b), even though British universities have made real progress in their efforts to work with business, there are significant gains to be made by improving this further. Universities need to get better at identifying and communicating their areas of comparative research strength and at organising themselves in a way that will allow them to exploit their new opportunities in the most effective manner. Businesses should learn how to exploit the innovative ideas that are being develo-

ped in the university sector and they have to improve their communication of business needs (DTI, 2003b). Overall, the review concluded that the outlook for R&D in the UK was positive, as new industries and services such as biotechnology and the creative industries increase their investment (HM Treasury, 2004). The government has also been encouraging universities to work with RDAs to exploit synergies and so help foster knowledge-based clusters around city university hubs, as part of the government's response to the *Lambert* Review.

The main barrier to University-business collaboration lies in differences in objectives between firms and researchers and a lack of stimulation provided by industrial work. Firms also cite differences in objectives, approach or misunderstandings as barriers to working with academics. Besides, the importance of knowledge transfer and more frequent and easy communications between business people and academics is underlined by the *Lambert* review.

In this context, UK universities play a crucial role. The UK science and engineering base is largely made up of universities, research institutes and the Research Councils. Its role is to conduct scientific research, to produce highly qualified scientists and engineers, and to contribute to the UK's wealth creation and quality of life (DTI, 2001). In the knowledge economy, emphasising innovation and creativity, universities have a key role to play. According to the new theory of strategic management of places (Audretsch, 2004), universities are a pivotal resource with several implications. In the latest years, HEIs have developed many knowledge transfer programmes, incubators and science and technology parks, public-private partnerships. All these activities are evidence of the new entrepreneurship policy.

According to Frenz, Michie and Oughton (2004), co-operation between firms and universities may enhance the innovative capacity and propensity of firms in a number of ways. These authors cite the following: by allowing firms to tap into the research skills and techniques acquired in university research; by gaining access to scientific knowledge located originally at least almost entirely within universities; by assisting in the development of new products and processes, by solving problems and raising awareness of new possibilities through more general interaction.

Harding (2004) showed that universities play a key role in economic performance and there is an increasing pressure on universities to work with business, but the doubt if increased funding and targets may be regarded as enough to address these issues still remains.

3.1. THE CRUCIAL ROLE OF THE INTERACTION BETWEEN UNIVERSITY AND INDUSTRY: THE IMPORTANCE OF A SUPPORT POLICY

Nowadays, there is an increasing focus on universities' entrepreneurial orientation and their ability to exploit and transfer scientific knowledge. Universities have changed their traditional mission and become more business oriented. In this context, an important theoretical development in the literature is termed "the Triple Helix approach".

In the latest decades, it has been assisted to a convergence and crossing-over of three worlds which were before very separate: public research, business and government (Viale, Ghiglione, 2000). This convergence has been explained first of all by Etzkowitz (1994) with the TripleHelix model and later on by Leydesdorff and Etzkowitz (1996, 1997), Leydesdorff (2005a, 2005b) with theoretical systems developing the idea.

In the TripleHelix model the main institutions of the knowledge-based economy are university, industry and government (Leydesdorff, 2005b).

The TripleHelix model of interactions between academia, businesses and government for the promotion of innovation, is a very useful tool to help understand science and technology policy issues. This approach refers to a spiral model of innovation that captures multiple reciprocal relationships among public, private and academic sectors at different stages in the capitalization of knowledge (Viale, Ghiglione, 2000). These institutional settings are increasingly working together, with a series of linkages emerging at various stages of the innovation process, to form this TripleHelix model.

Nowadays, knowledge has an increasingly important part in the innovation process. As a matter of fact, the universities play a larger role as knowledge producing and disseminating bodies. In the knowledge-based economy, innovation is not only an activity largely performed by industry and government, but also the university sector becomes a key element both as human capital provider and seedbed for new firms. The three institutional spheres are increasingly interrelated (Leydesdorff and Etzkowitz, 2000).

Two different interpretations of the TripleHelix model see the neo-corporatist one and the evolutionary configuration. The first one is focussed on reaching a consensus on activities among the representatives of academia, business and government, with the involvement of innovation coordinators (Viale and Ghiglione, 2000). The neo-corporatist model is considered not satisfactory in terms of the level of integration among actors and it seldom results in innovation-related business start-ups and has a generally low technological output (Viale and Ghiglione, 2000).

The evolutionary interpretation, instead, sees a limited but crucial government role. This has to define the normative framework for the planning of individual incentives for reorienting academic and industrial actors towards a higher level of integration (Viale and Ghiglione, 2000). Within this model, academia, business and government are learning to encourage economic growth through the development of generative relationships (Leydesdorff and Etzkowitz, 1997).

According to the evolutionary interpretation of the TripleHelix model, it's very important to underline the role that universities can play as promoters of socio-economic development (Fondazione Rosselli, 1995). In this context, the productive system of peripheral regions is based largely on SMEs presenting a lack of R&D investment and the weakness of the institutional support system. The evolutionary

model suggests that there is a potential for knowledge-based development in these regions, stressing the role of universities as a factor for socio-economic development within a context of interaction among academia, businesses and government (Viale and Ghiglione, 2000).

According to Metcalfe (2005), the TripleHelix allows for an understanding of the interactions between university, industry and government innovation systems, but this model displays some limitations. The relations between the various actors don't follow a natural law, as affirmed by the TripleHelix model. This reinforces the idea that academic entrepreneurship is rooted in the sciences, rather than representing the full range of academic functions that have been influenced by the state and the market.

3.2. MAIN INSTRUMENTS OF INNOVATION POLICIES AND INDUSTRY-HEIS RELATIONSHIP

The UK government has recently reviewed all business support schemes to see if their impact could be enhanced. One of the main objectives of the DTI innovation review was to identify if the mix of government supported measures was the most appropriate to tackle the market failures. The DTI has radically replaced well over 100 business support schemes, which businesses found very confusing, with just nine simpler products, focused on innovation and continuous improvement (DTI, 2004; DTI, 2004c). The new solutions are directly managed by the Business Link network for the small and medium businesses, and by the Department of Trade and Industry for larger businesses. These nine solutions are the following: Knowledge Transfer Networks, Collaborative R&D, Knowledge Transfer Partnerships, Achieving Best Practice in Your Business, Selective Finance for Investment in England, Grant for R&D, Grant for Investigating an Innovative Idea, Support to implement best practice, Small Firms Loan Guarantee.

The main important ones in the innovation and knowledge transfer field are summarised in the table 1.

A first step was made with the revisions to SMART scheme, Small Firm Merit Awards for Research and Technology. SMART was the SBS initiative that provided grants to help individuals and SMEs to research and develop technologically innovative products and processes.

SMART formally closed to applications on 31 August 2003 and has been replaced by the Grant for R&D which has been available since 1st June 2003. Grant for R&D is the DTI's initiative that provides grants to help individuals and SMEs to research and develop technologically innovative products and processes (DTI, 2003).

Knowledge transfer networks have the aim to encourage the diffusion of new and existing technology. The product builds upon the existing Faraday Partners-

hips, which connect universities and independent research organisations with business and finance in key areas of technology (DTI, 2003).

Table 1.- The DTI's business support solutions

SUCCEEDING THROUGH INNOVATION			
The product	Who is it for?	What does it provide?	
Knowledge Transfer Networks	All businesses wanting to grow by exploiting technology.	A grant to an intermediary to set up a network in a priority technology area, bringing together businesses, universities and others with an interest in technology applications.	The DTI is delivering the Technology Strategy and Programme through these products.
Collaborative Research and Development	All UK-based businesses wishing to exploit technology.	Funding for collaborative R&D projects between businesses, universities and other potential collaborators.	The DTI is delivering the Technology Strategy and Programme through these products.
Grant for Investigating an Innovative Idea	Small businesses wishing to exploit an innovative idea.	Reimbursed consultancy to help businesses get advice on the steps needed to implement their ideas.	Available in England only. In many cases similar schemes are offered by the appropriate organisations in Scotland, Wales and Northern Ireland. All other solutions are UK-wide.
Grant for Research and Development	Small businesses with an innovative product or technology.	A grant to help businesses carry out R&D that could lead to a technologically innovative product or process.	Available in England only. In many cases similar schemes are offered by the appropriate organisations in Scotland, Wales and Northern Ireland. All other solutions are UK-wide.
Knowledge Transfer Partnerships	All businesses needing expert help to innovate.	A grant to cover part of the cost of using a person to transfer and embed knowledge into a business from the UK knowledge base via a strategic project.	

SOURCE: DTI (2004d).

Collaborative R&D support is available to meet some of the costs and risks associated with research and technology development and to facilitate collaboration between different businesses (DTI, 2003).

Another important initiative is the Grant for Investigating an Innovative Idea, available only in England under the responsibility of the DTI. The aim of the grant product is to help SMEs based in England to develop their ideas by working with external experts. The outcome is an action plan, which one can then use to take the idea forward to develop significantly improved products, processes and services. The Grant provides 75% of the costs of outside experts (DTI, 2003).

Knowledge Transfer Partnerships provide direct support for knowledge transfer by enabling universities to work with businesses using graduates, to undertake specific knowledge transfer projects in firms of all sizes. This builds on the former Teaching Company Scheme (TCS) since September 2003. Knowledge Transfer

Partnerships are an enhanced and more flexible version of TCS (DTI, 2004b). Whereas TCS was largely restricted to two-year projects, the new form of support is more flexible, allowing projects from between 1 and 3 years and encouraging a wider engagement of knowledge based partners (DTI, 2003).

Besides TCS⁹ and the subsequent Knowledge Transfer Partnerships, DTI's current portfolio of programmes to encourage knowledge transfer between science base and industry includes Link, Foresight, CASE, the University Challenge Fund and HEIF.

Link is the main Government mechanism to link industry and R&D sector in pre-competitive research. The Foresight Programme, formerly Technology Foresight Programme, was introduced in 1994 with the aim at creating a new partnership between science and industry (Larédo and Mustar [ed.], 2001). It's largely focused on the development of new, commercially viable technologies and thus is arguably technology evaluation, such as investigation into a technology's potential for exploitation (Harding & Harding, 2003). The Cooperative Awards in Science and Engineering (CASE) is used to finance students research under the tutorship of academics and external sponsors from industry or the public sector. The programme is largely financed by the Research Councils and wants to finance research projects of PhD students (Larédo and Mustar [ed.], 2001; CBI, 2001).

Other relevant schemes already in place are the University Challenge, established in 1998 to encourage the exploitation of the results of scientific research in universities (spin-outs), now amalgamated with the Higher Education Innovation Fund and the fund for the commercialisation of IP in Public Sector Research Establishments.

Finally, the Higher Education Innovation Fund (HEIF) helps hi-tech businesses and finances knowledge transfer activities. HEIF¹⁰ has helped universities to build more and stronger relationships with businesses, particularly small firms, and other users of research. This is a clear example of efforts to foster innovation at the regional level (Frenz, Michie and Oughton, 2004).

4. THE ROLE OF SCIENCE PARKS

In the following analysis it's examined the role played by science parks structures, which can be regarded as one of the most important instrument in the universi-

⁹ For an analysis on the efficiency of TCS model, see Lipscomb and McEwan (2001, pp. 393-401). For a comparison between the English TCS model and the corresponding French CIFRE scheme, see Gibert (1998, pp. 32-37).

¹⁰ "The second round of IESF (IESF2 for academic years 2004-2005 and 2005-2006) attracted bids of over £300 million against the £187 million available, demonstrating the support in the university sector for developing knowledge transfer work. Around 116 English universities will be supported through IESF2, including more than 100 universities working together in around 46 collaborations, reflecting the quality of knowledge transfer strategies developed by a wide range of institutions" (HM Treasury, 2004, p. 75).

ty-business relationship and networks, but there are also some criticism and doubt persists on their effective work.

The term “science park” is usually used to describe a property based initiative that has a formal working link with a University or other higher education institution or research centre.

A science park is a business support and technology transfer initiative that encourages and supports the start up, incubation and development of innovation led, high growth, knowledge based businesses, provides an environment where larger and international businesses may develop specific and close interactions with a particular centre of knowledge creation for their mutual benefit, and has formal and operational links with centres of knowledge creation such as universities, higher education institutes and research organisations (Parry and Russell [ed.], 2000). Anyway, it must be said that the interaction between host university and the companies on the park is hard to achieve in practice and can be a major problem.

It’s widely known that the earliest parks were established in North America about 40 years ago (Cesaroni and Gambardella, 1999). The concept moved to Europe in the late 1960s and later to other continents and countries, including Asia, China, East Europe, Africa, South America and Australia¹¹. In Europe, science parks are concentrated in France and the United Kingdom (Sancin, 1999). In particular, in the United Kingdom the number of science parks increased rapidly during the 1980s (Hassink, 1992; Cesaroni and Gambardella, 1999).

The first science park in the UK was that of Heriot-Watt University, Edinburgh (Scotland), in 1965. In 1972 was founded a second park at Cambridge University. Both followed the style of typical USA parks and both moved forward very slowly producing little impact on their local economies and largely going unnoticed until the mid 1980s (Rowe, 2002). From these two experiences, the phenomenon has reached a number of over 50 parks (Sancin, 1999). During the ‘80s, the Thatcher government promised additional funding to those universities which made themselves more relevant to the needs of industry. This produced the motivation that drove the second wave of UK science parks (Rowe, 2002; Cesaroni and Gambardella, 1999). The universities of Aston, Birmingham, Manchester and Warwick established projects in the early to mid 1980s. The government encouraged also the English, Welsh and Scottish development agencies to work in partnership with universities to bring forward more projects and this accelerated the pace of development throughout the latter 1980s. During most of the ‘90s, instead, the movement tended to stagnate at a level where about 50% of UK universities had an associated science park.

According to Rowe (2002), there has been another spurt of growth in the latest years, due to the conversion of polytechnics to universities in 1992 (some of which have marshalled resources to become involved in science parks), the strong growth

¹¹ “It has been estimated that by 1998 there were nearly 475 parks (science, research and technology parks) and some 900 science and technology industrial parks (STIPs) in the world. Of the STIPs about 50% are located in the Asia Pacific region” (Parry, 2000, p. 36).

of the IT industry during that period and the consequent attraction of property investment for IT oriented science park development (Bristol Science Park, 2004), the movement of former government research laboratories towards the private sector.

Examples of the most important and effective science parks at the moment are the following.

- The Surrey Research Park is now recognised as one of the most successful science parks in north west Europe, attracting major corporations and helping in the formation and growth of many small high-tech businesses (Parry and Russell [ed.], 2000).
- Aston Science Park in Birmingham is another example of successful economic development. It has been built in an area of economic and industrial deprivation (Russell, 2000). It opened in February 1983 and is now recognised throughout the world as one of the leading innovators in science park developments and a good environment in which business and academia work together.
- Cambridge science park represents one of the most important English experiences in this field. Most important success factors were the role of the Trinity College in providing excellent scientific knowledge to small and medium businesses, the good quality of life, the network and collaboration between university, local government and businesses, and a very good location relative to London (Sancin, 1999; Segal, Quince and Wicksteed, 2000; Brioschi and Cassia, 2004; Wicksteed, 2004).
- Newtech science park in North Wales was created with the aim to revitalise the region's economy after the crisis of the '80s. North East Wales Polytechnic competencies were used to benefit local economic development through providing services to firms, rather than to create a relationship between university and business (Sancin, 1999).

From the beginning of the '90s, science parks can be considered as a recognisable feature of the university and the economic framework of the UK with most technology based businesses aware of the science park concept (Rowe, 2002). Also the institutional actors are now aware of the importance of science parks in the country.

4.1. SOURCE OF FINANCING AND MOST IMPORTANT CHARACTERISTICS OF ENGLISH SCIENCE PARKS

The first science parks were set up with funding and support from Universities, such as the Cambridge one, without any form of public financing. Following their success, local governments, such as councils, who also own land and have an economic responsibility for their area, have also invested in science parks development. The positive benefits in terms of employment and economic development were key for a financing at local level. Since then, many other investors and eco-

conomic developers have become involved. So today science parks are normally financed in partnership, which most commonly consist of a research organisation such as a university, large technology-based private company, hospital or formal research council plus the Regional Development Agency (RDA) and a private developer. Even the original parks which started off with just the university as investor now have several founders who have joined the scheme as it has expanded and developed new facilities.

The partnership approach can be problematic as the cultures of the different partners are very different. There are a lot of gaps between the private sector, the university, the RDAs and the public sector in general. They have different expectations, timescales and even the language they use in meetings may cause steering groups to talk at cross-purposes. This is why consultants are often involved in these meetings and the development of parks to help bridge the gaps in understanding between the key partners.

In the latest years, the government has increased its support for enterprise associated with science parks. The UK government believes that science parks play a key role in achieving the aim of developing new businesses and industries using new technologies and knowledge, because they can help to exploit the knowledge and technology contained in a university or research organisation. In short, science parks have a significant role to play in the exploitation of the results of scientific research and in facilitating the growth of businesses specifically established to exploit that research (Russell, 2000).

Also the Regional Development Agencies in the UK are taking a greater interest in the role played by member parks in the UK. RDAs have been close supporters of the science park concept, given the statistical evidence that science parks had a significant regional effect in encouraging indigenous start-ups as well as acting as magnets to attract companies from elsewhere to join such concentrations of knowledge based businesses (Dalton, 2000). RDAs regard science parks as catalysts for regional economic growth, industrial change and renewal as well as for potential solutions to an unemployment problem (Dalton, 2000).

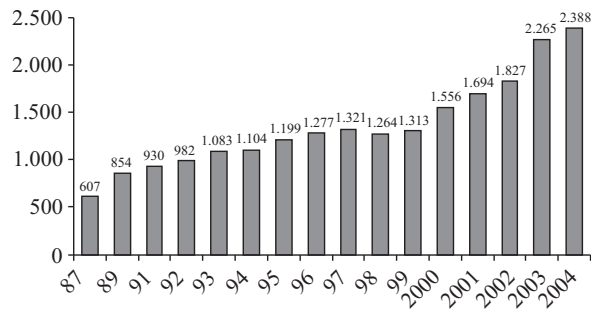
In this context, an important role is played also by UKSPA, the United Kingdom Science Park Association, that has continued to grow at a steady pace since its formation in 1984. The UK science park movement has developed to the extent that it now provides some 1,300,000 m² of accommodation, housing more than 2,300 clients, compared with just over 2,200 in the previous year (Figure 5), who in turn employs about 58,000 people (Figure 4). Approximately 65% of the overall number of science parks in the UK are UKSPA members (UKSPA, 2004). There are currently 57 full members of UKSPA (Figure 3), with a further 8 associate parks under development (UKSPA, 2005).

At an international level, science parks are promoted by the UK Science Park Association (UKSPA), the Department of Trade and Industry and UK Trade and Investment (the most important agency for the promotion of international commerce).

Each park also has its own marketing budget and invariably hires the services of a marketing company to help promote the parks facilities and the activities of the park locally. Besides, each park hires the services of a local and a national property company who is probably involved in advising the development of the buildings, in helping to promote the facilities and bringing potential tenants on site to encourage them to view the space available. As a result of this international campaign, over the last 15 years a trend has emerged that an increasing number of firms come to UK science parks from overseas. It's a sign of increasing inward investment activity (UKSPA, 2004).

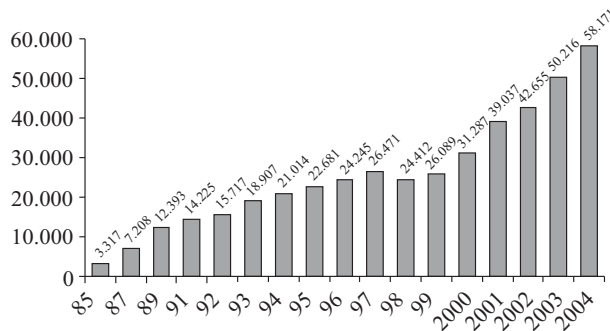
There are currently at least 80 science parks in the UK, but while Scotland has by far the greatest number (Figure 6), with the East of England, South East and North West following behind, Wales is at the bottom of the table with very few major science parks (Bristol Science Park, 2004). Most are science parks in the traditional sense, inter-linked with academic institutions, but there are also a number of parks which are solely privately owned (Bristol Science Park, 2004).

Figure 3.- Number of UKSPA science parks

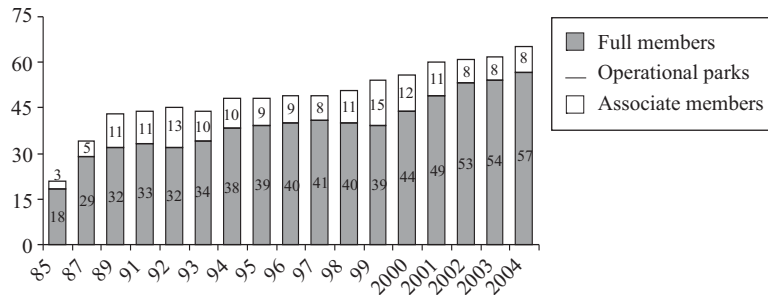


SOURCE: UKSPA (2005).

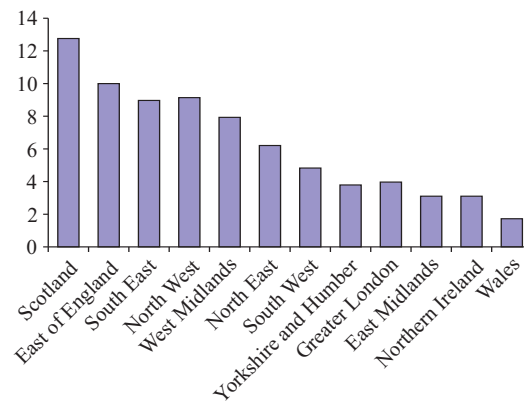
Figure 4.- Number of jobs in tenant companies



SOURCE: UKSPA (2005).

Figure 5.- Number of tenant companies

SOURCE: UKSPA (2005).

Figure 6.- UK science parks – number by region

SOURCE: Bristol Science Park (2004).

Most important characteristics of English science parks can be summarised as follows.

- The ownership of science parks varies. The property may be owned by Universities, local authorities, private companies or property developers (Bristol Science Park, 2004). A science park supports its tenants by the provision of property services together with business services.
- Any site that is less than 30 acres in area is unlikely to be able to meet its operating expenses as a genuine science park unless it's a part of an existing campus (Dalton, 2000). Besides, distance is important: generally speaking, the greater the distance between the science park and the potential tenant company's main base, the greater will need to be the reputation and quality of research expertise of the focal institution in the subject areas of concern to the company if it is to act as a

- magnet (Dalton, 2000). The development of a science park is a long-term project, typically taking 15 to 20 years for its full accomplishment from first inspiration to complete maturity (Dalton, 2000), and it implies several factors.
- Given these assumptions, science parks in the UK are often located in the inner city in direct proximity to higher education facilities. Consequently, lack of space is usually a common problem and the prices are fairly high. Therefore, a large number of parks are filled up with established firms looking for prestigious locations (Hassink, 1992).
 - UK science parks are dominated by SMEs. The original aim of the science park concept was to provide a location, where spin-off firms could be sited so that they could exploit the commercial potential of the results of research and could continue to maintain close and informal relationships with the academic and research staff¹². Later, the success of the early science parks encouraged other organisations to take an interest in these projects (Dalton, 2000).

4.2. SOME CRITICISMS ABOUT ENGLISH SCIENCE PARKS WORK

According to the research undertaken by the ANGLE Technology (2003), there has been a continued growth in science park provision in the UK over the last years and the most important single factor affecting the performance of individual science parks is the state of the sub regional knowledge economy within which they are operating. Regarding company performance, science park based companies have higher growth rates than similar companies at other locations. In terms of innovation performance, on-park new technology based firms launched more new services and have a significantly higher proportion of qualified scientists and engineers than their off-park counterparts over a three year period of investigation, while off-park firms launched nearly twice as many new products on average than on-park ones. Instead, there was no difference between the intensity of investment in R&D between the on-park and off-park firms.

The research undertaken by the ANGLE Technology (2003) confirmed that science parks play a positive role in supporting the growth of technology-related businesses as evidenced by the steady growth of tenant companies and enhanced growth in employment for science park based businesses compared with similar ones at other locations.

The ANGLE Technology research added that there is significant potential for the UK science park movement to play a bigger, more enhanced role in the UK knowledge economy in the future, and recommended that UKSPA worked more closely with central government and the Regional Development Agencies to support the delivery of the innovation agenda.

¹²“In short, the science park would provide an intensely supportive environment designed to encourage the creation and growth of these knowledge based businesses which could benefit from this opportunity for continuous technology transfer” (Dalton, 2000, p. 44).

However, this research indicated that science parks are failing to perform as well as might be expected with regard to the promotion of Higher Education Institution (HEI)-industry linkages and the transfer of technology from HEIs to science park businesses.

Science parks in the UK have a high density of well qualified scientists and engineers, who potentially have much to offer budding scientists and entrepreneurs of the future. UKSPA is ideally placed to manage a national programme engaging science parks, schools and Universities with the objective of raising awareness, sharing experiences, and encouraging more young people to study science and business.

Perplexities are expressed also by Rowe (2002). The experience of science parks in the United Kingdom has been mixed. While some are very successful, such as the Cambridge science park, many others remained too small to achieve critical mass. According to Rowe (2002), there are many parks which appear to have little sense of direction, allied to low growth. Rowe regards this fact as a bad sign. UK science parks in aggregate risk being seen as “yesterday news”. Many UK science parks are in a hiatus period where they are re-evaluating their position and will emerge with new objectives and a new sense of direction in due course.

In short, despite the wider recognition of the value of science parks, these bodies have not always enjoyed a positive following. According to Parry (2000), in the 1980s they were regarded as “high tech fantasies” and were criticised for failing to be effective vehicles for technology transfer. However, the statistical record of their development which has been kept by UKSPA since 1984, clearly demonstrates that some of the early fears about the shortcomings of science parks have not materialised (Parry, 2000). In the 21st century, the UK government and many mainstream property companies have begun to recognise the value and importance of science parks in terms of economic development (Parry, 2000). The Government is committed to developing a knowledge-driven economy in the UK, through developing new businesses and industries using new technologies and knowledge. Science Parks have a significant role to play to this aim.

5. CONCLUSION

In the knowledge-based economy innovation policies are pivotal (Salter *et al.*, 2000; Borràs, 2003). The United Kingdom chose a policy of renewal in this field, according to new strategies of the Labour government. The focus now is on where government can really make a difference by investing in science and innovation, supporting skills and setting the overall market framework (DTI, 2004). It also seems that the Government is recognising the fact that in order to promote innovation to enhance global competitiveness, many of the policy actions need to be delivered at the regional level (Frenz, Michie and Oughton, 2004).

The UK government is taking steps to promote science and innovation through increase in investment and by encouraging the commercial potential of primary re-

search. The aims are to implement the ten-year science and innovation investment framework, taking forward the recommendations of the *Lambert* review of business-university collaboration (HM Treasury, 2004b). We are assisting to an increasing pressure on universities to work with business all around the UK (Harding, 2004). The Treasury and the Department of Trade and Industry (DTI) have led move to prioritise the knowledge-based economy and have recognised the broader role for universities in generating and transferring knowledge to industry (Harding, 2004). In the latest years, the United Kingdom has reached some progress in university-business partnerships, has assisted to an increasing tendency to move R&D into the private sector and has acquired awareness of an increasing dynamic role for policy. The devolution process is still in progress and has showed its first implementation results. According to Frenz, Michie and Oughton (2004), it's important not only for firms to co-operate with universities and others to access new knowledge, but also that firms need to have the necessary absorptive capacity if they are to benefit fully from the potential that such co-operation offers. To get the most from such arrangements firms need to be "learning organisations".

In the field of business-university relationship, science parks make a significant and distinctive contribution to the UK's economic infrastructure. According to the ANGLE Technology research (2003), the accommodation they provide is valued by tenants and the overall commercial performance of the companies based on them is better than similar firms located off-parks. There is, however, a number of specific areas where there is potential for the science park movement to enhance its contribution to the development of the knowledge-based economy in the UK.

In a knowledge based economy businesses are expected to choose places where they can recruit knowledge workers, either because they are already present or because the places will be attractive to them (Wicksteed, 2004). Besides, of greater importance is effective networking, at a national and international level. Finally, the presence of talented people, who can well be internationally mobile, is an advantage that can favour the success of a new initiative (Wicksteed, 2004). All these factors underlined by Wicksteed (2004) are taken into account and can be found in the most successful science parks, such as the Cambridge one. Also according to Rebecca Harding, networks, alliances, sectoral specialization, flexibility and dynamism are taken into account in the debate on the centrality of technology for competitiveness. These priorities, together with the power of the regions, may be defined as the sources of innovation in the UK (Harding, 2002; Harding, 2001).

Success will, however, depend on implementation. It's too early to say if these reforms will be positive and how much they'll improve the business environment.

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