

Arthur D Little

**The Social and
Economic Impact of
Publicly Funded
Research in 35
Participating
Universities**

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Executive summary

This report focuses on the social and economic impact of research in universities other than the major research intensive institutions. Using information gathered from a group of 35 such universities, the study examines the nature of their research portfolio and its significance in relation to the concerns and needs of key stakeholders.

Our overall conclusion is that **the research base of institutions of the type broadly represented by the participating universities represents an important, distinct and valuable component of the wider UK research base.** It is a component which, while smaller than that of the research intensives, adds to the diversity, accessibility and knowledge transfer capability of UK higher education. It is in many respects complementary, not merely additional, to the work of the research intensive universities. The social, economic, scientific and technological research base of the participating universities is supportive of many important areas of industry, commerce, public services and public policy.

Building on a modest investment in research from the funding councils and the research councils, the participating universities (PUs) attract very substantial additional contract research from a diverse range of customers. **The scale of this leverage effect, compared to that at other universities, is striking.** It is over two and half times as great as for other HEIs with respect to contract research from UK public bodies; over twice as great with respect to UK industry; and four times as great with respect to EU funding.

PUs tend to work in research areas of economic, cultural and social relevance that have relatively small infrastructure costs, with less emphasis on “big science” than the research intensives, and with strong applied, practice based and policy research. A variety of PUs have been able to achieve steady enhancement in research excellence through focus and investment, helping to sustain the diversity and vibrancy of UK academic research, and providing environments conducive to multidisciplinary research.

The Government’s Science and Innovation Investment Framework “Next steps” document stresses the importance of maximising the effectiveness and economic impact of investment in the research base. To that end, it places priority on a science and innovation system that is responsive to public policy priorities, encourages greater interaction between industry and the research base in a variety of ways, and ensures that science, technology, engineering and mathematics (STEM) subjects are attractive to students. **Research in the PUs addresses all these facets of the ‘Next steps’ agenda.**

PU research is highly relevant to the **policy agendas of a wide range of government departments and other public agencies**, both national and regional. PUs serve these customers effectively, a fact reflected in the level of contract research secured from government and public bodies. In addition to securing very considerably more contract research in proportion to underpinning public (funding council and research council) investment in the research base than other universities, they help to inform policy across numerous areas of public importance.

PU participation in **European research programmes** is high, compared to the public research base investment, and they are highly effective in attracting EU funds to the UK

Both quantitative and qualitative evidence highlight the strong role played by PUs in supporting the **regional regeneration and economic development** agendas

PUs have research relationships with **multinational and national industries**. Their success in securing research contracts from many of the leading UK and international private sector R&D investors demonstrates confidence in important areas of PU research capability. For example, PUs cited links with all the top 10 R&D investors in the 2005 DTI R&D Scoreboard.

At the other end of the company size scale, PUs have extensive research-based links to **SMEs**, reflected in high levels of participation in knowledge transfer partnerships. In addition, they are particularly well placed to provide the necessary research base for emerging industries. PUs participate strongly in Knowledge Transfer Partnerships, many of which benefit considerably from the underpinning research base. In addition, they are particularly well placed to provide the necessary research base for emerging industries.

The value of the **physical proximity** of universities with high quality research capability is highlighted by the **Lambert review** of business-university collaboration and is stressed by large as well as small firms. The location of many of the PUs in urban areas without a more research-intensive HEI enables them to play a role within a local and regional context which cannot be provided by research intensive universities, and which would be severely compromised by excessive research concentration.

Businesses look to universities for **people** even more than for research outputs. Ability to attract and retain the necessary skills is key to the UK's ability to secure internationally mobile R&D investment – a national priority. PUs play an important role in helping to ensure the necessary skills supply, both of graduates trained through specific research experience and of those whose undergraduate teaching has benefited from being undertaken in an institution with a vibrant research community.

1. Introduction

This report presents the findings of a study commissioned by 35 participating universities (PUs). These universities are for the most part, but not exclusively, from the post-1992 generation, in contrast to the research-intensive institutions that account for the majority of research funding.

The PUs include the following:

- Abertay
- Anglia Ruskin
- Bath Spa University (awarded University status in March 2005)
- Bolton
- Bradford
- Coventry
- De Montfort
- Derby
- Glasgow Caledonian
- Gloucestershire
- Greenwich
- Hull
- Kingston
- Leeds Metropolitan
- Liverpool John Moores
- London Metropolitan
- London South Bank
- Luton
- Manchester Metropolitan
- Middlesex
- Northumbria
- Paisley
- Plymouth
- Roehampton
- Salford
- Southampton Solent (awarded University status in July 2005)
- Staffordshire
- Sunderland
- Teesside
- Thames Valley
- University of Central England at Birmingham
- Central Lancashire
- East London
- Westminster
- Wolverhampton

These institutions have viewed with concern some of the implications of Government policy in relation to research at PU Higher Education Institutions (HEIs), and have commissioned this study to contribute to the evidence base necessary for those implications to be more fully assessed. Specifically, they asked the study team to examine the types of impact that research in the participating universities (PUs) may have, either directly or indirectly. The study draws upon publicly available information held by the Higher Education Statistics Agency (HESA), Higher Education Funding Council for England (HEFCE), Scottish Funding Council (SFC), and results of the 2001 Research Assessment Exercise (RAE) as well as information provided by the PUs. The outputs of the study are designed to support and inform a programme of engagement with appropriate bodies at national and regional level.

This report concerns only those impacts of the PUs that depend in a material way on the existence of a *research* base, which is funded in part by the public sector. Clearly, the PUs have a broad range of impacts on their host communities and wider society through a diverse set of activities. Whilst the research base is vital to the majority of these activities, some activities are not dependent on the research base. These, and the impacts that result, are outside the scope of this study, however the study team recognize their significance.

1.1 Structure of the report

This report has been structured to address the issues of primary importance to the main stakeholders and users of PU research, including:

- Higher education funding councils and the Office of Science and Innovation
- Policy makers in central and regional government
- Business and industry

Chapter 2 looks at the context for research in relation to the needs of these stakeholder groups, taking account of major policy priorities documented by a number of Government departments including points made in the Government's recent document "Science and innovation investment framework 2004-2014: next steps", issued in conjunction with the 2006 Budget. Although this document was published while the present study was under way, it brings together issues of importance to HM Treasury and the three other sponsoring Departments: Trade and Industry; Health; Education and Skills. Chapter 3 summarizes the main characteristics of the PUs' research portfolios, and asks what is distinctive about these research portfolios (noting that PUs are themselves diverse in their research emphasis, as in other aspects of their work). Chapter 4 then examines the impacts and significance of PU research on key users, and considers the significance of PU research at national, regional and sub-regional level.

Chapter 5 draws out some important conclusions and issues for further consideration by the PUs themselves and by policy makers and funding agencies. Finally, appendices provide further detail drawn from survey responses and supporting information.

2. The context for research

Recent trends in funding of universities suggest that governmental policy on support for research is moving towards the concentration of research activity in a decreasing number of “research-intensive” institutions. Such a move is supported by some institutions but in general there is real concern about the impacts such a policy would have on the quality and diversity of the Higher Education (HE) sector and the supply of appropriately qualified individuals to support a knowledge-based economy for the UK.

Any examination of these issues in more detail must take account of the differing interests and concerns of the main stakeholder or user groups, and so we consider these briefly below.

2.1 Higher education funding agencies and the Office of Science and Innovation

The purpose of the HE funding agencies, such as the Higher Education Funding Council for England (HEFCE) and the Scottish Funding Council (SFC), is to “promote high quality education and research, within a financially healthy sector” by providing public funding for both teaching and research to universities and other higher education institutions. They do not, in general, attempt to prescribe how individual institutions should discharge their responsibilities, though they do promote good practice and consider intervention where necessary in relation to subjects that are both strategically important and vulnerable – the latter as reflected either by an imbalance between supply and demand, or by a concentration of the subject in institutions which may be particularly vulnerable to change.

In relation to research, the Funding Councils’ objective is expressed by HEFCE¹ in terms that merit quotation in full:

“Our strategic aim is to develop and sustain a dynamic and internationally competitive research sector that makes a major contribution to economic prosperity, national wellbeing and the expansion and dissemination of knowledge.

To sustain our research base against global competition we must recognise and support excellent research financially, and foster effective collaboration.

¹ See www.hefce.ac.uk

HEFCE continues to develop a selective funding system that allocates our grant primarily by reference to robust assessments of research excellence and also works to maintain and develop the research infrastructure. A key feature of a world-class research system is its openness and ability to change. We wish to enable researchers to respond to new trends and developments in their disciplines and in the research environment, and to pursue new fields of enquiry. Our funding arrangements nurture and respond to these as well as recognising established excellence.”

Under the dual support system, the role of the Research Councils, funded by the Office of Science and Innovation (formerly Office of Science and Technology) is complementary to that of the Funding Councils. The Research Councils provide funding for university research, whether through specific programmes or in responsive mode, on the basis of the excellence of the research proposed and in line with priorities set out in their own Corporate Plans.

For the purposes of this report, we draw a distinction between on the one hand, the roles of the Funding Councils and OSI through the Research Councils; and on the other, the roles of other Government departments and public agencies. We consider the former as concerned to support and sustain an excellent research base for the UK academic sector as a whole; and the latter as *users* of, i.e. customers for, that research base and the institutions that house it.

2.2 Central Government, other Government Departments and public agencies

The Government’s recently released Science and Innovation Investment Framework “Next steps” document² outlines the UK’s vision for the support of university research and the way in which this support should be implemented. A key consideration of the document is the way in which the “effectiveness and economic impact” of investment in the research base can be maximised. To this end, the document sets out three priority mechanisms which are designed to re-align the UK research base with the needs of the economy. These mechanisms include:

- Improving the strategic management of investment in science and innovation, to ensure that the UK’s science and innovation system is more responsive to public policy priorities, and that different funding mechanisms are coordinated more effectively to deliver the objectives set out in the Science and Innovation Investment Framework 2004-2014. This will enhance business confidence in the value of engaging with UK science

² Science and innovation investment framework 2004-2014: next steps, March 2006

- Ensuring that the right skills and brokering mechanisms are in place to encourage greater collaboration between industry and the research base, and enable businesses and the science base to interact in a range of ways to suit their needs
- Making STEM subjects more attractive to students, to ensure a highly skilled and diverse workforce to drive future innovation and growth

The document notes that “user-focused and interdisciplinary” research, to which the PUs tend to align themselves to a substantial degree, will be rewarded. Moreover, health research (an area in which the UK has traditionally been strong) is identified as a key lever for the retention of business investment in R&D, as evidenced by the ring-fencing of the DoH R&D budget and the formation of a new health research fund of at least £1 billion per annum (jointly held by the Secretaries of State for Health and Trade and Industry). The participating universities have notable strengths in health R&D and are therefore likely to offer much to the delivery of the “next steps” document in this regard.

The document reaffirms the Government’s commitment to the underpinning dual support system, which encourages universities to undertake strategic responsibility for their research portfolios, thereby allowing for blue-skies research and generating the flexibility required to swiftly respond to market conditions. More straightforward and metric-based RAE and QR funding systems are to be implemented, which will seek to encourage all types of research, from “curiosity driven” to “user-focused”. This will facilitate the development of a well-networked knowledge-based economy, in which applied and practice based research, in which the PUs have considerable capability and strength, remains an important function rather than a lower-value “add-on” to the big science undertaken mainly by the more research-intensive universities.

In order to encourage the transfer of knowledge from the research base, the Government is supporting three key initiatives. These include the Higher Education Innovation Fund (HEIF), Knowledge Transfer Partnerships (KTPs) and Knowledge Transfer Networks (KTNs). The role of HEIF is to apply a formula-based funding system in order to financially support a “wider range” of institutions. KTPs provide funding for researchers to undertake strategically important projects for a company and KTNs, which form part of the Technology Strategy, act to assemble stakeholder networks in order to support the sharing of information and knowledge transfer in the relevant technology areas. The PUs can add significant value in this respect, since their working practices can be more consistent with such initiatives than those of the research-intensive universities.

The importance of Science, Technology, Engineering and Mathematics (STEM) skills is also noted throughout the “next steps” document. Mechanisms such as the Continuing Professional Development (CPD) of science teachers and initiatives to increase interest in STEM subjects are supported by the presence of local HEIs, and PUs represent a valuable part of the regional community in this regard.

Whilst the Government’s “next steps” document² outlines the UK’s fundamental science and innovation objectives and the steps required to achieve these, Government departments also have their own policy agendas. Table 1 summarises these policy agendas.

Considerable policy responsibilities have been assigned to the devolved administrations in Scotland, Wales and Northern Ireland and, particularly since 1997, to the nine English regions. Each of the latter has its own Regional Economic Strategy, and the Regional Development Agencies (RDAs), created in 1999 (later in London) are responsible for the periodic revision of these strategies and for leading their delivery. In doing so, they are themselves important customers for research, for example in order to generate the evidence base for regional strategy formulation and to underpin policy at the regional level. Moreover, all of the RDAs recognise the importance of their regional research base in supporting and enhancing a knowledge-led economy. They have sought both to enhance selected aspects of research capability in universities and elsewhere, and to foster improved knowledge transfer and industry linkage under the leadership of regional Science and Industry Councils.

In the devolved administrations and most especially in Scotland, powers and responsibilities are more extensive. One reflection of this is budget – the Scottish Executive will manage a budget of over £30 billion in 2007-08, as compared to several hundred £m for a typical RDA - though the RDAs exert direct or indirect influence over considerably greater sums. Matters devolved to Scotland include health, education and training, local government, social work, housing, planning, tourism, economic development and financial assistance to industry, aspects of transport, law and home affairs, the environment, natural and built heritage, agriculture, forestry and fishing, sport and the arts. The Scottish Executive therefore assumes policy responsibilities mirroring most of the Whitehall departments in table 1. Its departments are significant research customers; it funds research in universities and elsewhere; and it attaches considerable importance to the maintenance of a strong Scottish research capability (see for example the Scottish Executive’s February 2006 progress report on "A Science Strategy for Scotland 2001" for a recent update).

Table 1: Policy agendas of Government Departments and selected public agencies

Department	Policy Areas	Description
DCLG / former ODPM)	Building Regulations, Civil Resilience, Fire and Rescue, Homelessness, Housing, Local Government, Neighbourhood Renewal, Planning, Regions, Social Exclusion, Sustainable Communities, Urban Policy	<p>Ensuring health and safety of people in buildings; ensuring UK resilience to major incidents (e.g. terrorist strike); reducing fire-related deaths and homelessness; bringing national policy to local government; improving quality of life in impoverished areas; efficient town planning; creating thriving and sustainable communities</p> <p>The Department needs to draw on an unusually wide range of research, from civil engineering, construction and safety technology to economic and social sciences. As with Defra, sustainability is a key theme across many fields of the Department's work</p>
HM Treasury	Enterprise & productivity, Financial management, Financial services, International issues, Public private partnerships, Public spending & services, Tax work & welfare, UK economy	<p>Maintaining macroeconomic stability; making microeconomic reforms; management of financial resources; ensuring innovative, fair and competitive financial services market; encouraging international financial stability; Private Finance Initiatives (PFIs); investment in public services; improving tax and benefit system</p> <p>The Treasury draws upon financial, economic and modelling research. In recent years it has also taken an increasingly 'supervisory' role covering many aspects of science and innovation, and so an understanding of the broad sweep of R&D relevant to the formulation and delivery of public policy and to innovation, productivity and competitiveness in UK industry, is also of great relevance</p>
DTI	Supporting successful business, Promoting science and innovation, Ensuring fair markets	<p>Implementing support initiatives for successful business (e.g. Manufacturing Advisory Service); investment in research and knowledge transfer; implementing initiatives to encourage dynamic markets to increase productivity and innovation</p> <p>DTI require an understanding of the relevance of scientific and other research to the many industry sectors for which the Department has responsibility. Within the Department, the Office of Science and Innovation combines the task of funding the Research Councils with broader responsibilities for promoting the effective use of science by Government, sustaining an innovation-friendly environment within the UK, facilitating the development and implementation of a UK-wide technology strategy (through the business-led Technology Strategy Board), and promoting the UK's participation and reputation in international research</p>

Department	Policy Areas	Description
Defra	Sustainable Food and Farming, Animal Health and Welfare, Environment, Natural Resources and Rural Affairs	<p>Developing strategy for farming industry; managing health and welfare of animals; protecting the environment; improving productivity of weak rural areas</p> <p>Defra's policy responsibilities make extensive demands on research, primarily but not solely in support of policy. Examples include flood modelling and flood protection engineering; food and veterinary science; radioactive and non-radioactive waste management; and sustainable development. A clear shift towards a greater emphasis on environment and climate change has been signalled by the Department's Evidence and Innovation Strategy. As in other Government departments, research that can reduce costs (e.g. through less expensive surveillance methods) is highly relevant</p>
Department of Health	Health and Social Care, Organisation, Human Resources and Training, Patient Choice, Emergency Planning, Medicines, Pharmacy and Industry, R&D, Equality and human rights	<p>Polices on health and social issues; improving organisation of NHS; increasing patient choice; formulating NHS contingency plans; managing health R&D; managing pharmaceutical relationships; ensuring equality of access to healthcare</p> <p>Health research is obviously key to the Department, and includes work on primary healthcare and practical service delivery as well as more 'upstream' aspects. Social and economic research is vital alongside the natural sciences</p>
DfES	Children, Young People and Families, Early Years and Childcare, Primary schools, Independent specialist schools, Personalisation and choice in the secondary years, Education and skills, Adult skills, Higher education, The People to Deliver	<p>Strategies for child welfare, childcare, primary schools, independent specialist schools and secondary schools; curriculum reform for 14-19 year olds; devising initiatives to support adult skills agenda; implementation of Higher Education Act 2004; ensuring suitably trained and competent staff</p> <p>Research on education itself and allied aspects of the social sciences is a foundation for evidence-based policymaking in this area</p>
Mayor of London	Air Quality, Biodiversity, Culture, Economic Development, Noise, Spatial Development, Transport, Waste, Other	<p>For London: Improving air quality; maintaining biodiversity; ensuring quality and diversity of culture; investment to promote economic development; reducing noise levels; managing growth; managing transport issues (e.g. congestion); managing waste</p> <p>Research relevant to transport, culture, sustainability and the build environment are of obvious importance. London's interests are reflected in many respects in those of other regions and large city authorities. Frequently, major local authorities work together to commission and learn from research conducted by academics and others</p>

Department	Policy Areas	Description
Regional Development Agencies (RDAs) and devolved administrations	Economic development & regeneration, Business efficiency, investment and competitiveness, Employment, Skills, Sustainable development	<p>Regional priorities include regenerating run-down sites; improving productivity; encouraging investment; creating employment; improving skills; encouraging sustainable development</p> <p>While regional strategies differ, a central trend since the creation of the RDAs in 1999 has been the devolution of responsibility from national Government to regional development agencies. This has included responsibility for many aspects of the innovation and enterprise agenda, in which all RDAs and the devolved administrations are extremely active. They have drawn upon research relevant to sustainable regional economic development, and they have become increasingly important stakeholders in R&D within their regions (for instance, by funding or co-funding the creation of centres of R&D excellence in order to promote innovation and cluster development)</p> <p>All the RDAs have faced a challenge in developing the skills and understanding to take on these R&D-related responsibilities, but they have worked closely with universities and others to support and make the most of research excellence in their respective regions. RDA Boards typically include current or former university Vice Chancellors, while engagement with major private sector R&D performers is achieved through regional Science and Industry Councils or equivalent, now established in all nine English regions.</p> <p>Devolved administrations, particularly in Scotland, have very much wider devolved powers mirroring those of most Government departments listed above.</p>

Sources: <http://www.odpm.gov.uk/>, <http://www.hm-treasury.gov.uk/>, <http://dtiinfo1.dti.gov.uk/>, <http://www.defra.gov.uk/>, <http://www.dh.gov.uk/Home/fs/en>, <http://www.dfes.gov.uk/>, <http://www.london.gov.uk/>, <http://www.englandsrdas.com/home.aspx>

2.3 Business and industry

Business and industry constitute increasingly important customers of, and partners with, the publicly-supported research base. Internationally, there are well established trends towards greater outsourcing of research and technology and towards R&D through alliances and collaborations embracing other firms, academic institutions and/or other research providers, as distinct from R&D conducted within large in-house corporate laboratories. This trend to ‘open innovation’ represents a massive opportunity for the broad research community in academia and elsewhere, particularly in a country such as the UK which has a demonstrably excellent record both for the excellence of its research and for its cost-effectiveness.

Academic institutions already collaborate extensively with companies and over the sector as a whole, around a tenth of competitively-won research grant and contract income is obtained from UK industry, commerce and public corporations (those which act like companies even though they are publicly owned). The motivations for companies to work with universities, and for choosing which particular universities to work with, typically involve pre-eminently the excellence and relevance of the science or technology concerned but also the attitudes, responsiveness and flexibility of the institutions and their staff – both the researchers themselves and the administrative and managerial colleagues with whom they have to deal. Additionally, intellectual property arrangements are among the key factors considered – with the template ‘Lambert’ agreements an asset in speeding up collaborations. Companies experienced in R&D co-operation frequently work with a wide variety of academics in both research-intensive and other institutions.

Two further factors are important in the context of this report.

First, *proximity* is a significant factor, especially when teams working on a project need to come together – increasingly the case as company personnel look to work with colleagues in universities, rather than just fund them and let them get on with it. The significance of proximity is readily understood in relation to smaller and medium size enterprises (SMEs). As the Lambert review commented:

“...proximity matters when it comes to business collaboration, especially for small and medium-sized enterprises (SMEs). Informal networks cannot easily be sustained over long distances, and even large companies may find it more efficient to work with research departments in their own locality. So it is very important that research departments with distinctive areas of expertise should continue to flourish right across the country.” (p.13)

“...Proximity is especially important for SMEs, which do not have the time or knowledge to identify relevant expertise a long way from home. So it is important that SMEs around the country should continue to have close access to research departments which are generating valuable ideas for the regional economy. Some high-technology SMEs look to world-class university departments for their collaborations, but even these will choose universities in their region wherever possible.” (p71)

Interestingly, the value of proximity is stressed by very large multinationals as well as smaller firms. For the former, a partner must be world-class: but if it is, the fact that it is an hour's drive away rather than a day's flight makes a vital difference. The Lambert review drew upon work by Arthur D. Little in this connection:

“Businesses are clear that proximity does matter. Personal contact is the best form of communication, and distance affects the capacity of firms to collaborate with universities. This applies to large firms in strategic university relationships as well as to SMEs with a more regional outlook. Research by Arthur D. Little on behalf of the RDAs confirms this point: ‘Physical proximity is important in scientific collaboration. The era of the Internet does not remove the need to build relationships by personal contact, even if they can then be sustained through electronic means. Indeed ... the importance of proximity is growing, because of an increasing need for companies to look outside for technology, ideas and co-operation.’” (p.70)

The review went on to quote evidence from the Community Innovation Survey (CIS) to show that “proximity matters to firms of all sizes”. The Table below, taken from the Lambert report, sets out the results of an analysis of the CIS data on UK-based firms that collaborate with universities and shows that “firms with local markets chose to work with a local university in almost 90 per cent of their collaborations. Firms with regional or national markets chose to collaborate with their local universities between a third and a half of the time. Even companies with international markets work with their local universities in a quarter of their collaborations.”

Table 2: UK business-university collaborations split by market size of company and university location

Location of university	Type of firm's largest market		
	Local	National	Overseas
Local	88%	12%	0%
Regional	47%	53%	0%
National	37%	47%	16%
International	26%	48%	26%
All	36%	46%	18%

Source: Community Innovation Survey, (UK), DTI/ONS, 2001

In relation to research concentration, Lambert concluded:

“For business-university collaboration, proximity matters. Business-university collaboration would not be well served by a university research funding system that increasingly concentrated more resources on fewer universities. If more small and medium-sized companies are to work with universities on research and innovation then a broader distribution of resources is desirable.” (p. 89)

Secondly, firms often look to universities less for research outputs in the form of technology, intellectual property and new knowledge, than for *people* – individuals trained in research and with the rigour, skills and intellectual grounding that companies need in their staff if they are to maintain competitiveness, as well as specific technological knowledge in some instances.

This issue of trained people is of varying concern depending on several factors:

- Geographic region – it can be harder to attract and retain staff in some localities than others. The presence of a university affects this in at least three ways. First, it helps to enhance the pool of bright, able people available in the locality, and to retain talent locally – for instance, it can be easier to attract able young people as students to a location and then retain them after graduation than to attract them as graduates from another region. Second, it provides capacity and infrastructure for further training, skills support and professional development. Third, it generally adds to the cultural, sporting and entertainment amenities of a town or city
- Sector – companies in some sectors, such as major pharmaceutical firms, are able to make a more attractive proposition in financial and career development terms than their counterparts in other sectors

- Discipline – the supply of able graduates in science, technology, engineering and mathematical (STEM) disciplines is of major concern with some disciplines, such as chemistry, potentially critical. The ability to recruit good chemists, for example, could be a real factor in shifting R&D in key industries overseas. Some of the required graduates will need research experience: most others will benefit from training in an institution where research adds to the vitality of the academic community and helps attract high quality academic staff. Consequently, this critical aspect of skills supply will be safeguarded by maintaining a broader base of institutions maintaining a sound research capability in the relevant disciplines and in fields that cross the boundaries between them.

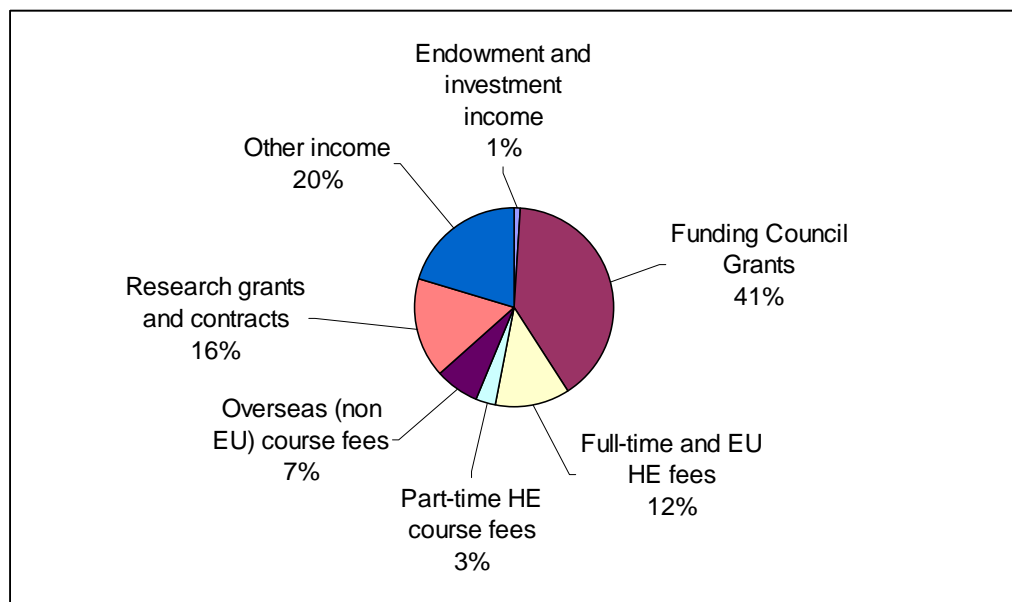
The importance of a strong university base, including a research component, is clearly evident.

3. Characteristics of the research portfolio of Research Partner Universities

The research portfolio of the PUs has some distinctive characteristics including the orientation to applied and practice-based disciplines rather than “big science”. Several PUs have been able to achieve steady enhancement in research excellence through focus and investment and the sector as a whole now attracts a healthy and diverse range of grant and contract research income.

There are 125 university institutions in the UK; 13 in Scotland, 12 in Wales and 2 in Northern Ireland; between them they employ 150,230 academic staff³. These institutions are very diverse organisations with large variations in size, mission, discipline mix, history and culture but all are self-governing and independent and authorised to confer degrees. The total income for UK HEIs in 2003/2004 was £16.9 billion, of which 16% comes from research grants and contracts (Figure 1)⁴.

Figure 1: Sources of income for the HE sector



Source: UUK based on HESA data

³ Universities UK

⁴ Ibid

There is significant variation in the composition of the research portfolio across the HE sector. In general, HEIs which have the largest research grant and contract income are those which have established medical schools and large science departments.

Table 3 details the discipline base of the PUs, based on submissions to the 2001 RAE. This suggests that PUs tend to orient themselves somewhat more towards applied and practice-based research and, with the exception of biological sciences and general engineering, less towards “big science” research (e.g. medicine, chemistry, physics) than research-intensive universities. At the same time, PUs also exhibit strengths in areas such as the arts and humanities that would not be classed as ‘applied’ though they do often have a bearing on cultural and creative sectors of the economy and society.

We do recognise, in addition, that many institutions have undergone significant changes in their research portfolio since 2001.

Table 3: Research areas in which HEIs made submissions in the 2001 RAE

UoA	Number of UoAs		Proportion of total UoAs (%)	
	Participating Universities	Other HEIs	Participating Universities	Other HEIs
Business and Management Studies	33	64	5.9	3.1
Art and Design	27	48	4.8	2.4
History	24	71	4.3	3.5
Other Studies and Professions Allied to Medicine	22	53	3.9	2.6
Education	21	62	3.8	3.0
English Language and Literature	21	68	3.8	3.3
Psychology	21	52	3.8	2.5
Computer Science	20	60	3.6	2.9
Communication, Cultural and Media Studies	19	19	3.4	0.9
General Engineering	19	29	3.4	1.4
Politics and International Studies	19	50	3.4	2.5
Environmental Sciences	15	19	2.7	0.9
European Studies	15	26	2.7	1.3
Built Environment	14	23	2.5	1.1
Geography	13	49	2.3	2.4
Nursing	13	30	2.3	1.5
Social Policy and Administration	13	34	2.3	1.7
Sociology	13	35	2.3	1.7
Applied Mathematics	12	46	2.2	2.3
Law	12	48	2.2	2.4
Sports-related Subjects	12	22	2.2	1.1

UoA	Number of UoAs		Proportion of total UoAs (%)	
	Participating Universities	Other HEIs	Participating Universities	Other HEIs
Biological Sciences	11	65	2.0	3.2
Music	11	48	2.0	2.4
Library and Information Management	10	13	1.8	0.6
Mechanical, Aeronautical and Manufacturing Engineering	10	37	1.8	1.8
Social Work	10	20	1.8	1.0
Drama, Dance and Performing Arts	9	31	1.6	1.5
Electrical and Electronic Engineering	9	36	1.6	1.8
Metallurgy and Materials	9	21	1.6	1.0
Philosophy	8	36	1.4	1.8
History of Art, Architecture and Design	7	32	1.3	1.6
Statistics and Operational Research	7	39	1.3	1.9
Town and Country Planning	7	21	1.3	1.0
Theology, Divinity and Religious Studies	6	37	1.1	1.8
French	5	38	0.9	1.9
Iberian and Latin American Languages	5	27	0.9	1.3
Agriculture	4	14	0.7	0.7
Economics and Econometrics	4	37	0.7	1.8
Linguistics	4	20	0.7	1.0
Physics	4	46	0.7	2.3
Pure Mathematics	4	43	0.7	2.1
Accounting and Finance	3	17	0.5	0.8
American Studies	3	10	0.5	0.5
Asian Studies	3	10	0.5	0.5
Chemical Engineering	3	14	0.5	0.7
Chemistry	3	42	0.5	2.1
Civil Engineering	3	28	0.5	1.4
German, Dutch and Scandinavian Languages	3	39	0.5	1.9
Hospital-based Clinical Subjects	3	28	0.5	1.4
Anthropology	2	18	0.4	0.9
Earth Sciences	2	23	0.4	1.1
Food Science and Technology	2	9	0.4	0.4
Italian	2	17	0.4	0.8
Pharmacy	2	10	0.4	0.5
Archaeology	1	25	0.2	1.2
Clinical Laboratory Sciences	1	24	0.2	1.2
Anatomy	0	7	0.0	0.3
Celtic Studies	0	15	0.0	0.7

UoA	Number of UoAs		Proportion of total UoAs (%)	
	Participating Universities	Other HEIs	Participating Universities	Other HEIs
Classics, Ancient History, Byzantine and Modern Greek Studies	0	26	0.0	1.3
Clinical Dentistry	0	14	0.0	0.7
Community-based Clinical Subjects	0	31	0.0	1.5
Middle Eastern and African Studies	0	11	0.0	0.5
Mineral and Mining Engineering	0	3	0.0	0.1
Pharmacology	0	9	0.0	0.4
Physiology	0	11	0.0	0.5
Pre-Clinical Studies	0	6	0.0	0.3
Russian, Slavonic and East European Languages	0	17	0.0	0.8
Veterinary Science	0	6	0.0	0.3

Source: 2001 Research Assessment Exercise Results

The applied research portfolios of PUs are clearly distinct from those of the more research-intensive universities, which have a strong emphasis on internationally competitive blue-skies research. Much of the strength of PUs lies in the complementary and equally key area of translation and moulding of research outcomes into end-user situations.

That said, it would be a mistake to assume that the contribution of the PUs does not attain an international standard of excellence. The 2001 RAE data prove the contrary: some 36 different subject areas from 14 different institutions were graded 5 or 5* (definitions of the grading system are provided in

Table 4), and many institutions can point to further improvements in the five years since the last RAE. Several PUs cite examples of progressively enhanced research excellence in RAE terms through a process of focussing on a small number of research areas, creation of multidisciplinary research environments and the strategic allocation of core funding (e.g. QR, SRIF). Examples of this are provided in Table 5.

Table 4: Definitions of grading system

Grade	Description
5*	Quality that equates to attainable levels of international excellence in more than half of the research activity submitted and attainable levels of national excellence in the remainder
5	Quality that equates to attainable levels of international excellence in up to half of the research activity submitted and to attainable levels of national excellence in virtually all of the remainder.
4	Quality that equates to attainable levels of national excellence in virtually all of the research activity submitted, showing some evidence of international excellence.
3a	Quality that equates to attainable levels of national excellence in over two-thirds of the research activity submitted, possibly showing evidence of international excellence.
3b	Quality that equates to attainable levels of national excellence in more than half of the research activity submitted.
2	Quality that equates to attainable levels of national excellence in up to half of the research activity submitted.
1	Quality that equates to attainable levels of national excellence in none, or virtually none, of the research activity submitted.

Source: https://admin.hero.ac.uk/rae/Pubs/4_01/section3.htm

Table 5: Examples of research areas which have demonstrated improved performance in RAE between 1996 and 2001

Institution	Research area; change in RAE rating between 1996 and 2001	Strategy employed
Anglia Ruskin	English; 3a to 5	Targeted recruitment of promising researchers; personal published targets; timetabling to provide research time; strategic collaboration with other institutions; focus on limited number of research themes; support for supervisors
Bradford	Medical Biosciences; 1 to 5	Investment in leadership and research facilities; promotion of researchers; strong links to industry and charities
Coventry	Electric and Electronic Engineering; 1 to 3a	Focus on core strengths; reduction in number of researchers submitted to RAE; pump-priming funding to recruit post doctoral researchers and PhD students
De Montfort	English: 3b to 5	Effective leadership; identification of niche for research
Glasgow Caledonian	History; 2 to 4	Strategic investment in small number of areas
London South Bank	English; created in 1998 (not submitted in 1996) to 4	Strategic recruitment of research staff; concentration on small number of areas

Institution	Research area; change in RAE rating between 1996 and 2001	Strategy employed
Plymouth	Psychology; 3a to 5 Computational Neuroscience; 3b to 5	Selective funding of areas of strength and which demonstrated potential for growth
Roehampton	History; 3a to 5	Strategic appointments (3)
Salford	Library and Information Management; 4 to 5*	Development and recruitment of senior staff in a very specific area, built critical mass from EU funding stream
Teesside	History; 3a to 5	Allocation of funds to department to develop strong research themes; recruitment of staff to cover research leave; investment in facilities and travel funding

Source: Arthur D. Little analysis of questionnaire survey

The capacity to achieve such enhancements and to compete effectively in open competition is directly related to track record, critical mass of research active staff and appropriate facilities and infrastructure. Consequently, the impact of the decision following the 2001 RAE to fund only those areas which achieved a 4 is widely recognised as having a hugely detrimental impact on the less research-active PUs and on research capacity. In previous years where funding, albeit at a lower level, was available for grades 3 and 2, the non-research intensive PUs were able to commit core funding to growing research capabilities of national significance. Withdrawal of this funding stream has led to the closure of research areas and loss of staff - for example, in one PU which had four areas rated 3 in 2001, three have closed and the one which survives lacks sufficient critical mass to be recognised in its own right.

Given the lack of core funding for research, the PUs have taken strategic decisions to focus research activity, although across the group as a whole coverage remains broad. Areas on which institutions have focused include disciplines which are generally applied and practice-based with close links with professions and end users. Such disciplines include subjects allied to medicine (e.g. ophthalmology, physiotherapy, occupational therapy), nursing, sports sciences, social policy, social work, media and communications, art and design, environment and education. Experiences elsewhere suggest that such disciplines do not always lend themselves easily to metrics used in RAE and to publications in the most prestigious journals. Given that the funding for individual projects in these disciplines is likely to be significantly less than in laboratory / clinical based disciplines, it is not unreasonable to expect that total income will be less than for HEIs with a large science base. These research centres/units are generally multidisciplinary but are dependent on a small number of key individuals. This lack of critical mass and institutional flexibility to recruit and retain such individuals is recognised by the PUs as potentially damaging to the research portfolio.

3.1 The makeup of research funding

Funding Council support for the research base of HEIs is composed of the “QR” allocation together with certain other elements including PhD supervision costs and capability funding. However, core funding of research by HEFCE and SFC for PUs is relatively low (Table 6), although there is evidence that PUs achieve substantial leverage effect in terms of their ability to win business from research “customers”, despite this relatively modest level of investment. The PU “multiplier” (total research grant and contract income divided by funding council investment) is 1.71 times greater than that of the Russell Group universities⁵ and 2.6 times that of the 1994 Group⁶ of universities.

Table 6: Funding council investment to PUs, Russell Group and 1994 Group HEIs

	Funding Council Investment	“Multiplier” ⁷
PU	£57,135,924	3.03
Russell Group	£794,647,255	1.77
1994 Group	£195,205,139	1.18

Source: HESA

Such core funding enables institutions to provide an infrastructure and platform from which to seek and secure competitively-won research grants and contract income and is allocated, in part, on the basis of research quality as measured by RAE score. Lack of funding for units of assessment (UoAs) rated less than 4 has impacted severely on PUs, where the most common RAE score is 3a. In 2003-04, total research grant and contract (RG&C) income for PUs amounted to £129 million, compared to £2.7 billion for the sector as a whole. Unsurprisingly, RG&C income accounts for a much smaller proportion of the total HEI income for PUs than for other universities.

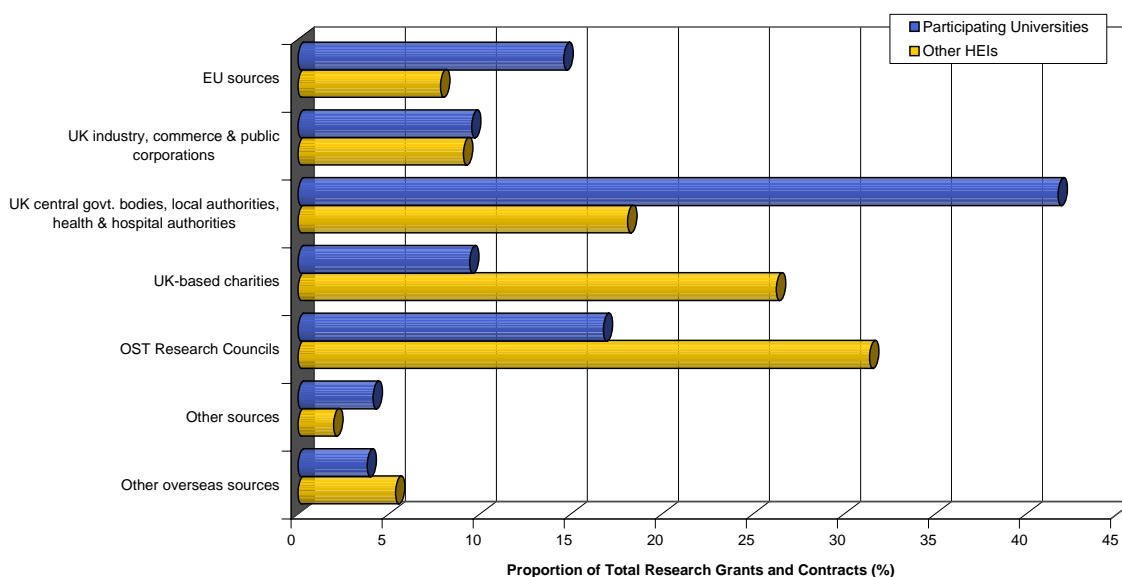
⁵ The Russell Group comprises the Universities of is an association of 19 major research intensive universities which in 2001/2002 accounted for over 60% of the UK universities’ research grant and contract income and 57% of grade 5 departments. The members are the Universities of Birmingham, Bristol, Cambridge, Cardiff, Edinburgh, Glasgow, Leeds, Liverpool, Manchester, Newcastle upon Tyne, Nottingham, Oxford, Sheffield, Southampton, Warwick and Imperial College of Science, Technology and Medicine, King’s College London, London School of Economics and Politics (LSE) and University College London.

⁶ The 1994 Group comprises 16 research intensive universities; St Andrew’s Durham, Lancaster, York, Warwick, Reading, East Anglia, Essex, Birkbeck, Goldsmiths, Royal Holloway, LSE, Surrey Bath, Sussex and Exeter.

⁷ The “multiplier” is derived by dividing the Research Grants & Contracts (RG&C) Income by the funding council investment (QR, PhD allocation, capability funding) for each member institution within a group, and then taking the average value for that group.

However, the breakdown of this income is revealing; Figure 2 shows the breakdown of RG&C income into the standard categories used by HESA as proportions of the total. Research Council funding is essentially grant funding, predominantly for “blue skies” research, on the basis of research excellence, and accounts for a much smaller proportion of RG&C income for PUs⁸ than for other HEIs, which is unsurprising, given the applied emphasis of the research portfolio.

Figure 2: Proportion of research grant and contract income in PU and other HEIs



Source: HESA data and Arthur D Little analysis

The combination of funding council and research council grants awarded on the basis of research excellence together provide a foundation of publicly funded research capacity upon which institutions can then seek to undertake research on a contract basis for a wide range of users and beneficiaries. The remaining categories of RG&C income reflect interaction with a number of user groups, and we discuss these in the sections that follow.

⁸ Denoted by CMU partners

4. The impacts of PU research on key users

PU's use a modest publicly funded research foundation to attract very substantial additional contract research from a diverse range of customers.

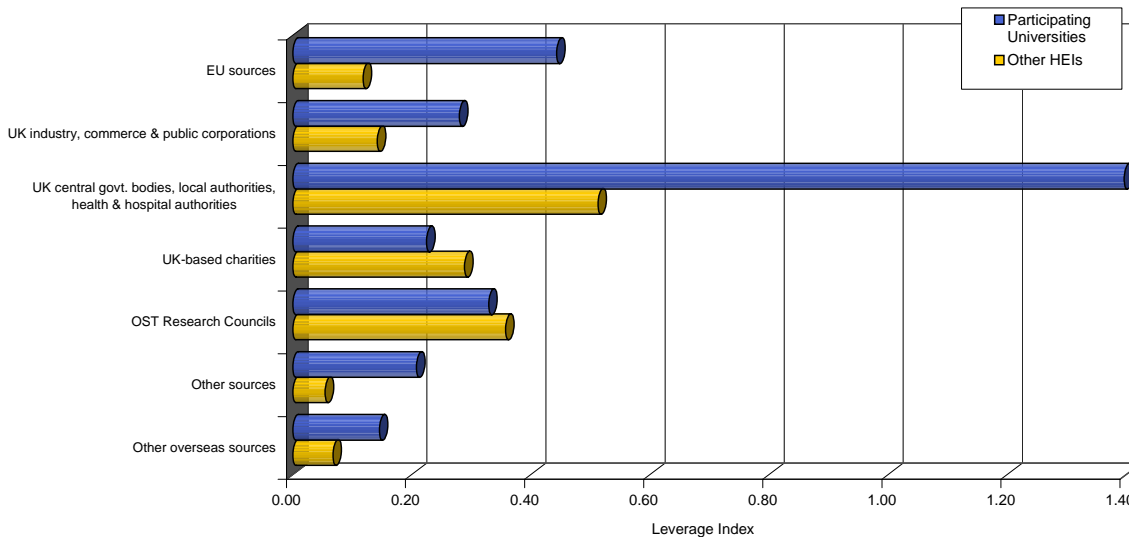
Using the foundation described above, both PUs and other HEIs have developed a research income from a diverse range of sources including government departments, industry and Europe. However, it is important to recognise that rationale for research paid for by these users is quite different from the research paid for by funding councils and research councils since these users procure research on a contract basis against specific needs. The primary aim of the research is therefore to meet these needs in a timely and effective way. Ensuring that the research involved is of a high scientific quality is essential but the research may not necessarily lend itself to publication in the most prestigious or high impact journals (or to publication at all if confidential) and therefore to RAE credit. Thus, the challenge for PUs is to use the comparatively small funding council and research council foundation to best effect; this chapter examines their effectiveness in doing so.

The effectiveness of the PUs in maximising the comparatively modest investment by funding councils is best demonstrated by calculating a “leverage index”, which is calculated in a similar way to the multiplier presented in Table 6 and is defined as RG&C category income divided by funding council investment (QR plus capability and other core funding). This is, in essence, a matter of how effectively universities leverage funding council support in order to win research income from other organisations. Figure 3 clearly indicates the strong performance of PUs in this respect – including, significantly, effectiveness of PUs in attracting funding from UK charities and research councils.

Funding council and research council income together may be regarded as “core” public investment in the research base, Figure 4, which includes research council income in the denominator⁹, illustrates how universities leverage this to bring in further funding from ‘customers’. It shows that the ratio of externally generated income to “core” funding is significantly greater for PUs than for other HEIs.

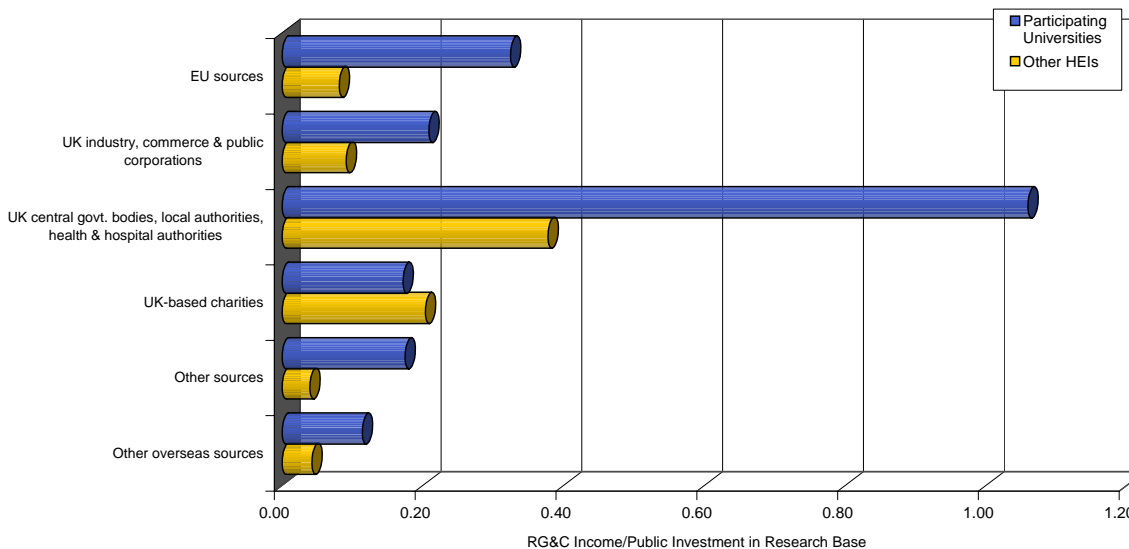
⁹ i.e. the Research Grants & Contracts (RG&C) category income is divided by the total of the funding council research investment and OST Research Councils income for each member institution within a group, and then taking the average value for that group.

Figure 3: Ratio of RG&C income to funding council investment (QR, PhD allocation, capability funding)¹⁰



Source: HESA data and Arthur D Little analysis

Figure 4: Ratio of RG&C income to public investment in research base (QR, PhD allocation, capability funding plus research council income)¹⁰



Source: HESA data and Arthur D Little analysis

¹⁰ Note that the most recent available data has been used to construct these graphs. This data includes 2003/04 HESA RG&C income data and 2005/06 HEFCE data for Quality Related (QR) research and capability funding. Only English HEIs have been considered in this analysis.

4.1 Government and policy agencies

In comparison to their basic research capacity, PUs are outstandingly successful in attracting research contracts from government agencies and public bodies, helping to inform a wide swathe of public policy.

Income from UK central Government bodies, local authorities, health and hospital authorities represents a major category of PU research income: here, public sector organisations are essentially customers for contract research to meet their business needs. The data suggest that although absolute research income from the UK public sector is modest, it is PUs that are significantly more oriented to serving public bodies *as customers*, with research directly relevant to their needs, rather than to undertaking grant-funded research. The organisation of research in PUs into multidisciplinary, practice-based research institutes, often employing practitioners and providing accredited courses and services, supports this customer-facing emphasis. Naturally, customer-oriented research can and does achieve high standards of research excellence: indeed, customers demand such standards, whether or not confidentiality and other considerations allow open publication of the findings.

Contribution to policy at national and regional level

PUs cite strong links with national policy makers both in terms of support for policy formulation and in response to defined national policy needs. The main governmental departments with which PUs are involved are detailed in

Table 7. This ability to support a wide range of policy across government, often in areas that are not priorities in research-intensive universities, is of extreme importance in enabling government to move to a more evidence based approach to policy. The importance of such an evidence based approach to policy is highlighted by government departments such as Defra and OST. For example, Defra notes the importance of seeking to base policies on “comprehensive and foresighted understanding of the evidence”¹¹. Moreover, the 1999 Modernising Government white paper¹² states that Government:

“must produce policies that really deal with problems, that are forward-looking and shaped by the evidence rather than a response to short-term pressures; that tackle causes not symptoms”.

¹¹ <http://www.defra.gov.uk/science/how/evidence.htm>

¹² <http://www.archive.official-documents.co.uk/document/cm43/4310/4310-02.htm>

Table 7: Examples of expertise at PUs which support national policy formulation and priorities

Government department	Examples of PU projects
OPDM	Public services for “hard to reach groups” (UCLan), transport (Kingston), urban regeneration (various), human and built environment (Salford)
DEFRA	Environmental sciences (Abertay), heritage and tourism (UCLan), community and countryside (Gloucestershire), CAP reform (Gloucestershire), spatial planning and green infrastructure (Leeds Metropolitan), waste management (Leeds Metropolitan), renewable energy (Northumbria), economic performance of rural areas (Plymouth)
DfES	Skills agenda (various), increasing employment and employability (Leeds Metropolitan), student financing and debt (South Bank), education (Sunderland)
Culture, Media and Sport	Cultural heritage (UCLan), sports policy (Leeds Metropolitan), impact and legacy of Olympics (Middlesex)
DTI	Innovation and competitiveness (Abertay), serious games and digital content (Coventry, UEL), ethnic minority business (de Montfort), support for business and economic generation (UEL, Thames Gateway), environmental impact of regional airports (Manchester Metropolitan, Westminster), zero emission enterprises (Plymouth)
Home Office	Emergency services (Anglia Ruskin), criminal justice (Glasgow Caledonian), gun crime (Kingston, South Bank), immigration (Roehampton)
DoH	Health Action Zones (UCLan), drug use (Liverpool John Moores), mental health (Plymouth, advisor to NICE), midwifery (Thames Valley), health services for children (Thames Valley)

Case Study: Scottish Informatics, Mathematics, Biology and Statistics (SIMBIOS) Centre (Abertay)

The SIMBIOS Centre was set-up in 2000 at the University of Abertay, making use of a Scottish Funding Council Research Development Grant and a grant from the European Regional Development Fund (ERDF). The Centre undertakes research at the “interface” between physical and life sciences and its main area of focus is in complex environmental systems, where it uses quantitative methods as modelling tools. SIMBIOS has attracted more than 10 times the initial Scottish Funding Council investment from Research Councils, EU, Government agencies and Trusts and other external sources. The Centre sources its research expertise from the University of Abertay. Moreover, it is a key member of a national research pooling bid to the Scottish Funding Council, which is worth £22 million and is designed to assemble the top Scottish environmental sciences university research groups.

Source: University Questionnaire

Case Study: SMARTlab/MAGIC (UEL)

UEL's Institute for Digital Media headed by Prof Lizbeth Goodman operates as both a centre of excellence in art/technology research, and a new media R&D centre and incubator for emergent practices and products. Projects with major corporations include Clubtech in partnership with Microsoft

Key research areas for future projects include: VR worlds and Emotionally Empowering Role Play, Olfactory Sculpture and Body Memory in Engagement with Public Art, Community Building Online, Managing International ArtSci Collaborations, Creating a Matrix for Gender Roles on Stage and Screen, Moving the Screen with Interactive Film and Convergent Media, and New Architectures of Space in Performance, IT for Developing Countries, Sustainable Development and Microfinance for Women entering the Knowledge Economy.

MAGIC is UEL's Multimedia & Games Innovation Centre: a creative PLAYroom where local groups from across the educational sectors can collaborate on site with representatives from local government, business and industry, SMARTlab and other UEL researchers and game designers, theatre artists, dancers, puppeteers, and educational technologists. In this magical playspace, everyone's input is equal, and the games we play and the ways we learn are all open for testing and pushing to the limits.

Source: UEL

Case Study: EU funding for Surface Engineering Research (LSBU)

LSBU's surface engineering research facilities are housed by purpose-built laboratories. The research has attracted both EU and EPSRC funding; facilities include a Sulzer Metco plasma spray unit, a controlled atmosphere plasma spray unit, an internal bore plasma unit, a high velocity oxy-fuel spray unit, several combustion flame spray units, infrared equipment, pre-treatment facilities, spray dryer unit, sol-gel facilities, powder processing equipment, several sintering furnaces and stoving ovens. Moreover, the University is host to a wide range of specialized materials evaluation test facilities, including reciprocating wear machines, pin-on-disc machines, debris analysis equipment, adhesion devices, in-situ residual stress measurement and electrochemical corrosion test facilities.

Source: University Questionnaire

Case Study: Researchers look for childhood illness links in pan-European health study (University of Bradford)

A University of Bradford academic has received a five-year funding package from the European Union (EU) to carry out research into genetic susceptibilities to illnesses in children. Professor of Biomedical Sciences at the University, Diana Anderson, is part of a 25 laboratory consortium across Europe that has been awarded a total of 13.6 million Euros, of which her laboratory in Bradford will receive around 557,000 Euros (around £400,000). This funding comes from the EU's Framework 6 Programme to carry out research into factors that cause genetic defects and immune system dysfunction in children by examining them and their parents. Professor Anderson has appointed two researchers from the University, Natalie Wyatt and Eduardo Cemeli, to assist with the study in this country. She will also help co-ordinate the work across the European laboratories, which is being led by Professor Jos Kleinjans at Maastricht University in Holland, with meetings every three months for the next five years.

The project, called 'NewGeneris', will study newborn babies and their parents in an attempt to identify what factors are significant in the breakdown of a child's system, which may lead to genetic defects, cancer or immune system disorders later in childhood. NewGeneris will link closely with the 'Born in Bradford' research project, and will be examining some of the families recruited for that study. Born in Bradford was launched in December 2005 by medical researchers from Bradford Teaching Hospitals NHS Trust, the University of Bradford and other partner organisations. They will be examining factors such as genes, diet, lifestyle, schooling, neighbourhood, and upbringing to help understanding of childhood illnesses and adult diseases. Professor Anderson said: "This is very exciting news for the University, not only because of the far-reaching implications of the research but also it is the longest time an EU grant has funded research here. "What we are planning to do here in Bradford and in some of the centres across Europe is establish a cohort of mothers, fathers and babies. We can then take various samples from them whilst observing the child's progress to determine what factors, such as dietary toxins, that might be involved later in a child's life. "What makes this research even more significant is that, until now, scientists have not taken much interest in the father's input into a child's development. Therefore we are appealing for dads to get involved in this study - after all, 50 per cent of the child's characteristics are inherited from dad so it makes sense not to ignore that." The NewGeneris research project started earlier this month with scientists using in vitro samples to test their methodology. It will conclude in 2011.

Source: University of Bradford

Case Study: European Lifestyles and Marine Ecosystems (ELME) (University of Plymouth)

European Lifestyles and Marine Ecosystems (ELME) - The Coastal & Marine Policy Research Group at the University of Plymouth leads a three year £2.5 million EU-funded collaborative research programme with 27 partners from throughout Europe modelling the impacts of human activity on Europe's seas and oceans. An expanding European frontier requires the European Community to re-examine its agricultural and chemical policies, implement a new fisheries policy and explore new ways to protect marine systems. ELME will enhance understanding of causality, forecast the impacts of divergent development scenarios and inform the public and Community policy makers to help develop strategies to protect marine life and exploit the sea in a sustainable manner.

Source: University of Plymouth

Case Study: EU funding for work on landslides (UEL)

Working with Thames Water on analysis of soil-pipe interactions to identify risk factors in mains water pipes. Has received EU funding for work on landslides and supervises several PhD students on KTP projects looking at innovative eco-friendly clay liners for landfill sites.

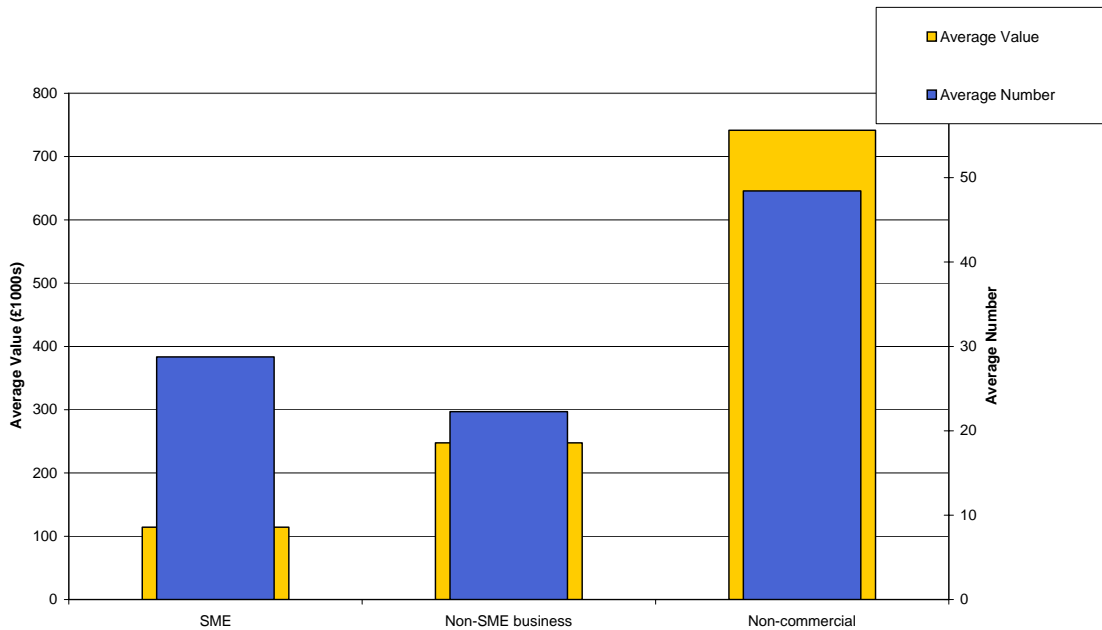
Source: UEL

4.3 Links to national and international industry

*PU*s have research relationships with multinational and national industries as well as SMEs. They are particularly well placed to provide the necessary research base for emerging industries.

Data for the number and value of research contracts in PUs (Figure 5) reveal that PUs secure a substantial number of contracts with larger businesses and that the average value is fairly substantial at approximately £250K. The largely applied research portfolio of the PUs makes them particularly well suited to working with end users of the research results and the emphasis placed by senior management on translation and interfaces with professional reflect this. Once again, the large number and average value of non-commercial contracts again reflects the orientation of PUs towards non-research council public sector clients in the UK.

Figure 5: Average value and average number of research contracts at PUs

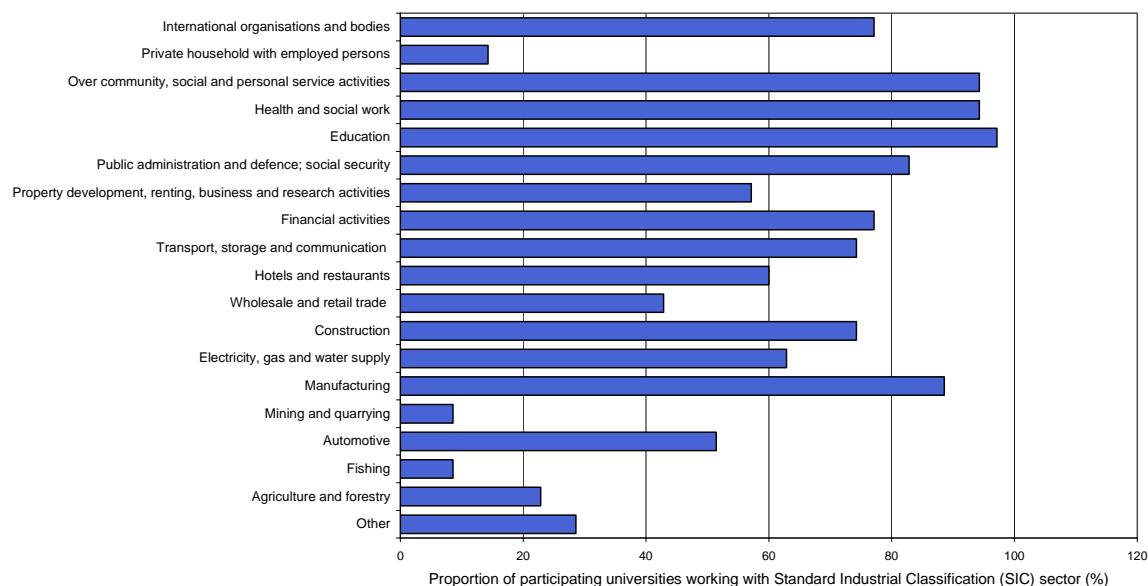


Source: Arthur D. Little analysis of HESA data

The sectors with which PUs have established research relationships are given in Figure 6. The prominence of public sector research customers and applied/practice-oriented research may well be connected with the high degree of involvement reported by PUs with community, health, education and public administration categories, which are rated highly along with, perhaps unsurprisingly, manufacturing, reflecting the histories of many of the PUs. Examples cited by PUs show that support for industry extends across

a wide sectoral range including important emerging fields such as creative and cultural industries and tourism and leisure for which there is as yet little substantial basis of prestigious research and few established funding streams. Given trends in the wider economy, one might conjecture that these emerging industries will require a much stronger research base in the future and work of PUs provides a valuable basis upon which to develop the necessary research capability. In addition, PUs are involved in industries such as construction which have limited input to research intensive universities.

Figure 6: Main industrial sectors with which PUs have research relationships



Source: Arthur D. Little analysis of HESA data

Arthur D. Little’s experience with large, R&D intensive companies confirms the trend towards an open innovation model including greater outsourcing of R&D services. Although most collaborations are with academic teams in leading research universities, companies maintain a broad range of academic contacts and work with less research intensive institutions as well as the more well-known research intensive universities. The present study has shown strong evidence that PUs have established research collaborations with national and international industry. In our survey, sixteen universities cited links with one or more of the companies listed in

Table 8. The listing indicates that these PUs (as a group) have research contracts with all of the top ten companies listed in the DTI R&D Scoreboard (2005). We consider it likely that other PUs also have links with these and similar companies but chose not to cite them, perhaps for reasons of confidentiality.

Table 8: Examples of national and international companies with which PUs have research relationships

Company name	2005 R&D scoreboard ranking
GSK	1
Astra Zeneca	2
BAE systems	3
Ford	4
Unilever	5
Pfizer	6
Airbus	7
Shell	8
Rolls Royce	9
BT	10
BP	11
Johnson and Johnson	14
ICI	17
Hitachi	25
Nissan	27
Smith and Nephew	36
Cadburys	39
Reckitt Benckiser	43
Novartis	47
Procter and Gamble	57
Sony	59
Siemens	61
HP	75
Pilkingtons	77
BBC	106
Alstom	165
BNFL	511

Source: DTI 2005 R&D Scoreboard

The nature of these research relationships is diverse and include contract R&D, collaborative R&D, access to facilities, Knowledge Transfer Partnerships (KTPs), consultancy and student placement.

Case Study: Centre for IT in Construction Construct (Salford)

IT for Business has become an outstanding example of how industrial and academic collaboration can achieve mutual benefits and bring about fundamental change in the competitiveness of the UK construction industry. It enjoys a membership of over 50 organisations including major construction companies, client organisations, suppliers, IT and communications companies, professional institutes, and Research & Design/academic institutions.

Construct IT is a unique initiative that aims to improve industry performance through the innovative application of IT and act as a catalyst for academic and industrial collaboration. Construct IT for Business harnesses the energy and enthusiasm of organisations who are committed to improvement; acting as a conduit for collaboration, innovation and education. It carries out objective studies, providing firms willing to invest, with helpful guidelines and terms of reference. The Construct IT initiative has won the prestigious Queen's Anniversary Prize for Higher and Further Education for the pioneering work it has done. The award represents royal recognition for its 'outstanding contribution to the advancement of the practice of IT in the UK construction industry'. Construct IT works in close collaboration with the Master's program in Construction IT, providing a variety of different study routes to suit individual requirements. These include single modules for Continuous Professional Development, Postgraduate Certificate, Postgraduate Diploma or a complete MSc programme available through three different pathways.

In 2001 Construct IT won the Queens Anniversary Prize for Higher Education.

Source: University Questionnaire

Case Study: Aircraft Maintenance Facility at Newcastle Airport (Kingston)

The KU knowledge base in aircraft engineering led to the development of the aircraft maintenance facility at Newcastle Airport, which is now one of the maintenance hubs for the easyJet operation. This expertise also enabled SERCO-KU-TAFE-Bwan to win the OMAN Military University College contact valued at c£1.5bn.

Source: University Questionnaire

Case Study: Reckitt Benckiser (LSBU)

Professor Jill Davies of London South Bank University's Department of Applied Science has a long standing research collaboration with Reckitt Benckiser one of the UK top 100 Companies, generally recognized for Household Products and some very well established Health Care products. Reckitt's have sponsored a number of PhD students working within Professor Davies' Nutrition Research Group. The thrust of the research done by Professor Davies and her team has been to better understand the underlying science behind a range of health conditions including constipation, irritable bowel syndrome and reflux disease. This work is relevant to a number of Reckitt's products such as Fybrogel, Senokot and Gaviscon. Reckitt's have benefited from this partnership in several ways. As well as the greater understanding of the basic science, the Company gets recognition at international conferences where the research findings are presented as well as papers in scientific journals. In addition, Clinical trials, facilitated by strong links with London Teaching Hospitals, and undertaken by the LSBU group have provided the Company with valuable product performance data.

Source: University Questionnaire

Attracting inward investment from international companies is a national priority, and UK Trade and Investment have been tasked with attracting more R&D and knowledge-based investment. The strength of the UK's R&D base is a vital asset in creating 'magnets' for such investment and although the role of PUs in this respect has not been examined as fully as it merits, there is already evidence of its significance – for instance, the Centres of Industrial Collaboration network, involving the University of Hull, has been instrumental in securing inward investment of £9m in the Hull and Humber ports region, while an Indian software company is reported as creating over 100 jobs on Teesside.

4.4 Scotland

The participating universities play a central part in maintaining a strong research and knowledge base within the Scottish economy

Three of the participating universities are located in Scotland, forming part of that country's vital knowledge base. Many of the considerations applying to the UK as a whole and to individual regions in England also apply to Scotland, for example in relation to the policy support and other needs of Scottish public agencies. Although some of these needs can be met from providers outside Scotland, this is not true of all. Moreover Scotland, in common with other economies of its size, regards a strong science and knowledge base as an essential foundation for economic development, entrepreneurship and investment, not least in priority sectors such as the environmental and life sciences and the creative industries.

Though Scotland is fortunate in having a remarkable range of research activity in its universities, the scale of its research base means that maintaining depth, diversity and range of opportunity for talented people is still more of a challenge than for a larger economy. An innovative approach to this issue is exemplified by the recent research pooling initiatives that link centres of excellence and expertise in separate institutions no matter where they are located. The success of this initiative will depend critically on ensuring that it remains open to contributions from a range of institutions including the participating universities. Accordingly, the maintenance and development of a strong research base across these universities is crucial in Scotland.

Case Study: Science Magic Show (Abertay)

The University uses part of its Knowledge Transfer Grant from the Scottish Funding Council to fund very well received 'Interactive Research Science Magic Shows' for primary schools. These events, presented by staff and post-graduate students, are aimed at enthusing a new audience to the excitement and wonder that science can deliver and highlighting the importance of science subjects for careers in a modern day society. They are designed to show the children that things that at first may appear to be impossible can be readily explained through scientific principles while at the same time optimising audience participation and ensuring the element of surprise throughout.

Source: University Questionnaire

4.5 The regional role

Both quantitative and qualitative evidence highlight the strong role played by PUs in delivering the regional regeneration and economic development agendas, drawing in many instances upon their research base and in turn generating opportunities for valuable further research.

The strongest body of evidence suggests a leading role for PUs in the support of regional economic development. Analysis of data from the 2005 Higher Education – Business and the Community interaction survey yields a clear and consistent message that PUs see the regional and sub-regional scale with their interaction with business and the community as being highly significant. The patterns of their sourcing and deployment of funds, and of the way these funds are used, are thoroughly consistent with this point of view. Although we do not have access to corresponding returns for the major research-intensive universities, one may conjecture that the latter would see a national and international scale as a more significant canvas on which to operate, with an approach to regional and sub-regional involvement that, while important, is perhaps more cautious – again supporting the view that the roles of the different types of university are complementary rather than unduly overlapping.

PUs cited significant contributions to the regional agenda through:

- Support of SMEs through access to specialist facilities, CPD and consultancy
- Provision of incubator facilities and innovation services
- Support of cluster initiatives (e.g. textiles, digital media, food)
- Social policy including diversity awareness, ethnic issues, domestic violence, children's needs, employment, local decision making
- Public health, mental health and access to health services
- Community based arts and cultural events including dance, cinema and theatre
- Tourism and heritage
- Urban regeneration

- Energy and transport

Case Study: Knowledge Dock (UEL)

Knowledge Dock Expert Centres have been developed with the specific aim of helping SMEs (Small to Medium Enterprises) access specialist technologies that have traditionally been prohibitively expensive to obtain. Being situated within the University of East London allows our clients to not only benefit from UEL's academic knowledge, but also its modern facilities and invaluable business expertise. The Expert Centres also assist customers throughout every stage of development whether it is a pre-start, start-up or developing business. Knowledge Dock is funded by HEIF, EU, and LDA to provide specialist knowledge transfer assistance to regional SMEs.

Source: University Questionnaire

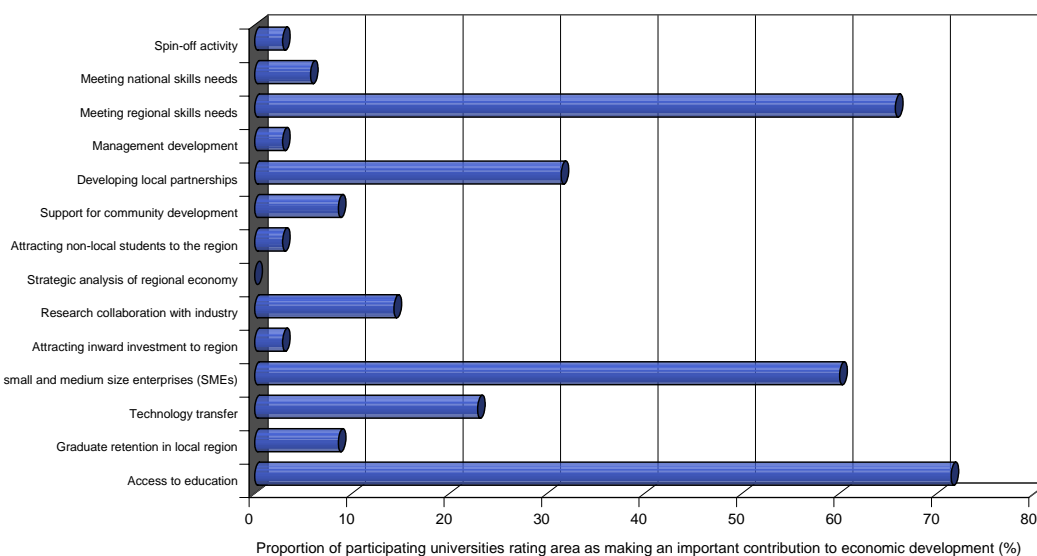
Case Study: Ethnic Minority Business (De Montfort)

Professor Monda Ram's ethnic minority business research group has won funding from many sources. For example, this was funded by EMDA to the amount of £100,000.

Source: University Questionnaire

Discussions with the RDAs suggest that there is a unique role for PUs with regard to the fulfilment of the regional agenda and for which the research-intensive universities may be ill-equipped. The near to market research portfolio and the understanding of the commercial setting make PUs well-placed to deliver such services and the high level of importance placed on meeting the needs of the regional agenda is clear in the development of research policy at PUs. Figure 7 shows that meeting regional skills needs (rather than national needs) and supporting SMEs were rated highly along with the important category of access to education.

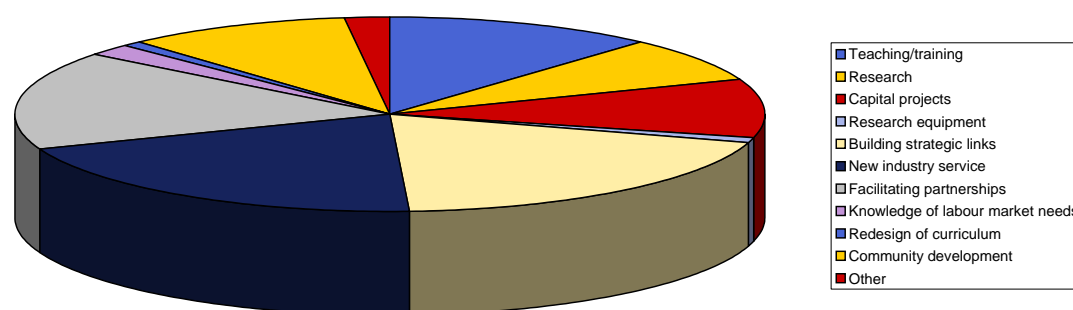
Figure 7: Contribution of PUs in relation to regional development



Source: Arthur D. Little analysis

Similarly, the selection of research areas in PUs is strongly influenced by regional priorities and these universities utilise regional funding in a manner that reflects this regional priority, for instance in providing assistance to SMEs and specifying their needs and in providing an effective single access point where SMEs approach an institution, in an endeavour to make the sector more accessible to SME communities. They also use regeneration funding in a way that reflects similar industry-oriented activities such as providing new industry services and facilitating partnerships (Figure 8).

Figure 8: Use of regeneration funding in PUs



Source: Arthur D. Little analysis of HESA data

Qualitative evidence suggests that funding is being used by PUs to buy “people” and cover revenue costs rather than invest in expensive infrastructure such as buildings and capital equipment: it is our experience that the former category is often more likely to deliver tangible benefits to regional and local enterprises. Major sources of income are ESF and ERDF which concentrate on jobs safeguarded, jobs created and innovation services. In addition to community development projects and access to services, many projects supported by these schemes are in the area of SME support, entrepreneurial training and initiatives to support traditionally “hard-to-reach” businesses e.g. ethnic groups and women.

The important role that universities play in the economic development and regeneration of modern cities was highlighted in Prof. Michael Parkinson’s report “State of English Cities”. In addition to supporting innovation and the development and transfer of new technology, many PUs specified the contributions made to the physical regeneration of their immediate environs including:

- The use of brown field sites for development
- Community based initiatives especially in performing arts and sports
- Public understanding of science and interfaces with the community through schools and events

Case Study: Use of an old Rolls Royce plant for the development of the TechnoPark (Coventry)

A new Technology Park at Coventry has been developed. This was built on a regeneration site of an old Rolls Royce works, close to the city centre. The park has attracted a number of organizations to the city and supports a large number of local businesses.

Source: University Questionnaire

Case Study: Introduction of innovative dance performance to community (Roehampton)

The Centre for Dance Research introduces innovative dance performance to the local community, and the AHRC Research Centre for Cross-Cultural Music and Dance Performance (a collaboration between SOAS, University of Surrey and Roehampton) involves dance performance from South East Asia.

Source: University Questionnaire

Case Study: Establishment of sport and exercise sciences (Gloucestershire)

The University has invested in a new campus in the City of Gloucester, an area with a significantly lower participation rate in higher education than the rest of the county. Science research infrastructure funding (SRIF) has been allocated to establish an excellent research infrastructure for sport and exercise sciences, which is being used to great effect by national, international and Olympic athletes, professional football and rugby teams and other high level performers. The public profile created through this research has enabled the University to engage in major outreach activities, which is now beginning to make a significant impact by raising aspirations among families with no history of participation in higher education.

Source: University Questionnaire

Case Study: Spaceport (Liverpool John Moores)

Spaceport is a £10 million visitor centre created jointly with LJMU and Mersey Travel. It is expected to draw 100,000 visitors each year. Whilst achieving a balance between education and visitor excitement is challenging, the University's engagement with schoolchildren through the National Schools Observatory has helped the partnership achieve this balance (approximately 500 primary and secondary schools are members of the ARI National Schools Observatory and LJMU has a target of 1200 schools by 2007). The LJMU Astrophysics Research Unit (ARI) is internationally recognised as a leader in astrophysics research, with expertise in robotic telescope technology.

Source: University Questionnaire

4.6 Small and medium-sized enterprises

*PU*s perform exceptionally well in research-based links to SMEs as reflected in a high degree of participation in KTPs and aided by close proximity.

The evidence suggests that PUs undertake projects which are contingent on their research base and play a valuable role in the dissemination of research outcomes. In addition PUs have a key role in the “moulding” of research results to maximise their impact in commercial settings. This is well illustrated by PU involvement in KTPs (previously Teaching Company Schemes), which are widely recognised as an excellent mechanism to deliver support for companies from the university research base.

Knowledge Transfer Partnerships

The applied aspects of the PU research base are particularly valuable to SMEs, which lack in-house R&D capabilities and which benefit from mechanisms such as consultancy, training services and Knowledge Transfer Partnerships (KTPs). The performance of PUs in KTPs compares favourably with that of both the Russell Group and 1994 Group HEIs (Table 4) and 35% of income from KTPs is spent at PUs; some £9M of a total of £25.7M. Many KTPs have direct links to the university’s research capability, perhaps because they involve staff who have developed their skills through that research, or because they involve some application of research outputs and knowledge. Others depend indirectly on the research base, e.g. through benefiting from facilities and resources attributable to research activity or because the academic expertise on which they depend simply would not exist without a research base to nurture it and provide its main focus.

Table 9: Average numbers of KTP projects for Russell Group, 1994 and PUs

	Average number of current KTPs	Average KTP income (£1000s)
PU	9	258
Russell Group	10	151
1994 Group	7	194
All HEIs excluding PUs	5	123

Source: HESA data

Two PUs are ranked in the top five institutions in the KTP league tables which are:

- Reading - 41
- **London South Bank - 34**

- **Wolverhampton - 32**
- Sheffield - 21
- Manchester - 21

Details of numbers of KTPs per institution are given in Appendix 2.

Case Study: Development of a Patient Support System (Coventry)

Elekta Ltd. design and manufacture of radiotherapy treatment systems. Through a KTP with Coventry University, a novel and practical control strategy has been designed, developed, implemented and successfully demonstrated for the patient support system (PSS) within the Elekta Synergy[®] image guided radiation therapy treatment suite. As well as successfully delivering the original objective, an additional control system has also been developed for the gantry.

The main elements of the project were:

- The critical evaluation of the existing PSS and the selection of the appropriate sensing equipment
- The realisation and validation of the PSS model developed using Matlab, Simulink and the SimMechanics toolbox
- The development of a new mechanism to assess independently the performances of the PSS and other elements of the Elekta Synergy[®] system which has evaluated and subsequently adopted by the company. The system resulted in a significant increase in the efficiency of the testing process

The main achievement has been the delivery of a working control system by the time of project closure, and this is considered to be the most significant contribution from the KTP.

Funding was obtained for an MSc project from Elekta (June-Sept 2003). The work was successfully completed in Sept 2003, with the company incorporating the software developed in its engineering support tool. The Project was completed and handed over at the closure of the KTP Programme, and the Associate employed as a Control Systems and Sensor Specialist at Elekta Ltd. This will help to facilitate further collaborative research and possible transfer of simulation/software/procedures to further product development.

Source: University Questionnaire

Case Study: Plymouth Hospitals NHS Trust (University of Plymouth)

The Plymouth Hospitals NHS Trust (PHNT) at Derriford Hospital, Plymouth, provides acute and specialist care services to a population of over half a million people. It has 1,300 beds and employs 6,000 people including 450 junior doctors. Among the many challenges facing NHS Hospital Trusts nationally is the delivery of more effective clinical training and deployment policies for junior doctors with a focus on reconciling the training and service needs within the time constraints of the EU Working Time Directive.

PHNT turned to the University of Plymouth's Knowledge Transfer Partnerships team and experts from the University of Plymouth's Faculty of Social Science and Business in assisting them in overcoming these issues by providing analytical and decision making support to senior management. With the appointment of KTP Associate Sonja Derrick, a Masters graduate in Management Sciences, with a strong background in operational research and business modelling, this challenging 3-year project addressed long-term strategic issues related to the educational experiences of junior doctors. Sonja's work focused on establishing a baseline of training practices and she developed a Training/Service Continuum, highlighting the balance of education and service in junior doctors' activities and factors affecting this balance. The importance of this unique area of work was recognised nationally. Sonja was influential in leading the local Medical Workforce Skills Mix Analysis group and results from this work led to a successful bid for £106k from the Strategic Change Fund to pilot new ways of working. This project was handed over to corporate management at this stage which then merged with the very successful Hospitals at Night Project which Sonja proactively supported. Sonja then developed spreadsheet and systems dynamics models to investigate the impact of changes to junior doctors activity and the training/service balance and also the impact of changes to postgraduate medical education. These models enabled management to experiment with different future scenarios, providing valuable insights and recommendations to top level Trust management.

Sonja has delivered excellent results through her Knowledge Transfer Partnership and has now been taken on in a full time post by the Trust as Foundation Years Manager. With responsibility for the new Junior Doctor training programme she will be able to continue the excellent work she has done and ensure its effective implementation. Sonja has also achieved a Postgraduate Diploma in Social Research and has now transferred to PhD.

Source: University of Plymouth

However, crucially, all are dependent on the research portfolio of the institution and reduction in research activity would undermine the capacity of PUs to deliver the current level of knowledge transfer. Indeed, the move to a more “size-dependent” algorithm for the allocation of the majority of funding in HEIF3 has the potential to jeopardise the essential PU role in the translation of research outcome into economic benefit.

Case Study: The role of Teesside in a Digital City (Teesside)

This project, predicated upon University capabilities in digital media technologies, is a major initiative in the NE to create new businesses, jobs and wealth. The University is playing a lead role in supporting new business generation, collaborative R&D, development of new researchers, and employer and community-based training. DigitalCity will create 130 new businesses by 2010. Its funding sources include SP, ERDF, ESF, LSC, NESTA and other external sources, which combine to allocate the project £8m. However, it is a key element of the RDA's inward investment strategy and further investors are expected.

Source: University Questionnaire

POs are instrumental in the development of incubation and innovation facilities often in areas which have otherwise lacked support for innovative firms. In addition to encouraging and retaining in the area spin outs from the research base, these facilities also provide a necessary component of the infrastructure for other knowledge based businesses. It is recognised that incubators and technology parks draw tenants from relatively small geographic radius (e.g. less than 20 miles), therefore the ability of POs to establish run such services and foster links between such companies and researchers is a contribution that could not be substituted by a research intensive institution some considerable distance away.

Case Study: Wolverhampton Science Park

Wolverhampton Science Park (WSP) is a joint venture between the University of Wolverhampton and the city council. Since its opening in 1995 the initial 25,000 sq. ft of lettable space has increased to 100,000 sq. ft as a result of the construction of an additional two-phases. The association of the University with the science park is considered to be a major contributor to the success of WSP in attracting businesses to the area. Currently plans are in-hand for further expansion.

Source: University Questionnaire

5. Main findings

The study has demonstrated that the research capability of the participating universities, and by inference others of a similar broad type, represents an important component of the broader UK research team and a key contribution to its diversity and breadth. It is complementary to, rather than a smaller scale and less prestigious version of, the research base of the research intensive institutions.

The participating institutions tend to orient themselves somewhat more towards applied and practice-based research rather than “big science”, but nevertheless achieve excellence of an international standard in a wide variety of subject areas – excellence that had been progressively enhanced by focus on selected research areas, creation of multidisciplinary research environments and strategic use of core funding.

Although public investment in the research base itself (as measured by the total of OST investment through the research councils and higher education funding council investment) is modest, the participating universities leverage this remarkably effectively by securing additional research grant and contract income on a competitive basis. This is particularly notable in relation to public policy agencies, where the “leverage” is striking in comparison to the sector as a whole. PUs clearly contribute to policy development at national and regional level and provide a valuable service to customers across a broad sweep of the public sector.

At the same time, the study has also demonstrated the significance of the PU research base in relation to business and industry. The contribution of PU research to large companies is significant, as indicated by the large multi-nationals which have chosen to place contracts with PUs. These are companies which for the most part have the freedom to select their research partners anywhere in the UK or elsewhere in the world. They are also organisations which insist on high standards of research quality as well as flexibility and responsiveness on the part of their academic partners. The list of large companies with PU linkages is a significant testimony to the quality of service provided by those institutions.

At the smaller end of the company size range, participating universities play a key role in the provision of support for SME’s both through contract and collaborative R&D and through activities that depend less directly on the research base such as innovation support, consultancy and training.

Both for small companies and for large, proximity is an important though sometimes under-appreciated factor, discussed in some detail in the Lambert review of business-university collaboration. Provided that the research base is relevant and of an appropriately high quality – a factor that depends on prior public investment – the physical proximity of PUs to many of their business customers is a valuable asset and one that the research intensives cannot always provide.

Within the local environment, PUs play an important role in enhancing the quality of the physical environment, including the redevelopment of brownfield sites for industrial and other uses, improved services and access to sports, entertainment and cultural facilities and community initiatives in areas such as public health and the performing arts.

Some RPU have indicated their contribution to the attraction of inward investment, though in general the potential of PUs in this respect appears largely unrecognised. It would merit further examination by the institutions.

Overall, PUs contribute a breadth and diversity to the UK academic research community which would be hard to achieve given the strong disciplinary structure and research focus in research intensive universities. This is clearly of value to a wide range of customers and users both in large and small business and in the public sector, and at local, regional, national and (in the case of multi-national companies and EU collaborations) international level. Together with the major research-intensive universities, these institutions play a key part in building and sustaining for the UK a research capability of excellence and relevance, constituting a national asset of enormous significance.

Appendix 1: Summary of responses to the questionnaire

Question	Summary of responses
A1: Distinctiveness of the research portfolio	The research portfolios of PUs are strongly applied and, in the majority of cases, focussed into a limited number (~6) of end-user oriented research groups or centres. Staff often include accredited practitioners and there is a strong emphasis on practice-based training and application of research outcomes. Disciplines include: creative industries (especially digital media and links with ICT), performing arts, sports science, environmental sciences, sociology (e.g. ethnic minorities), social policy and social care, education, disciplines related to health, engineering and some elements of law. Although some institutions have strengths in biological sciences and astrophysics and one institution has an undergraduate medical school, "big science" research is generally not represented
A2: Specialist research facilities	PUs have made significant investment from internal funding and SRIF to upgrade and develop state of the art research facilities linked to their research centres. Facilities listed included individual items of equipment (e.g. NMR, Mass Spec., confocal and fluorescence microscopy) as well as complete facilities (e.g. media suites, design studios, motion analysis laboratories, ICT and VR suites) with some specialist centres for forensics and aircraft maintenance
A3: Major concerns	The withdrawal of funding from lower rated units of assessment after the 2001 RAE has led to the closure of some research areas and investment in their development has been lost. Maintenance of critical mass, poaching by research intensive HEIs, attraction and retention of high quality researchers are key concerns. The absence of core funding for research limits the expansion of existing research activities especially those in disciplines which are new and emerging and not currently well supported by funders (e.g. creative arts and media). The introduction of FEC was cited as problematic for some PUs
A4: Impact of research strengths	The maintenance of a research capability impacts directly on the attraction of both staff and students. Recruitment of professionally qualified staff in practice-based disciplines is dependent on research activity and the vibrancy of the environment benefits from the presence of research students. The emphasis on applied research with links to end users in the public and private sector are essential to the research portfolio with many initiatives linked to regional priorities
A5: Areas exhibiting greatest improvement	Significant investments have been made to improve the RAE performance with obvious success in many cases. In all cases, strategic decisions have been made to focus investment in a small number of areas, channelling SRIF and internal funds to support staff recruitment and retention, upgrading of facilities, student bursaries, pump-priming funds and, in some cases, merging disciplines (e.g. arts and IT). Academic leadership in these areas is key and the mentoring and monitoring of research-active staff has been implemented successfully

Question	Summary of responses
B1: Staff development programmes	Many PUs have training programmes for academic staff covering proposal writing, supervising research students and staff delivered by central research offices. Other approaches include strategic recruitment, use of sabbaticals, "promising researcher" fellowships, pump-priming funds reduced teaching load for new staff, encouragement to register for PhD, access to proportion of overhead to support development of ideas, mentoring schemes. Only one specified a link to promotion
B2: Distinctive local provision	With the exception of Bath Spa which provides research in aspects of local history, none identified research programmes with a distinctive local character although research was linked to regional priorities. Many PUs have established Graduate Schools in order to improve services for and the experience of postgraduate students and there is evidence of sharing of resources and training between five north east universities
B3: Recruitment of academic staff	Insufficient detail available from which to draw robust conclusions. There are no data to suggest that PUs provide a seed-bed for the training of new academic staff but Kingston and Northumbria indicated that ~35% of staff are recruited from industry
B4: Destination of leavers	Insufficient detail available from which to draw robust conclusions, but there is a suggestion that the majority who remain in academia move to other post-92 institutions
C1: Links with national/international companies	While there is some variation between PUs the majority cite relationships with large multinational/national companies, some listed amongst the major R&D spenders. These include BP, AstraZeneca, Ford, Lilly, Airbus, Alstom, Andrews Textile Industries, British Aerospace, Ford, General Motors, Jaguar, BT, HP, ICI, Unilever, Pfizer, Cadbury, Smith and Nephew, GSK, Novartis etc. Relationships include contract R&D, collaborative R&D, access to facilities and consultancy, KTPs, EU programmes and CPD
C2: Links with local/regional companies	PUs have extensive links with regional industry, particularly SMEs and the main mechanism for interaction is KTP. Crucially success in KTP is contingent upon the research base but it is important to note that the majority of KT activity arises from areas which are rated 2 or 3a in RAE terms. This suggests that the metrics used in RAE do not adequately reflect the contribution of the PU research base. Funding from RDAs supports interactions with SMEs, in some cases linked to regional priorities and clusters and include access to consultancy, expertise and facilities (see C6)
C3: Links to regional or national policy	Links to regional policy cover priority technologies and cluster, health, community development, job creation and safeguarding, built environment, economic development, transport (e.g. regional airports and London Mayor), SME support, training (with LSC) National links include: OPDM, DEFRA, DOH, DfES, NHS, DTI, DCMS, HO, Treasury

Question	Summary of responses
C4: Specialist facilities available to industry	Centres and larger scale facilities are available to industry (individual items listed in A2 above are likely to be prioritised for teaching). Main disciplines include sports science, ICT and VR, environmental monitoring, microscopy and imaging, physiological monitoring, CAD/CAM, rapid prototyping, computer suites. Most are managed by departments and not actively promoted; access agreements are generally negotiated by the TT office. Northumbria has ISO9000 accreditation for its services
C5: Expert advisory and consultancy services	Services are linked to research centres/institutes and generate significant annual income with 5 citing income in excess of £1Mpa. Income details were not available for many PUs and experiences elsewhere suggest that the significance of this activity and associated income stream is under-estimated
C6: Details of funding from local or regional Government	Extensive funding from RDAs covering business support (primarily SMEs), entrepreneurial training, proof of concept funding, incubator facilities and science parks, centre for industrial collaborations (CIC), access to facilities and expertise for local business, evaluation programmes (e.g. economic impact studies), community development (e.g. hard to reach groups) and networks. Note: funding for equipment and capital projects is relatively small, the majority of funding is directed towards SME support in technology areas prioritised by the RDA
C7: Support for emerging businesses	Examples cited include: website design, e-business, specialist facilities in digital media and creative industries, environmental issues, design, construction industry and incubator facilities
C8: "Third mission" funding	All bar one has received funding under the HEROBAC or HEIF initiatives. In most cases funding has supported the creation of a centralised "business liaison" service and single point of access to university expertise. These services include expertise in IP management and technology and knowledge transfer. It was noted that HEBCI metrics will not represent the impact of interactions with SMEs. HEIF3 is expected to have a negative impact on PUs as allocation of funds is predominantly on the basis of size. Thus, support for KT activity in PUs is likely to receive less funding
C9: Good practice in knowledge and technology transfer	CICs, incubator facilities cited as valuable but most identified success in KTP as a key mechanism
C10: Contribution to inward investment	CICs have been instrumental in securing inward investment (£9M) in the Hull and Humber ports region (Hull); Indian education software company generated 120 jobs (Teesside); £1.5Bn Oman Military College contract secured at Newcastle (Kingston); science parks are attractors of investment (Coventry and Wolverhampton). Note: many of the respondents did not complete this question or supplied information about ERDF and ESF funding streams
C11 Impact of presence	Major impacts include the redevelopment of brown field sites, access to cultural and sports facilities. Involvement in community projects was highlighted particularly in the areas of public health and performing arts
D1: Indicative staff costs	Data provided was insufficient to draw robust conclusions, absence of sector "average" makes comparison impossible

Question	Summary of responses
D2: Measure of value for money	Gearing of relatively low funding council investment against outputs such as publications and research funding secured were deemed most appropriate. (Some concerns about the use of the phrase in an academic context)
E1: Case studies	Various supplied; many relating to KTP projects. Those suggested include Plymouth (Peninsula Medical School, Combined Universities of Cornwall, Cauliflower project), Teesside (Clemence, Digital City), Bradford (CICs), UCLan (South African Telescope Project, Ethnicity and Health), Kingston (Aircraft Maintenance), South Bank (Reckitt Benckiser research into GE conditions), UEL (Knowledge Dock), Salford (CAMPUS project, Money Line, Contraception – the Board Game), Liverpool John Moores (Spaceport), Abertay (SIMBIOS), Coventry (TechnoCentre, Touchstone Housing, Eleckta)
E2: Measures of esteem	Membership of RAE panels, research funding panels, secondments to central government departments etc.

Appendix 2: Summary of Knowledge Transfer Partnerships

Grouping	University	Current KTPs
	Birkbeck College	0
	Goldsmiths College	0
	Royal Holloway and Bedford New College	0
	The University of Bath	21
	The University of East Anglia	1
	The University of Essex	3
	The University of Exeter	13
1994 Group	The University of Lancaster	3
	The University of Reading	41
	The University of St Andrews	0
	The University of Surrey	9
	The University of Sussex	1
	The University of York	5
	University of Durham	12
1994 Group Average		9
	Anglia Ruskin University	6
	Bath Spa University College	1
	Coventry University	9
	De Montfort University	17
	Glasgow Caledonian University	12
	Kingston University	12
	Leeds Metropolitan University	6
	Liverpool John Moores University	15
	London Metropolitan University	7
	London South Bank University	34
	Middlesex University	1
	Roehampton University	1
	Southampton Institute	0
	Staffordshire University	6
PUs		
	Thames Valley University	0
	The Manchester Metropolitan University	17
	The University of Bradford	12

Grouping	University	Current KTPs
	The University of Central Lancashire	3
	The University of East London	2
	The University of Greenwich	6
	The University of Hull	13
	The University of Northumbria at Newcastle	2
	The University of Paisley	5
	The University of Plymouth	18
	The University of Salford	7
	The University of Sunderland	5
	The University of Teesside	9
	The University of Westminster	5
	The University of Wolverhampton	32
	University of Abertay Dundee	6
	University of Bolton	1
	University of Central England in Birmingham	13
	University of Derby	1
	University of Gloucestershire	18
	University of Luton	4
PU Average		9
	Cardiff University	15
	Imperial College of Science, Technology & Medicine	1
	King's College London	1
	The University of Birmingham	6
	The University of Bristol	4
	The University of Cambridge	10
	The University of Edinburgh	6
	The University of Glasgow	3
Russell Group	The University of Leeds	15
	The University of Liverpool	13
	The University of Newcastle-upon-Tyne	13
	The University of Nottingham	15
	The University of Oxford	3
	The University of Sheffield	21
	The University of Southampton	8

Grouping	University	Current KTPs
	University College London	11
	University of Manchester	21
	London School of Economics and Political Science	0
	The University of Warwick	7
Russell Group Average		10
Average for other HEIs (excluding Russell, 1994 and PU)		5