

**FINAL REPORT AND
RECOMMENDATIONS**

**Encouraging a British
Invention Revolution: Sir
Andrew Witty's Review of
Universities and Growth**

OCTOBER 2013

Part 1: The Report of the Review

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Foreword

"Universities generating cutting edge research and resulting insights may be likened to the tip of an arrow, with the arrowhead behind it representing the economic activity enabled by research-led innovation. Maximising the size of these arrowheads and their economic benefit to the UK, specifically, is fundamental..."
(Review Preliminary Findings, July 2013.)



Since my Review was commissioned, I have had the chance to review evidence and meet entrepreneurs, members of LEPs, Business Schools and Universities across the country.

Two conclusions dominate:

1. The UK has an extraordinary wealth of ideas, technology and human energy – much of which is world-leading and capable of seeding not just new companies but whole industries with potential to build substantial export positions.
2. Significant scope exists to better align funding streams, organisational focus and increase cross institution collaboration to avoid delays in ideas reaching maturity and the risk of British inventions building foreign industries.

At an early interview session, I was deeply struck by the statement: “Britain doesn’t breed entrepreneurs, it breeds endurance entrepreneurs”. The point being that the ‘thicket’ of complexity that exists between central and local structures and diffusion of funding and advisory energies leads to unnecessary hurdles for those striving to translate ideas to job creating businesses.

At the heart of my recommendations – three philosophies:

1. Structure funding flows by technology/industry opportunity – not by postcode. We should embrace the country’s density of population and institutions and drive greater collaboration wherever the ‘idea flows’ – eliminating unnecessary regional barriers which create domestic competition instead of marshalling our resources to run a global race.
2. Universities have an extraordinary potential to enhance economic growth. The full

diversity of institutions have a role to play from local SME support and supply chain creation to primary technology leadership and breakthrough invention. Incentives should be strengthened to encourage maximum engagement from Universities in the third mission alongside Research and Education.

3. Government should help facilitate what I have called Arrow Projects* to drive forward globally competitive technological ideas into real businesses. The Arrows should provide full support to the invention at the 'Tip' and should be uninhibited by Institutional status, geography or source of funding. Government should put its weight behind creating global scale through encouragement of real collaboration in fields in which we can win. A great debate has taken place on whether Britain can or should have an ambition to grow its manufacturing sector. It seems obvious that at least two basic conditions need to be met to have any chance of a long term sustainable manufacturing base:

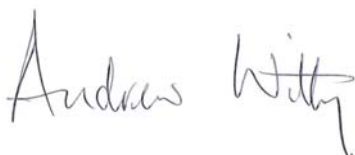
1. An invention culture which successfully translates from 'mind to factory'.
2. A globally competitive sense of timing and scale.

My review has convinced me that while the UK can't do everything, it has the capacity to do much, very well, if we do a better job of aligning our resources and put simply, on occasion, 'get out of our own way'!

The advances in knowledge in this era reveal a prize worth challenging our behaviours for and if we were successful could herald a British Invention Revolution to rival the transformation witnessed in the 19th Century.

Surely a prize worth re-thinking how we work?

Finally, while responsibility for this report is mine alone, I have benefitted greatly from insights of the distinguished experts on the Review's Advisory Group – Professor Sir John Bell, Professor David Greenaway DL, Professor Graham Henderson CBE DL, Professor Dame Julia King, Professor Wendy Purcell, Professor Dame Nancy Rothwell, Colin Skellett OBE – and I am very grateful to them for the time and thought they have given.



Sir Andrew Witty
September 2013

* Collaborative projects to develop new technologies through mobilising national clusters in fields offering significant international markets, combining an arrow tip of leading research with an arrowhead of related economic activity. They would be led by universities where world-class research in the field is taking place, and would bring together leading researchers, industrial and supply chain partners and key economic players such as Local Enterprise Partnerships, wherever they might be located.

Executive Summary and Recommendations

Chapter 1: Universities and Growth

Universities have extraordinary potential to enhance economic growth...

1. The strongest basis for regional economic growth is activity rooted in a sound understanding of a locality's comparative economic advantage. This means that the task of Local Enterprise Partnerships (LEPs) and other bodies seeking local growth is to understand where comparative economic advantage lies, and to focus on how best to land the benefits of associated economic activity for their locality.
2. Effective economic engagement is central to many universities, and is enabled and catalysed by excellent research and teaching, and vice-versa. It takes a wide range of forms. Much of the UK's comparative economic advantage in the twenty-first century could be derived from our universities, including from world class research in fields relevant to the Industrial Strategy sectors and technologies.
3. Universities should assume an explicit responsibility for facilitating economic growth, and all universities should have stronger incentives to embrace this "enhanced Third Mission" – from working together to develop and commercialise technologies which can win in international markets to partnering with innovative local Small and Medium Enterprises (SMEs). An annual report should set out universities' Third Mission work, together with actions the Government should take to better facilitate it.

Recommendation 1. Universities have extraordinary potential to enhance economic growth. Incentives should be strengthened to encourage maximum engagement in an enhanced Third Mission alongside Research and Education, and universities should make facilitating economic growth a core strategic goal. Universities should report their Third Mission activity, for inclusion in an annual report to the Government which also identifies impediments to this activity, with recommendations as to where the Government could act to remove these. Each year the Government should publish its response to these reports and recommendations.

Chapter 2: The Information Base: Mapping Economic Activity and Research Centres

We must improve our knowledge of where there is research strength...

4. To assist the development of strategies for local economic growth the Review has published heat maps showing research centres active in Industrial Strategy sectors and technologies, locations of economic activity including cluster mapping, and information on the number of graduates and industry research and consultancy funding in Science, Technology, Engineering and Mathematics. These are in addition to the maps published with the Review's *Preliminary Findings*.
5. However limitations remain in the information base as to where there is research strength. The annual investment in research in UK universities and research centres, excluding businesses' internal spend, is of the order of £10 billion – even a small relative

improvement in the quality of investment decisions will translate into a substantial absolute gain.

6. Some of those making research investment decisions, such as large research and development intensive firms, may have a deep understanding of where there is relevant research capability but for others, including LEPs and SMEs, the research landscape is more opaque. They would benefit from greater transparency, as would universities able to make their activity and competence known to a wider audience of prospective research partners.

Recommendation 2. Prospective investors in research should have online access to as much information as possible as to where there is research strength. This should include identifying research by sector and technology, and where possible by the businesses and charities funding it. It should also include further development of indicators such as citation-based measures of research strength by sector.

Chapter 3. Universities Facilitating Economic Growth

Incentivise universities to mobilise collaborative national clusters to win in global markets...

7. The UK's research strength is a great national asset which we should work hard to maintain and develop. It can be the foundation for building a lead in the critical research-led technologies and sectors of the future. Universities where world class research is taking place should lead collaborative efforts to develop technologies offering the UK comparative advantage in international markets, and to realise the associated economic benefits.
8. These collaborations are termed "Arrow Projects" – combining an arrow tip of leading research with an arrowhead of associated economic activity. Their objective would be to develop new technologies through mobilising national clusters in fields offering significant international markets, such as quantum technologies. They would bring together leading researchers, industrial and supply chain partners and key economic players such as LEPs, wherever they might be located.
9. They would be substantial undertakings, and the Government should create a new funding stream to which the university-led consortia would apply to secure the funds to take forward Arrow Projects. Proposals will show how they will maximise opportunities for SMEs and also maximise the supply chain presence here. There should be one funding application to one gateway rather than multiple applications to various funding sources. A strong independent process should be created to assess applications. The fund should be substantial: at least £1 billion over the life of the next parliament, and the bar for approval should be set high to ensure successful proposals are robust.

Recommendation 3. The Government should establish a funding stream worth at least £1 billion over the life of the next Parliament available to Arrow Project consortium bids where:

- **there is a credible prospect of technology offering the UK comparative advantage in international markets**
 - **the collaboration includes the key research centres, their LEPs or devolved equivalents, and private sector partners, with funding from the latter two**
 - **there are robust research/development/economic outcome metrics.**
- Funding for bids should be decided through independent assessment by a panel of leading figures from industry, academia and government. Most weight should be given to proposals which advance the Industrial Strategy.**

Chapter 4: Universities and Small and Medium Enterprises

Release the full potential of universities to support innovative local SMEs...

10. The future growth of the UK economy will in large part come from fast growing SMEs, but – while on most indicators the UK's innovation performance is above the EU average – our performance in terms of the proportion of SMEs that are innovative is relatively weak. Universities offer SMEs varied and substantial benefits, but many SMEs lack resources for external engagement and the quality of support available from the local university is key.
11. Universities should be incentivised pro-actively to seek out innovative and potentially innovative SMEs and to support them with technology, expertise, talent and know-how. The process should aim to increase the visibility of innovative SMEs to potential partners, suppliers and investors. Universities will need to work with appropriate local partners to do this to exploit others' capabilities and avoid duplicating existing provision.
12. To encourage this the budget for Higher Education Innovation Funding (HEIF) should be increased and its focus on supporting innovative SMEs sharpened.
13. The introduction of "impact" in the forthcoming Research Excellence Framework (REF) provides another sort of incentive to translate research insights into benefits for local businesses. This is welcome in strengthening incentives to achieve effects such as benefits to local businesses.

Recommendation 4. In order to strengthen the incentives on universities to engage with innovative SMEs the Government should make an explicit long-term commitment to HEIF, which should increase to £250 million a year. It should be adjusted so that:

- **Institutions' HEIF strategies show how all local SMEs that could benefit from working with an HEI are enabled to do so**
- **The five-year allocation period does not entail excluding institutions which do not qualify for more than a year.**

The method of determining institutions' allocations should be reviewed to sharpen the incentive to engage with innovative SMEs.

The impact weighting in the Research Excellence Framework should be increased to 25% in the next REF, strengthening the incentive on universities to achieve effects such as benefits to local businesses.

14. Successful university practice in interacting with SMEs usually involves a managed single point of entry to make their access to the university as straightforward as possible. This should include an easy route to university business schools, an under-exploited source of support for innovative SMEs. Business schools should be given incentives to provide practical hands-on support for these firms, and plans for an accreditation scheme to achieve this are very much to be welcomed.

Recommendation 5. Universities should put in place a single point of entry for SMEs that 'triages' their needs and directs them to the relevant part of the university. This point of entry should also look to drive up SME demand and engagement, and work with external partners across the locality, as well as within the university. University business schools should be incentivised to prioritise working directly with local businesses on workable solutions to practical problems.

Chapter 5: Local Enterprise Partnerships

Put universities at the heart of Local Enterprise Partnerships, collaborating across the country...

15. LEPs' overarching purpose is to promote economic growth and job creation, so the Review concerns a particularly important part of their activities.
16. LEPs face significant challenges. They, like our universities, are heterogeneous. An important element of LEPs' role is to understand local comparative advantage and sector strengths and to use this understanding to create strong economic plans, collaborating across the country and supporting collaborations of different research centres where these collaborations will help to maximise opportunities. This will not be easy for many LEPs who will need to draw on the support of universities and other local partners. Universities offer LEPs a valuable resource, both as sources of local comparative advantage through the attributes and roles described in chapters 3 and 4, and in the practical task of developing those plans.

Recommendation 6. LEPs have up to €1 billion of European Structural and Investment Funds to invest in innovation. They should look to direct a large share of innovation funding towards excellent universities and research centres in order to nurture sustainable growth founded in comparative advantage, including through universities supporting innovative SMEs in their localities. LEPs should do this within frameworks which relate funding to economic outcomes. They should collaborate, and support university collaborations, beyond their own areas wherever these will deliver an economic or research benefit.

17. Where there is a university presence in the locality this should be reflected in the composition of the LEP, so that the contributions universities are making can be integrated into LEPs' leadership of local economic development. All LEPs with

universities in their areas should have a university presence on the LEP Board.

Recommendation 7. Ministers should write to the chairs of all LEPs with universities in their areas setting out the expectation that these LEPs should have a university presence on the Board. Where a LEP is participating in an Arrow Project led by a university in its area then it may well be appropriate for the university to provide co-chairmanship of the LEP. University members should be prominent in, and may often chair, LEPs' Innovation or R&D and Innovation sub-committees.

18. Universities should also play a prominent role in Enterprise Zones and Growth Hubs, where applicable. Local authorities provide much of LEPs' delivery capability, and the Government's measures to encourage orientation of them to the pursuit of growth in their participation in LEPs are welcome.
19. A mechanism to achieve co-ordination and coherence of LEP plans at national level is needed, to ensure plans avoid duplication and missed opportunities to collaborate. This body would advise Ministers and the National Growth Board on the strength of LEP proposals, be a source of advice to LEPs themselves, and a means of meeting the longer term need to support LEPs, universities and others in setting collaborative priorities and making investment decisions on R&D and innovation.
20. It would also recognise those LEPs which are proving most effective, and identify the associated good practice in order that it may be spread – a prerequisite for ensuring that the pursuit of local growth is not hampered by inadequate support for the bodies charged with pursuing it.
21. There is also a risk of missed opportunities through LEPs failing to invest as much as they could in innovation and R&D. The Government should ensure this risk does not materialise.

Recommendation 8. The Government should ensure that all the funds available to LEPs to invest in Innovation and R&D are spent on these areas. It should establish an authoritative advisory capability to advise it and LEPs and other relevant decision-takers on how strongly LEP proposals are based in a sound assessment of comparative advantage, and to identify and communicate the best practice of the most effective of LEPs so that the Government and LEPs can work to bring all LEPs up to the level of the best.

Chapter 6: The Role of National Innovation Support Organisations

Make realising universities' potential to enhance growth a central purpose of the Technology Strategy Board and UK Trade & Investment...

22. All of the various Government organisations with innovation support roles should assess what more they can do to achieve an overarching commonality of purpose in supporting the Industrial Strategy and local growth.
23. The Technology Strategy Board, as the UK's innovation agency, and UK Trade and Investment (UKTI), the body charged with winning inward investment and promoting

exports, will be central to Arrow Projects and should apply resources to advancing economic growth derived from universities. The TSB's national approach, allocating funds to the best projects wherever found, is the right one. But the TSB should set its sights higher in contributing to local growth and national strategic priorities – its resources should be thrown fully and proactively into supporting LEPs in formulating strong plans and into advancing strategic national industrial priorities. This should be reflected in its organisational objectives.

Recommendation 9. The Technology Strategy Board's objectives should include advancing national strategic economic priorities so that its contribution to the Industrial Strategy, to Arrow Projects and to the growth priorities of the devolved administrations is central to its accountability for its performance. This role should include:

- **Supporting and advising on the development of Arrow proposals**
- **Identifying and taking opportunities to ensure its programmes benefit Arrow Projects**
- **Contributing to the assessment of bids for Arrow status**
- **Building awareness on innovative capability within each LEP area and sharing its knowledge to help make LEP local economic plans as strong as possible.**

24. UKTI has a critically important role in ensuring that we maximise the benefit that we derive from our universities, both in realising export potential and securing inward investment. However to date there is only limited evidence of UKTI engagement in this field. It should assign dedicated resource to realising key UK propositions, in particular to advancing the Industrial Strategy Sectors, the Eight Great Technologies, and Arrow Projects. Its organisational objectives should reflect this role, including metrics in relation to overseas investment and/or exports secured.

25. UKTI's task is made more difficult by the number of LEPs, Enterprise Zones, and other spatial elements of the economic development landscape. Increasing its commitment to working with universities offers UKTI a means of achieving more effective regional engagement. An approach centred on a limited number of strategically important economic initiatives is workable in a way that a pitch to foreign investors which seeks to incorporate the merits of dozens of different locations simply is not.

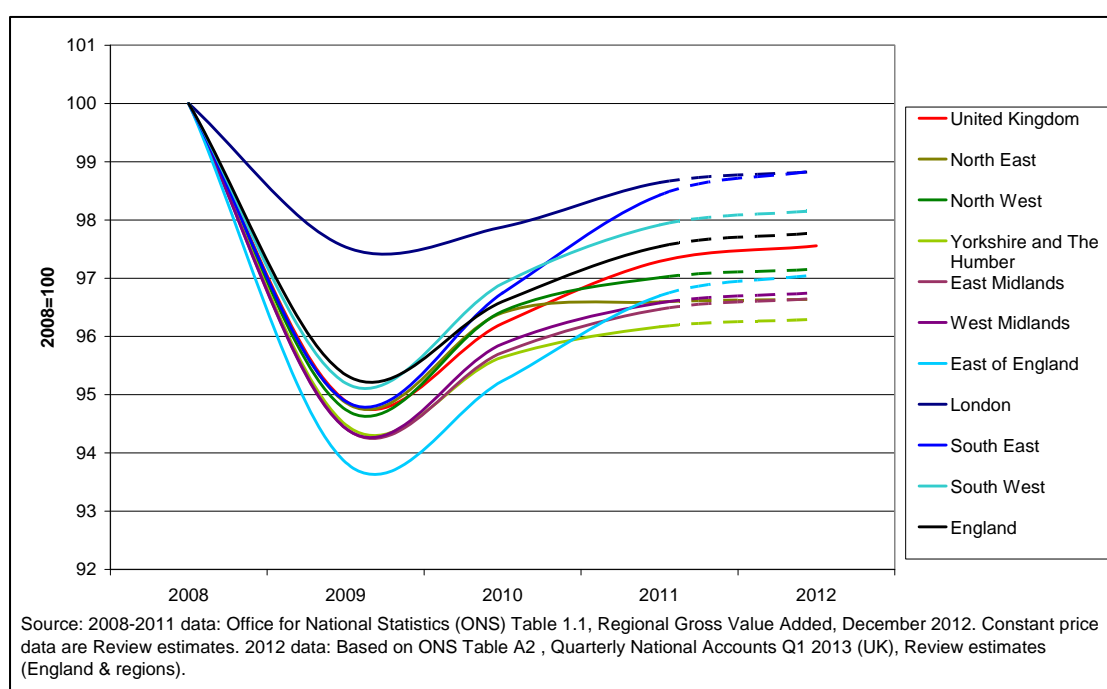
Recommendation 10. UKTI's objectives should include advancing national strategic economic priorities so that its contributions to our national SME export performance, to the Industrial Strategy, to Arrow Projects and to the growth priorities of the devolved administrations are central to its accountability for its performance, with associated metrics relating to exports and/or overseas investment. It should assign dedicated resources to these priorities, in each case located so as best to work alongside the key businesses and universities.

Chapter 1. Universities and Growth

The Context of the Review

- 1.1 It has never been more important to realise the economic potential of our universities. The UK economy has been through five years in the doldrums, and output remains below its 2008 level. Some regions, particularly away from London and the South East, have been especially badly affected (see Chart 1.1). Establishing sustainable and balanced economic growth is the most pressing challenge facing the country.

Chart 1.1 Regional Gross Value Added (estimated constant prices) 2008-2012



- 1.2 The Government has taken a number of steps to meet this challenge. It has introduced an Industrial Strategy¹, focused on eleven sectors and eight technologies. During the Review a number of sector strategies have been published. I welcome the Industrial Strategy and the partnership between the Government and industry that it represents. I also welcome the recognition that the right starting point for economic development policy is sectors and technologies. The soundest basis for competing successfully is strengths within the sectors and technologies of the future.
- 1.3 The Government has also reshaped the landscape of institutions supporting local economic development. Local Enterprise Partnerships (LEPs) have been introduced in England. These are discussed further in Chapter 5.

¹ <https://www.gov.uk/government/speeches/industrial-strategy-cable-outlines-vision-for-future-of-british-industry>

- 1.4 At EU level, a new round of European Structural and Investment (ESI) funds is becoming available, for the period 2014-20. In England approximately €6 billion of ESI funds is to be allocated to LEPs for the period 2014-2020. A further €3.5 billion is to be allocated to the rest of the UK. It is envisaged that up to €1 billion of ESI funds will be directed towards innovation and this will need to be matched on an equal basis by contributions from both private companies and public sector finances.
- 1.5 The Government has recognised the importance of research to our future economic performance in some of its spending decisions. Research budgets have fared better than many others, and in the Spending Round 2013 it substantially increased its funding for the Technology Strategy Board.
- 1.6 This is the context in which the Review has examined how to maximise the contribution to growth that we can derive from research and expertise in our universities. In this report I offer my proposals. They are built on the two hypotheses that I put forward in the Review's *Call for Evidence*, which were supported by the overwhelming majority of respondents who commented on them.
- 1.7 The first is that the strongest basis for regional economic growth is activity rooted in a sound understanding of a locality's comparative economic advantage. I have been reinforced in this belief as the Review has progressed. Investors do not put their money into Yorkshire or Bristol or Northampton but into businesses making particular products, and individuals do not work for places but for organisations. Accordingly the task of bodies seeking local growth is not to promote this or that place as such, but to understand where comparative economic advantage lies and to see how best to land the benefits of associated economic activity for their locality.
- 1.8 Moreover, a preoccupation with geographical units tends to lead to a myopic concentration on what is inside the boundary, to the exclusion of what is outside. Some stakeholders have suggested to me that this myopia characterised some of the Regional Development Agencies. It is especially wrong-headed in a small country: as I noted in the *Preliminary Findings*, England is smaller than the areas covered by some sectoral clusters in the USA.
- 1.9 Second, I suggested that much of the UK's comparative economic advantage in the twenty-first century could be derived from our universities, including (though not limited to) from world class research in fields relevant to the Industrial Strategy sectors and technologies. I discuss the economic impact of universities below.
- 1.10 The main focus of the Review has been on England but I have been mindful of lessons to be drawn from approaches being taken in Scotland, Wales and Northern Ireland. Excellent research happens across the UK and there is a common interest in seeking to get the most benefit from this for national and local economies. My recommendations are therefore mainly focused on England but I would expect them also to be of interest to the devolved administrations.

The Economic Impact of Universities

- 1.11 The contribution of universities to the economy is large and varied. The value of the impact of the Higher Education sector as a whole was estimated as £59 billion (or around 4 per cent of GDP) in 2007/08 by the University of Strathclyde, on behalf of Universities UK² – a figure equivalent to around £69 billion in today's prices. This impact takes many forms, including employment, provision of skills, creation and transfer of knowledge, working with companies and other partners of all sizes, purchase and supply of a range of products both directly and through staff and students, facilitation of communication, attracting inward investment, alumni networks, civic leadership, etc.
- 1.12 In his *Review of Business-University Collaboration* last year Sir Tim Wilson noted that no one university can operate in all these domains. Our universities are diverse, and different universities have different strengths. During the Review my support team and I have been fortunate to witness examples of excellence across all of these fields.

The *University of Warwick* is one of the largest employers in the Coventry and Warwickshire sub-region, with over 5,000 staff; its annual turnover is £400 million. Based on research by Universities UK, it is estimated that the university has generated up to 5,000 additional jobs in the local economy. The presence of the Warwick Manufacturing Group on site, pursuing cutting-edge research and knowledge transfer work with global companies as part of the Technology and Innovation Centre, has attracted investment of over £85 million in automotive Research and Development (R&D) from Tata Motors. Warwick's Science Park is home to 60 per cent of the fastest growing companies in Coventry and Warwickshire, with 150 companies employing around 2,000 staff.

The *University of Lincoln* is worth up to £250 million annually to the greater Lincoln area economy, supporting over 3,000 jobs. In 2009 it opened the first new dedicated School of Engineering to be created in the UK for more than 20 years, in collaboration with Siemens plc. In the last 10 years, its Sparkhouse business incubation centre has enabled more than 230 start-ups to find their feet, creating almost 400 jobs.

Since January 2011, *Teesside University* has worked with over 1,000 organisations, supporting over 650 companies on European Regional Development Fund (ERDF) programmes and creating over 550 jobs. Over the past decade 430 new businesses have been created through the University's pioneering graduate enterprise and Digital City Innovation (DCI) initiatives. A recent report by the KSA Partnership showed DCI was contributing £20 million a year to Gross Value Added in the North East.

- 1.13 It would take a much bigger review than this one to explore properly all these aspects of universities' contributions to the economy. The focus of this Review is on the role of universities in translating research into economic impact, realising that impact at local level, and the accessibility of universities to firms (especially small and medium enterprises (SMEs)) that could benefit from engaging with them. That is not because these are more important than, for example, provision of skilled

² <http://globalhighered.files.wordpress.com/2009/11/economicimpact4full.pdf>

graduates, but because they are central to my two hypotheses mentioned above. Moreover aspects such as provision of skilled people have recently been examined in Sir Tim Wilson's review.

Universities and Economic Engagement

- 1.14 There have been suggestions in the past that attention to the economic impacts of research is a distraction from, or even positively at odds with, the proper research and teaching aims of a university. During the Review I have seen a growing body of evidence that this is not only mistaken, but that for many universities effective economic engagement is actually one of the conditions of success. In other words what I heard was a persuasive argument that effective economic engagement is not an alternative to excellence in research and teaching but enabled and catalysed by it, and vice-versa.

Table 1.1 Top Five English Universities by QS Ranking, with Rankings for Industry Funding in STEM Subject Research, and for Contract Research Income

1. University of Cambridge (3; 11)
2. University College London (4; 3)
3. University of Oxford (1; 1)
4. Imperial College (2; 2)
5. University of Manchester (5; 4)

QS: Quacquarelli Symonds Limited <http://www.topuniversities.com/subject-rankings>

STEM: Science, Technology, Engineering and Mathematics

Industry Funding taken from *HE Finance Plus*, Higher Education Statistics Agency (HESA), 2011/12

Contract Research Income taken from *HE Business and Community Interaction Survey*, HESA, 2011/12

- 1.15 Table 1.1 shows that there is a close correlation between a university's international ranking and the amount of research funding it receives from industry. Similarly, an increasing proportion of the world's top universities have an associated high-tech cluster, such as Cambridge's 'Silicon Fen' where around 1,500 firms employ approximately 50,000 people.
- 1.16 It is not only research intensive universities for which economic engagement is central. Many others have pockets of research excellence, such as the Institute for Automotive and Manufacturing Advanced Practice at the University of Sunderland. Most play a crucial role in providing skilled graduates both for the UK and their own

regions, including in leading technologies. They also act as lynchpins in local or national networks joining up business and industry with the knowledge base, and helping them to access both skills and the knowledge they need to drive business development and growth. Respondents to the Review's *Call for Evidence* sent many examples of this type of local engagement.

University of the West of England has played a lead role in ERDF-funded regional innovation networks in the South West supporting SMEs in Aerospace and Advanced Engineering, Creative Industries, Biomedical Sciences, Environmental Technologies and Microelectronics; more than 700 businesses have been supported over a three year period with significant increases in employment and output.

Coventry University Enterprises Limited's Innovation Networks project has assisted over 300 networks of collaborating SMEs in the region with revenue or capital grants of £10,000 to support development of innovative new products, processes or services, and the university has assisted over 100 SMEs through its Sustainable Building Futures project.

The *Lancaster University* Environment Centre is a facility for the co-location of environmental technology and service-based companies alongside a community of 450+ university and Government scientists which has provided support to over 500 SMEs.

Bradford University's Centres of Polymer, Micro and Nano Technology and aspects of Pharmaceutical Engineering Sciences are working with over 100 companies in the Eight Great Technologies areas of Advanced Materials, Nano-Technology, Energy Storage and Regenerative Medicine.

Nottingham Trent's Future Factory has directly supported over 500 SMEs by delivering over 70 events on themes of sustainability. The project has facilitated almost 100 collaborative projects which enable SMEs to tap into the extensive creative resource within the university.

Teesside University's new Resource Efficiency Pathways to Sustainable Growth project aims to draw on the expertise within the university's School of Science and Engineering to provide a wide range of specialist consultancy and support to regional SMEs.

- 1.17 Many universities are long established in their localities, and are deeply embedded in them. They have a character of permanence which is an important attribute in undertaking a leading role in facilitating economic growth. I agree with Sir Tim Wilson in recognising the role of universities as "anchor institutions"³. The scale and focus of their activities varies from the international to the very local but effective economic engagement is the common thread. I would encourage universities to make facilitating economic growth an explicit goal in their statements of purpose. I use the term Third Mission for this. The term is not new, and many universities already work to bring industry and academia together for economic and research benefits. However, when I refer to a Third Mission it is in an enlarged sense of the term, going beyond knowledge transfer activity and assuming a responsibility for

³ *A Review of Business-University Collaboration*, Sir Tim Wilson, 2012

facilitating economic growth, and recognising the interrelated and mutually reinforcing character of excellence in research, education and economic engagement. For universities such as the “red brick” ones established in the late nineteenth century I believe this is no more than a twenty-first century articulation of the principle of industry and academia working together on which many were founded⁴.

- 1.18 Of course, I recognise that there are various drivers of economic growth which are not the responsibility of a university (though universities are affected by them). What I am concerned with is institutions drawing on their attributes as universities to facilitate growth.
- 1.19 All universities should have stronger incentives to embrace this enhanced Third Mission, from working together to develop and commercialise technologies which can win in international markets to partnering with innovative local SMEs. Later in this report I make some proposals which should be among these stronger incentives.
- 1.20 During the course of the Review universities have told me of the opportunities and the obstacles they encounter in these activities. A process is needed which lays out in one place the Third Mission work of all universities – and thereby highlights the best, and encourages others to emulate it – and which also identifies the blocks in the road that prevent universities achieving more, with clear recommendations to government where it could act to remove them. This would draw on, but go beyond, existing reports by the Higher Education Funding Council for England and others. I envisage an annual report to the Government which draws together key themes and recommendations, and reports the Third Mission work of every university. The Government will want to consider whether to ask an existing non-governmental body in the field to undertake this task, or to create something for the purpose.

Recommendation. Universities have extraordinary potential to enhance economic growth. Incentives should be strengthened to encourage maximum engagement in an enhanced Third Mission alongside Research and Education, and universities should make facilitating economic growth a core strategic goal. Universities should report their Third Mission activity, for inclusion in an annual report to the Government which also identifies impediments to this activity, with recommendations as to where the Government could act to remove these. Each year the Government should publish its response to these reports and recommendations.

- 1.21 In Chapters 3 and 4 I set out what a Third Mission in this sense might mean in practice. I recognise that the characteristics and circumstances of universities vary greatly, and the translation of this Third Mission into practice – and the difficulties involved in doing so – will differ considerably from one institution to another. In Chapter 5 I explore the implications and opportunities for LEPs, and in Chapter 6 for

⁴ *Industry-Academic Links in the UK*, Jeremy Howells, Maria Nedeva and Luke Georghiou, PREST University of Manchester, December 1998

national organisations supporting research and innovation.

- 1.22 Before that I turn to the Review's work to map the country's key research centres – the information base for decisions on how best to build research-led growth nationally and locally.

Chapter 2. The Information Base: Mapping Economic Activity and Research Centres

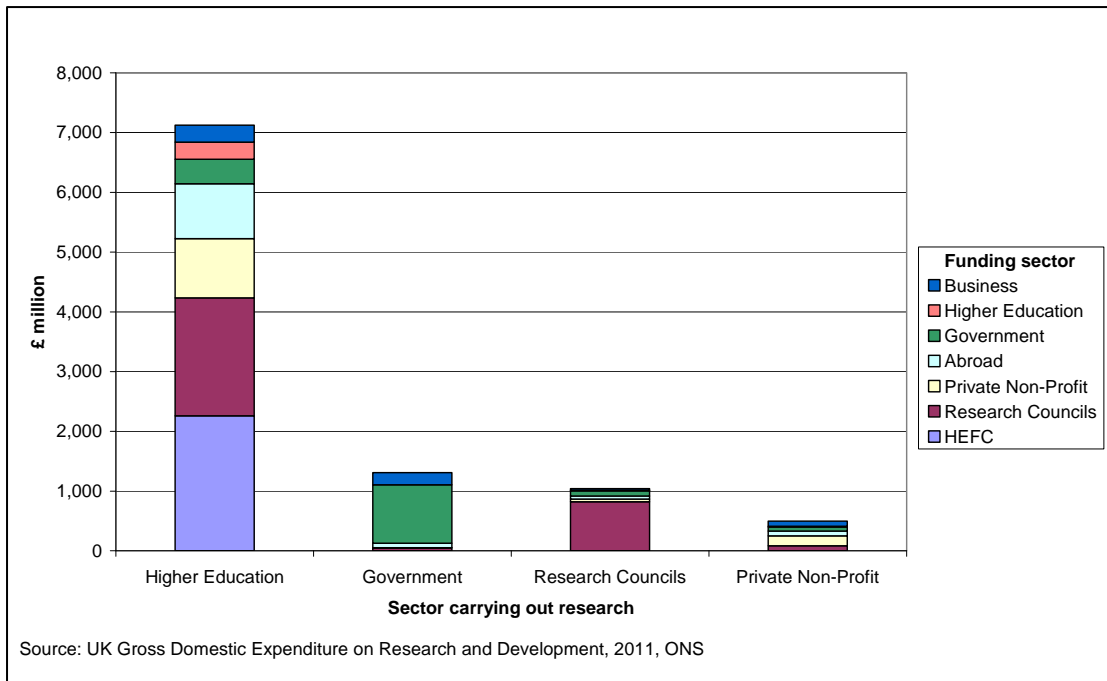
- 2.1 In the Review's *Preliminary Findings* I said that a sound assessment of local comparative advantage requires awareness of others' strengths to inform comparison and to identify opportunities for collaboration. I commented on LEPs' preparation of Strategic Economic Plans during the summer, noting that LEPs need an overview of the whole country if their plans are to be both individually sound and collectively coherent, and thereby deliver best value for their investment of public money in R&D and innovation.
- 2.2 To assist LEPs I presented heat maps showing locations of economic activity in the sectors in the Government's Industrial Strategy, UK universities ranked in the top 200 in the world in Science, Technology, Engineering and Mathematics, and centres undertaking Research Council funded research on aspects of the Industrial Strategy "Eight Great Technologies". I noted that those maps had limitations: in particular, the classifications used to produce them could not do justice to the granularity of economic and research activities.
- 2.3 I also reported that it had not been possible to find a methodology (other than collecting opinions) to identify centres where there is excellent research relevant to most sectors in the Industrial Strategy, and that this was unsatisfactory. I looked forward to presenting improved versions in the final report of the Review. These maps are at Part 2 of this report, and are discussed below.
- 2.4 The maps have benefited from the comments and suggestions of those who responded to the invitation in the *Preliminary Findings* to submit views on the heat maps.
- 2.5 Since the publication of the *Preliminary Findings* I have commissioned further work so that the maps published with this report indicate where research is taking place in fields relevant to Industrial Strategy sectors. Frequency of citations in relevant publications is one tool for indicating the importance of given research. Work by Elsevier for the Review support team has used this approach, defining appropriate key terms and searching academic publications for them to identify research centres active in Industrial Strategy sectors and technologies.
- 2.6 The maps also show improved information about the location of economic activity, in particular for those Industrial Strategy sectors for which I was unable to provide this information in the *Preliminary Findings*. This information has come from research on industry clusters currently being carried out by BIS. I have also provided comparisons between locations of economic activity in 2011 and 2013 for selected industry sectors. Finally I have provided information on the number of graduates and industry research and consultancy funding in Science, Technology, Engineering and Mathematics.
- 2.7 However, the maps still have some limitations. Many respondents to the *Preliminary Findings* drew attention to areas of strength not shown on the maps. Not all of these are captured on the improved package of maps because developing methodologies

which would enable this remains a work in progress. Others pointed out that research capability is not always to be captured in two dimensions: for example, what constitutes excellence depends partly on the purposes of the user; excellence in research as such does not indicate translational capacity, and so on.

2.8 Moreover, as well as hindering decision-making, shortcomings in the information base suggest shortcomings in the incentives on universities. “What gets measured gets done” and a defective information base means that we are not measuring, or otherwise appropriately recognising, some of the things that matter. As a result they will be under-encouraged. Much of the measuring of universities is not carried out by government, and so is outside the power of the Government directly to affect. However the Government and its agencies do require a significant amount of data from universities, and they should ensure that the incentive effects of what they seek, and the way they seek it, are as positive as possible.

2.9 These challenges have influenced my recommendation below. It is also influenced by the size of the annual investment in research in UK universities and other research centres which, excluding businesses’ internal spend, is of the order of £10 billion. Chart 2.1 shows how this is made up.

Chart 2.1 Research And Development Performed In The UK, 2011, By Source Of Funds And Sector Carrying Out Research (Excluding Research Carried Out Within Business)



2.10 This is a very large sum. Even a small relative improvement in the quality of investment decisions will translate into a substantial absolute gain. A good deal of information relevant to these decisions is already available. The Higher Education Statistics Agency publish each Higher Education Institution’s (HEI) research grant

and contract income from 13 different sources (e.g. research councils, UK industry, UK charity, EU industry etc) for over 30 different subject areas. The Research Councils' RCUK Research Gateway can be searched to find research council funded activity by individual technologies, universities or researchers⁵. UK Trade and Investment has an online interactive map of UK business and research excellence⁶ and Scottish Enterprise is developing sector asset maps. However, the experience of the Review in seeking to assemble heat maps suggests that there is room to strengthen this information base further.

- 2.11 Some of those making these spending decisions, for example some parts of government and large R&D intensive firms, have a deep understanding of what research capabilities relevant to their interests are to be found where. Others, such as LEPs, SMEs, overseas companies and smaller charities may lack this understanding. For them the research landscape is more opaque.
- 2.12 I believe they would benefit from transparency (subject to any funder requirements for commercial confidentiality) as to which universities and research centres receive what amounts of funding, classified according to sectors and technologies, from which businesses and charities, just as is available for research council spending. They will then be able to take into account where others are spending their money, and the amounts individual universities are receiving in given fields. For their part universities who are active in particular research fields will benefit from an effective and reliable means of making their activity and competence known to a wider audience of prospective research partners.
- 2.13 I envisage an online facility which would provide not only this kind of information, but also other indicators of research strength by sector, such as citation-based measures. There are attractions in a tool onto which universities could directly report this income. The National Centre for Universities and Business (NCUB) would seem well placed to take this forward, and to take responsibility for maintaining and improving it, engaging stakeholders in universities and business to do so. It would have some synergy with the platform NCUB are currently developing which will provide access to case studies, outcome data and connectivity to bring together case studies, experiences and outcome data as well as the means to connect to new partners and other sources of support.

Recommendation. Prospective investors in research should have online access to as much information as possible as to where there is research strength. This should include identifying research by sector and technology, and where possible by the businesses and charities funding it. It should also include further development of indicators such as citation-based measures of research strength by sector.

⁵ <http://gtr.rcuk.ac.uk/>

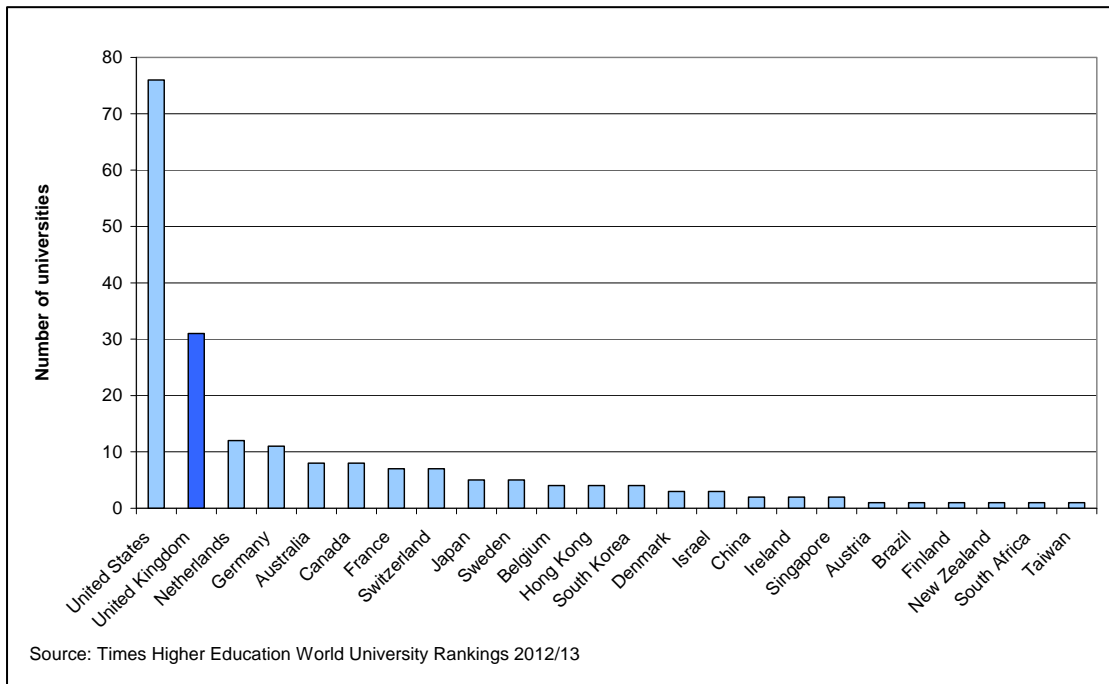
⁶ <http://www.ukti.gov.uk/investintheuk/investorsmap.html>

Chapter 3. Universities Facilitating Economic Growth

Strength in Research and University-Business Collaboration

3.1 The research strength of the UK's universities is an enormous national asset. The UK's research base is world class and internationally renowned: second in the world only to the USA for number of citations, and the most productive in the G8. With only 1 per cent of the world population the UK produces 6.9 per cent of world publications, receives 10.9 per cent of citations and 13.8 per cent of citations with highest impact.⁷ The most recent Universitas 21 report ranked the UK twenty-fourth in the world in its relative measure of resourcing, and second for output⁸. The UK has more universities near the top of the world rankings than any country other than the USA (see Chart 3.1).

Chart 3.1 Top 200 Universities by Country 2012/13



3.2 In addition the UK has a number of outstanding research institutes with world-leading facilities which are proven environments for developing first-class researchers. We remain first or second in the world at research in most research disciplines, despite growing international competition.

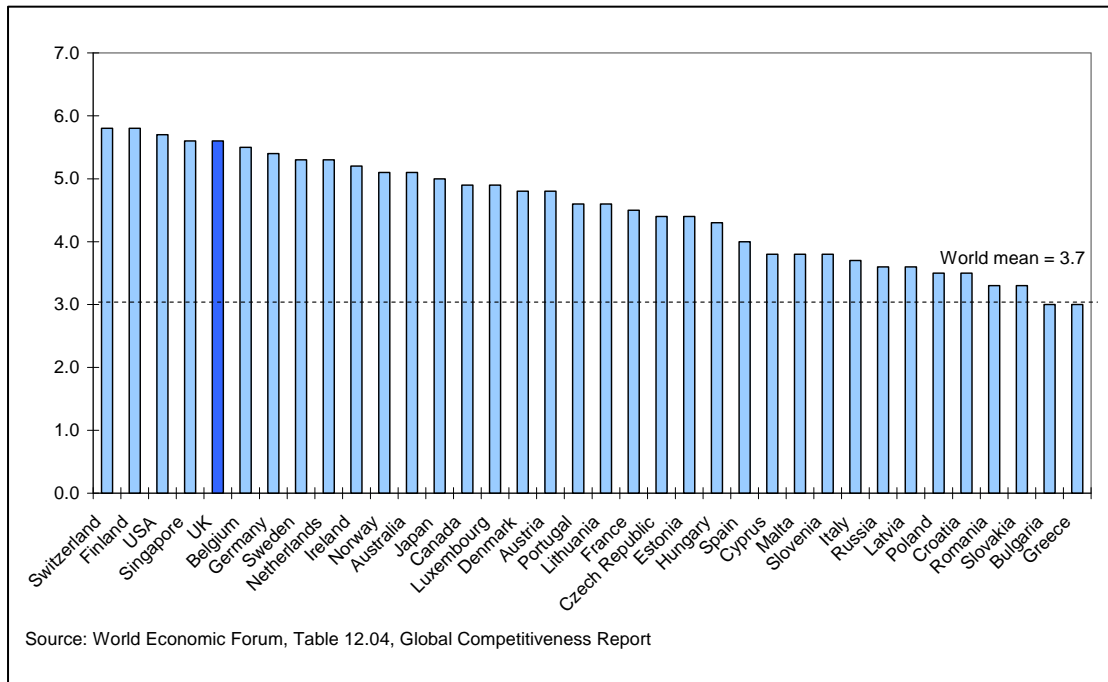
3.3 We also have a strong record in university-business collaboration. The World Economic Forum (WEF) ranks the UK fifth in the world, and second in the European Union, for university-business collaboration in R&D (see Chart 3.2).

⁷ International Comparative Performance of the UK Research Base, November 2011,

⁸ U21 Ranking of Higher Education Systems 2013, Universitas 21, January 2013

Chart 3.2 University-Industry Collaboration In Research And Development In The EU28, Other G8, And Other Selected Countries

(1 = do not collaborate at all; 7 = collaborate extensively)



- 3.4 These are great strengths. But we must not take them for granted. Other countries recognise the value of excellent universities and are putting substantial resources into improving their research and higher education institutions. (Our slippage from second place last year to fifth this year in the WEF rankings illustrates the point.) Moreover new technologies and markets are emerging every day. We will have to work hard to maintain our position of strength in the face of increasing competition and improving performance from other countries. Provided we do that, our research strength can be a solid foundation for building a lead in the critical research-led technologies and sectors of the future, including – but not limited to – those industries and technologies covered by the Industrial Strategy.

A Leadership Role for Universities

- 3.5 Universities with leading edge research capabilities in fields such as these are in a unique position to assume a leadership role in facilitating economic growth. They possess resources in terms of research and innovation capacity and expertise, both national and international connections, strong links with leading companies in their sectors and the capability to analyse and understand research from across the globe and the markets in which that research can be applied. Typically they will already be involved in widespread networking to be able to draw on relevant research, wherever it is based.

- 3.6 In other words universities are ideally placed to carry out a central role in the development of sectors, taking forward key emerging scientific and technological developments through connections in their own regions, across the UK with other like-minded institutions, and small and large businesses, including on an international scale. They are in a pivotal position to identify the key breakthroughs and to establish the connections that will create the critical mass to anchor a technology in the UK. Moreover they frequently have the administrative and other resources to lead the development of multi-party plans for realising the economic benefits of research. For example, universities have bid for, and applied, over £300 million of ERDF funds since the current programme began in 2007, frequently in multi-party engagements with businesses and others.
- 3.7 I believe universities can play a key role in bringing about the successful realisation of the comparative advantage these attributes represent. During the Review I have discussed this idea with a number of universities, and many have expressed enthusiasm for undertaking or extending this activity.
- 3.8 In the Review's *Preliminary Findings* I likened universities generating cutting edge research and its resulting insights to the tip of an arrow, with the arrowhead behind it representing the economic activity enabled by research-led innovation. I suggested that maximising the size of these arrowheads and their economic benefit to the UK, specifically, is fundamental to both sectoral and local growth strategies. I also pointed to the scope for universities that wish to do so to draw on the sort of characteristics mentioned above to play a larger role in facilitating economic growth – to which I applied the term a Third Mission in Chapter 1.
- 3.9 In this chapter and Chapter 4 I offer proposals to take this further. Although this enhanced Third Mission can take a number of forms I intend to focus on two. The first, the theme of this chapter, is leadership of or participation in research/business collaborations with the potential to produce technologies offering the UK comparative advantage in international markets.

International Market Opportunities

- 3.10 In Chapter 1 I said that establishing sustainable and balanced economic growth is the most pressing challenge facing the country. As the Government has made clear, sustainable economic growth will be export-led. If we are to achieve enduring export-led growth in the future then we must set our sights high when we consider the global markets of the twenty-first century. That entails recognising that in some fields we need a mechanism which can mobilise a “national cluster” in the context of a prospective market opportunity where something smaller will risk lacking the weight to land it. The box on quantum technologies illustrates this sort of research-led major market opportunity.

Quantum technologies involve the control and manipulation of quantum states to achieve results not possible with classical matter, exploiting the laws of physics in radically new ways. They promise future dramatic changes in the technological capabilities in several key application areas.

The Engineering and Physical Sciences Research Council currently invests approximately £30 million in research, training and fellowships of direct relevance to quantum technologies; this exceeds £150 million when complementary research areas vital to the successful development of quantum technologies are included, such as photonics, electronics, communications, functional materials, sensors, instrumentation, and computer science.

Further UK quantum technologies investment will be required to keep pace with international investments and ensure the UK remains at the forefront of this rapidly expanding domain.

Potential Applications for Quantum Technologies

Quantum Secure Communications: as the secrecy of quantum communications can be measured directly, it is very useful for distributing secure digital keys on networks. Quantum key distribution is widely regarded as one of the first quantum information technologies with commercial applications.

Quantum Metrology: next generation metrology capabilities will be based on quantum phenomena, and will deliver new standards for time, frequency, length, charge and other key fundamental measures. These will have immediate important applications, and will enable better standards for rapid electronic stock trading, for instance, as well as new navigation opportunities.

Quantum Sensors: quantum sensing technologies promise sensors that can detect at the single molecule level; that can sense ultra-weak electromagnetic and gravitational fields with unprecedented precision. These sensors will provide new paradigms for healthcare and medical imaging technologies; security and environmental monitoring; and manufacturing of high value materials.

Quantum Simulators: the modelling of real molecules or materials at the atomic scale is key to technological problems ranging from the interaction of drug molecules with their targets, to the nature of high-temperature superconductivity.

Quantum Computation: quantum physics offers the possibility of a computing engine capable of solving problems that are completely intractable on current and future generation conventional hardware. The hardware required to build such a computer would also deliver revolutionary capabilities for other quantum technologies.

- 3.11 During the course of the Review the potential of quantum technologies has attracted increasing interest as an example of the type of technology that might inspire an “arrow tip” collaboration. Work is currently being taken forward by several UK universities, and this work could be co-ordinated, with strategic oversight, to ensure that the UK maximises its chances of commercial success.

- 3.12 In fields such as quantum technologies I envisage enabling “arrow tip universities” – those where world class research in the field is taking place – to lead collaborative efforts of Higher Education Institutions (HEIs), LEPs (in England) and private sector partners to maximise the economic benefit to the country – in the terms of my metaphor, to maximise the size of the associated “arrowheads”. Such consortia would be brought together to advance sectors through proposals centred around excellent research in leading research institutes and supported by a range of other key organisations, as well as securing investment funding from the businesses within them who will benefit from their outcomes.
- 3.13 These “Arrow Projects” will be large multi-party collaborations in technologically advanced fields. The partners in a consortium are unlikely to be geographically co-located – the main objective would be to bring together all the necessary players to advance an area of research or technology in the most effective way. I would not expect the number of Arrow Projects to reach double figures, and they would not be duplicative: the principle is to brigade national capability to land a punch internationally.
- 3.14 Participating universities would not come only from the leading research intensive universities. As the heat maps published as part of this report indicate, there is research excellence in fields relevant to international market sectors in other universities. I would also expect some of these collaborations to involve universities who are not themselves leading research in the field in question, but who can make a vital contribution, for example in supplying skilled people, engaging local businesses, etc. It will be for universities to decide whether to take part and in what sorts of roles according to their priorities and capabilities.
- 3.15 Moreover a key objective would be to maximise the associated economic activity taking place here – what I have called the arrowhead. This entails building the capabilities and resources that will develop supply chains in the UK. This is a multi-faceted challenge, embracing among other things skills, support for small and medium enterprises (SMEs), access to finance, appropriate available facilities, transport infrastructure, etc. I am encouraged by the recognition in some of the Government’s Industrial Strategy sectoral strategies of the importance of maximising supply chain presence here, and of the need to coordinate action across a number of fronts to achieve it.
- 3.16 Universities can help to meet some of these challenges, particularly provision of skills, and making facilities and support available to innovative SMEs (explored further in Chapter 4). Arrow Projects will involve them in doing so.
- 3.17 Universities undertaking world class research, or that make important contributions in other ways, may be in any part of the UK. It will be important to draw on the UK’s excellent research wherever it is located. In England the LEPs have a key interest in supporting Arrow Projects that will benefit business in their areas. Outside England this would be a role for the Devolved Administrations or their agencies. Local authorities with available facilities or funds may also be involved.
- 3.18 Partnership with industry and business in the relevant sector will be essential. Their

knowledge of sectors and markets will be key in bringing together plans and investment to develop new technologies. Indeed the approach I am suggesting is already being adopted by innovative major companies, who are working to realise the benefits of such multi-party collaborations in their own sectors. Where possible Arrow Projects should look to understand and build on the experiences such companies have had of working in this way.

In August 2012 BP announced a \$100 million 10 year investment in an International Centre for Advanced Materials (BP-ICAM) – a partnership between BP and four world-leading universities (University of Manchester, University of Cambridge, Imperial College London and Urbana Champaign University of Illinois). The ICAM is focusing on tackling materials-related research challenges faced by the Oil and Gas industry such as:

- The need for better structural materials and smarter coatings, so that oil recovery and conversion technologies can operate safely and efficiently to access reservoirs in increasingly demanding environments
- New generations of industrial membranes for separation, filtration and purification of oil and gas, water and chemicals in production, refining and biofuels processes and petrochemicals
- The need for new steels designed for improved resistance to aggressive environments.

These universities are Centres of Excellence in their own right and BP has chosen to work with these on the basis that they already have significant research infrastructure and expertise as well as PhD training capability which BP can tap into – much of this capability has been enabled through EPSRC funding over a number of years.

Making the Arrow Projects Happen

3.19 I have outlined a model in which universities collaborate with each other, as well as with business in order to create true critical mass and avoid unhelpful competition. I am looking to stimulate universities to work with each other, the private sector and local and central government, to deliver national and local economic benefits. This is not a simple or trivial task and will require changes in culture, behaviour and funding. I do not underestimate the scale of change I am proposing.

3.20 I have reviewed the funding streams for research and innovation to see how far adjustments are needed to make Arrow Projects happen (see Annex 1 in Part 3 of the Report for an overview of these funding streams). Several offer part of what is needed:

- HEFCE's Catalyst Fund supports universities to engage in collaborative activity which promotes economic growth, but – while in some respects it recognises several of the issues I have identified – its scale and ambition is much too small for the challenge I have described
- The UK Research Partnership Investment Fund brings together public and private money to finance major research projects but provides a source of capital funding

only, without the focus on plans for realising economic activity and market position for the UK

- Depending on its character an Arrow Project might also be able to access funds from the Technology Strategy Board, Research Councils, European Structural and Investment Funds, the Regional Growth Fund and possibly others.

- 3.21 I draw two conclusions. First, the Government will need to create a new funding stream to bring Arrow Projects into being. The Government will need to decide how far this stream is new money or drawn from existing resources. Second, although a material part of what a given national cluster Arrow Project wants to do could almost certainly be funded from existing sources, assembling this funding from multiple streams is likely to be time-consuming and to limit management flexibility to shift resources if necessary. I believe that we should remove these barriers and free up management to use their judgement to deliver the agreed objectives of the Project.
- 3.22 One way of doing this is create a specific funding stream that is a block grant, with one gateway to replace the multiple applications. An Arrow Project bidder would indicate from which other funding streams they would otherwise have sought contributions (e.g. the Technology Strategy Board and Research Councils). Instead of applying to those funding streams, it would make a single block grant application to access all funding. This should significantly reduce the resources needed to apply for grants while ensuring there is no scope for duplicate applications for funding the same activity.
- 3.23 While not exact parallels the research commitments in major technology-centred Industrial Strategy sectoral strategies indicate the scale of funding which will be necessary. The Aerospace strategy includes a commitment to make £2 billion available over seven years to fund a new Aerospace Technology Institute⁹. The Agri-tech strategy sets aside £160 million for a catalyst to take ideas from the laboratory to market, and a centre to develop, adopt and exploit new technologies¹⁰. Taking account of the envisaged number of projects and the costs of research, the funding available for Arrow Projects should be of the order of at least £1 billion pounds over the life of the next Parliament, with a large part of that funding to come from participating businesses and LEPs.

Selecting Arrow Projects

- 3.24 Each Arrow Project bid should set out how it can take full advantage of and develop research currently being undertaken or planned by a leading university in the field, how it will harness expertise offered by universities and companies working in the relevant technologies, and tap into facilities offered by locally based organisations in one or more LEP area. They should also show how the consortium would work together, how it would interact with other institutions in the innovation system e.g. UK Trade and Investment (UKTI) and the Technology Strategy Board – including how it draws on relevant Technology Strategy Board facilities or initiatives – and

⁹ Lifting Off – Implementing the UK Strategic Vision for UK Aerospace HM Government, March 2013

¹⁰ A UK Strategy for Agricultural Technologies HM Government July 2013

how the bid brings the partners together to offer something new or unique that might not otherwise have taken place. It would show too how it would exploit universities' networks of international partnerships and collaborations.

- 3.25 I would also expect any bid to include a strategy for maximising the opportunities for SMEs, including how the partners will reach out to innovative SMEs who may be able to contribute and benefit from the project. More widely, bids would need to indicate what action is needed to maximise the supply chain presence here, including how far the sorts of issues mentioned at paragraph 3.15 above arise and how they should be addressed.
- 3.26 The proposals around which the bids are built would need to be of a significant scale. This is about having global impact – essential if they are to fulfil the brief of leading the development of an entire sector. Their significance and likely impact should be judged relative to the size of the sector and market in which they are based and the universities leading bids should be required to evidence a potential demonstrable impact on the sector in the UK. They should also be judged on how far they bring together the key research centres and other relevant organisations. This means that bids would not need to meet a minimum amount of required funding, the amount applied for would be judged against the size and importance of the sector, the new collaborative nature of the bid and the level of potential growth.
- 3.27 However the consortia come together, I would expect there to be a university in the lead role. Public funding would go to that body, which would be accountable for delivery and the impact of the project. Typically there would be a single figure appointed as Chief Executive of the project and authorised by the university and consortium partners to lead it.
- 3.28 Bids should not be restricted to prescribed timetables or to pre-determined subject fields, both of which – while appropriate in contexts such as the sorts of competitions run by the Technology Strategy Board – are potential constraints on universities and businesses working up the most persuasive propositions. Consortia bidding for funds from the new mechanism will need to be built around new opportunities presented by research when they arise. The partners will take time to assemble and to clarify their respective roles in the project proposal. The risk that the pot would be scooped by the earliest rather than the best bids should be mitigated by a rigorous assessment process that includes stringent peer review, so that only the most credible projects gain support.
- 3.29 Arrow Projects will be long-term strategic commitments and it is critically important that the mechanism for determining which bids to fund should be designed to maximise the chances of robust decisions. It should involve assessment by a group of pre-eminent independent experts. Some (such as a senior leader from the Technology Strategy Board) may be permanent members of the assessment group, involved in every decision. Others should be senior industry or academic figures co-opted to bring sectoral or technological expertise on the case in question, so that every assessment features peer and expert review.
- 3.30 Arrow Projects would come forward, and be carried through, on timeframes unrelated to the political cycle. There are good arguments for placing the decision-

taking on which projects to support at arms' length from Ministers, to ensure that project merit is assessed at a distance from political considerations. An alternative would be to adopt many of the features of the Industrial Development Advisory Board (see box) which brings together distinguished experts to advise Ministers on applications for forms of business support, with sanctions if Ministers do not follow its advice.

The Industrial Development Advisory Board (IDAB)

IDAB is a statutory body which provides independent and expert business advice to Ministers on large business investment decisions in relation to applications from companies proposing to undertake capital investment projects in the Assisted Areas in England. It has around ten members drawn from industrial, accounting, financial and academic backgrounds and all have significant expertise and experience. They meet when there are new applications to consider. The Board is statutorily empowered to require the Secretary of State to lay a statement before Parliament, should an IDAB recommendation not be followed.

- 3.31 Although the IDAB model comes from an English context its function, assessing the strength of an investment case, is applicable regardless of the bidders' location in the UK. An advantage of the IDAB model is that Ministers – who are the accountable decision-takers in relation to the Government's Industrial Strategy – would remain answerable for their decisions to support Arrow Projects. Moreover I would expect them to hold Arrow Projects to account for delivering the commitments which they have made in return for funding, and for their wider leadership of projects which are strategically important to the national economy.

Recommendation. The Government should establish a funding stream worth at least £1 billion over the life of the next Parliament available to Arrow Project consortium bids where:

- **there is a credible prospect of technology offering the UK comparative advantage in international markets**
- **the collaboration includes the key research centres, their LEPs or devolved equivalents, and private sector partners, with funding from the latter two**
- **there are robust research/development/economic outcome metrics.**

Funding for bids should be decided through independent assessment by a panel of leading figures from industry, academia and government. Most weight should be given to proposals which advance the Industrial Strategy.

- 3.32 Spreading this type of model across the country to exploit and develop clusters that exist in the UK around our key sectors would enable the UK to take better advantage of the expertise, funding and facilities we have, regardless of the location of the skills base, technology base and centres of research excellence.
- 3.33 It will increase the possibility of the UK leading international markets in the future. That depends in part on the work of national government bodies such as the Technology Strategy Board and UKTI. The implications for these bodies are explored in Chapter 6.

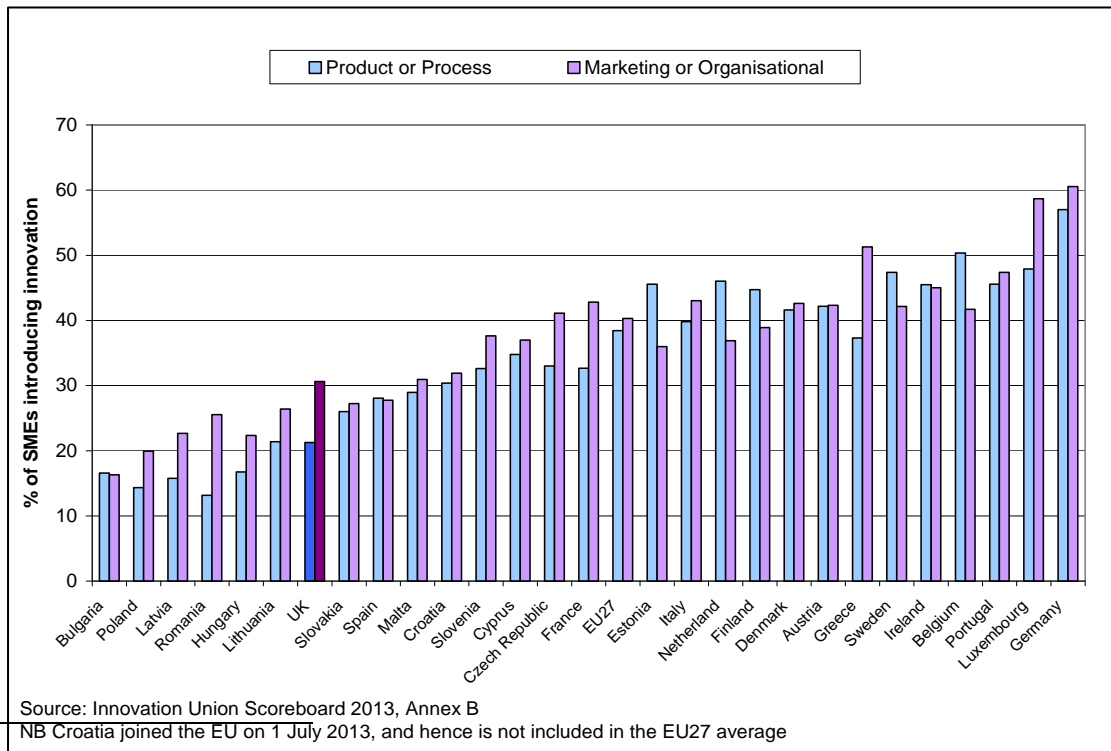
3.34 I have already noted that it will also partly depend on SMEs. And it is to the second dimension of the enhanced university Third Mission – university support for local business activity, and particularly that of innovative SMEs – that I now turn, in the next chapter.

Chapter 4. Universities and Small and Medium Enterprises

Small and Medium Enterprises and Innovation

- 4.1 Responses to the Review's *Call for Evidence*, and meetings I have had with universities have shown that the importance of engaging effectively with Small and Medium Enterprises (SMEs), and the challenges of doing so, are widely understood. I welcome this recognition. The future growth of the UK economy will in large part come from fast growing SMEs. The fastest growing SMEs, generating half of all new jobs, are those that are driven by innovation¹¹. In fact our national innovation performance depends in part on SMEs.
- 4.2 But the UK lags behind many of our competitors in being able to produce fast-growing, innovation-rich SMEs with the potential to break into global markets and supply chains. While on most indicators the UK's innovation performance is above the EU average, our performance in terms of the proportion of SMEs that are innovative is relatively weak (see Chart 4.1). Our share of exporting SMEs, and the proportion of SMEs' revenues accounted for by exports are both below the EU average¹². In 2011 only 4 per cent of expenditure on research and development (R&D) came from real SMEs (i.e. those not part of a larger enterprise group), though this was higher than in the previous 11 years¹³.

Chart 4.1 European Countries' Innovation Performance 2012, % SMEs Introducing Innovation



¹¹ Rebalancing Act, Shanmugalingam S. et al, Nesta, 2010.

¹² Trade and Investment for Growth, BIS, February 2011

¹³ Business Enterprise Research and Development 2011, ONS, November 2012

Universities and SMEs

- 4.3 The benefits SMEs may derive from universities are varied and substantial. In the *Preliminary Findings* I characterised these benefits as including “enabling entrepreneurs to launch businesses, consultancies, student internships, year-long student placements, access to facilities, joint working on business and technological problems, running of business focussed networks, and brokering facilities.” To these I would add the international relationships with businesses and other academic institutions and international alumni networks which can be an invaluable resource for an SME seeking to export its products.

“The University of Huddersfield works proactively to foster collaborative R&D activities, and commercialisation and enterprise from its student and staff base. The University has recently opened its new 3M Buckley Innovation Centre (3M BIC) which focuses on co-location of businesses alongside the university to foster collaborative R& D activities. The philosophy for the centre is one of open innovation practice and delivers a one-stop-shop for rapid access to markets, finance, technology and skills for industry. The 3M BIC showcases centres of excellence from within the university and houses bespoke equipment dedicated for industrial use with flexible access mechanisms. The sectors supported through the centre are advanced manufacturing and design, energy, IT and healthcare. In addition the university has established The Duke of York Centre for Young Entrepreneurs to enable student and graduate start-up companies to be incubated and mentored alongside existing companies.” University of Huddersfield response to the *Call for Evidence*.

“The ‘Knowledge Action Network’, a collaborative project between the University of Cumbria, Manchester Metropolitan University and the University of Chester, enables the universities to develop collaborative networks of SMEs, focused in particular sectors and on business innovation. This approach is proving very productive in creating links that did not exist previously, innovation and new product development.” University of Cumbria response to the *Call for Evidence*.

- 4.4 For many SMEs, lacking resources for external engagement, the quality of support available locally is key. During the Review I have heard about a range of valuable interventions to support local SMEs, such as those described in the box. Stakeholders also talked to me about SMEs who could benefit from university engagement but do not do so because they remain unaware of the possibility. I recognise this challenge, but it is not the only one. Research shows that SMEs see relationship-building between companies and universities to develop trust as key to successful innovation⁶. However, I also heard evidence that SMEs do not always find universities accessible.

“We find it difficult to get the interest of academia to do the work that Cellzome needs to complete. Universities see the work as being ‘contract’, too small or short term to engage their interest and energy, and appear to be more interested in the larger, longer term strategic industry-academic alliances coming from big pharma.” Alan Watt, Chief Science Officer, Cellzome Inc, quoted in *Collaborate to Innovate*, Big Innovation Centre and Intellectual Property Office, 2013.

The Enhanced Third Mission and SMEs

- 4.5 In the light of the evidence I have seen during the Review I am sure that we have not yet realised the full potential of universities to support innovation in SMEs. Many universities recognise this very clearly.
- 4.6 What would it mean in practice for a university to commit to an enhanced Third Mission focused on supporting local innovative SMEs? I would expect to see all the benefits highlighted at paragraph 4.3 above, with differences of emphasis according to local circumstances. I envisage an eco-system in which universities and SMEs are working together, and where universities are pro-actively seeking both innovative and potentially innovative SMEs.
- 4.7 I would like to see universities committed to ambitious programmes of identifying potential fast growing SMEs and injecting technology, expertise, talent and know-how into them. The goal should be to reach and engage with every innovative SME in the locality that could benefit from university engagement. In Chapter 2 I recommended measures to give prospective research investors access to as much information as possible on research strength. Similarly this process should aim to increase the visibility of our innovative SMEs to potential partners, customers, suppliers and investors. These companies can only reap the full rewards of their innovation if others know about it.
- 4.8 Many of these SMEs will have the potential to become exporters, or grow their export markets, though they will often need support to move into exporting. Universities are often well-placed to offer support, drawing on their alumni networks and international business relationships. I will go on to consider the implications this may have for UKTI in Chapter 6.

SETsquared is a collaboration between the universities of Bath, Bristol, Exeter, Southampton and Surrey which partners in enterprise activities. It currently supports approximately 250 technology start-ups and has given birth to around 1,000 high-tech start ups since its inception ten years ago. In July the University Business Incubator Index ranked it the best in Europe, and fourth in the world behind three counterparts in the USA¹⁴.

- 4.9 Universities will need to work with appropriate local partners to achieve this. In many places this will also involve multiple universities. In some cases large corporates will be valuable partners; in others trade or business representative bodies may be key. Other partnership opportunities will arise through engagement via the Local Enterprise Partnership (LEP), or playing a part in the local Growth Hub. Chapter 5 provides examples of such opportunities. Through Growth Hubs partners have formed close working relations to offer targeted business support and finance vehicles to SMEs in key sectors. Similar partnerships have emerged to bid into the Regional Growth Fund (RGF).

¹⁴ <http://www.setsquaredpartnership.co.uk/>

- 4.10 Universities will obviously explore the opportunities available to help them play this role, as a number do now. These may include making use of available resources from a range of sources including European funding, funding from the Higher Education Funding Council for England (HEFCE), the Research Councils and Technology Strategy Board, and RGF.
- 4.11 However, if universities are to go further in this direction than at present they should be given additional encouragement to do so. In part this should come from LEPs using resources available to them to support this kind of university activity, and I make a recommendation to this effect in the next chapter. I believe there is also scope to utilise Higher Education Innovation Funding (HEIF) further to encourage university support for innovative SMEs.
- 4.12 I have heard extensive support for HEIF throughout this Review. Stakeholders have told me how valuable it is to the universities, SMEs and other businesses it supports. It has funded many of the best examples of university support for local business that I have referenced in the *Preliminary Findings* and in this report. Evaluations of HEIF demonstrate its effectiveness. An estimate of the impact of the funding suggests that for every £1 of HEIF invested, it returns £6 in gross additional knowledge exchange income¹⁵.
- 4.13 HEIF is currently funded at £150 million per year, with an extra £10 million a year until 2015 being allocated to top performers. It is allocated on a formula basis alongside HEFCE's institutional funding for research and teaching. For the core £150 million HEIF, the minimum award is £250,000 and the maximum £2.85 million. Higher Education Institutions (HEIs) are eligible to receive HEIF if their knowledge exchange activity reaches a certain threshold. Ninety-nine out of the 130 English HEIs received a HEIF award for 2011-15.
- 4.14 This is an approach which seeks to allocate more of the pot to those who are doing more, but it does not ask how big a pot is needed in the first place. I believe that question needs to be addressed. Otherwise we risk failing to provide some of our innovative SMEs – a vital engine of jobs and growth – with the knowledge exchange and support they need. This risk would seem to be a real one: the high returns on HEIF investment mentioned above suggest that there may well be unmet need.
- 4.15 HEIF should be big enough to fund all good claims on it. This implies making it substantially larger. I recommend below that it should be increased to £250 million a year. Time will be needed to ascertain whether that is the right level. As long as strong spending proposals are coming forward, and the sorts of returns on investment reported above are being achieved, then adjustments in funding should be upward not downward.

¹⁵ Strengthening the Contribution of English Higher Education Institutions to the Innovation System: Knowledge Exchange and HEIF Funding, PACEC, April 2012

Higher Education Innovation Funding (HEIF)

The majority of universities have embedded “knowledge exchange” activities and many already take a strategic approach to these. In recent research 80 per cent reported that they have taken steps to align with the key national priorities of the research councils and the Technology Strategy Board. Many work to increase the competitiveness of their local and regional economies offering services ranging from entrepreneurship training to working directly with their LEPs.

Figure X5 Strengthening the underlying innovation conditions



Source: HEIF2011-15 strategies, PACEC analysis

“Third stream” funding to complement universities’ activities in support of industry was introduced in the last century, leading to the introduction of the HEIF in 2001. Today, HEFCE provides funding for knowledge exchange through HEIF. This supports and develops a broad range of knowledge-based interactions between universities and colleges and the wider world, which result in economic and social benefit to the UK.

- 4.16 My approach requires that the strategies HEIs submit to HEFCE to access their knowledge exchange allocations meet key criteria to ensure HEIF spending achieves the aim of supporting innovative SMEs. These criteria should include requirements to set out how universities will work with local partners so any local SMEs that could benefit from working with an HEI are enabled to do so. It should also make clear the roles of other partners, and confirm that university plans do not replace investment the SMEs would make anyway, or duplicate other sources of

SME support which may be available.

- 4.17 As well as these adjustments other features of HEIF should be reviewed in order to strengthen the incentive on universities to engage with every innovative or potentially innovative local SME who could benefit. In particular:
- The effects of further increasing the formula weighting given to SME-related income should be explored, so that those universities that do proportionately more with SMEs are appropriately rewarded. In addition, scrapping the ceiling on institutions' allocations in relation to qualifying SME income only should be explored
 - The Government should make an explicit long-term commitment to funding for knowledge exchange, alongside funding for teaching and research, so that universities can develop long-term plans, confident in continued funding
 - For the same reason the five-year allocation model should be retained, though calculated on the basis of several years' data so that the incentive to perform is maintained. It should also be adjusted so that institutions which receive no formula funding are not excluded from receiving funding for the next four years, and therefore lacking this incentive to pursue Third Mission activities. Those that miss out one year should have another opportunity to secure an allocation in 12 months time, creating an incentive to "up their game" the following year.
- 4.18 The introduction of "impact" in the forthcoming Research Excellence Framework (REF) provides a different sort of incentive to translate research insights into benefits for local businesses. The REF is the mechanism used by HEFCE to determine the funding it will provide to universities (see Annex 1 at Part 3 of the Review for a fuller description of the REF). The first REF assessment is to include a 20 per cent weighting for impact evidence. There have been proposals that this might rise to 25 per cent in due course, perhaps in the next REF which might take place around 2020. I would welcome this as it would increase the incentive on universities to achieve effects such as benefits to local businesses. I hope that it would also encourage universities to continue to consider recognising academics for a wide range of successful third stream activities beyond research publications – academics whose work may lead to these benefits should be incentivised to achieve them. There should be a presumption of increase in the weighting for impact evidence to 25 per cent in the next REF, subject to evaluation of the current REF.
- 4.19 There that this might rise to 25 per cent in due course, perhaps in the next REF which might take place around 2020. I would welcome this as it would increase the incentive on universities to achieve effects such as benefits to local businesses. There should be a presumption of increase in the weighting for impact evidence to 25 per cent in the next REF, subject to evaluation of the current REF.

Recommendation. In order to strengthen the incentives on universities to engage with innovative SMEs the Government should make an explicit long-term commitment to HEIF, which should increase to £250 million a year. It should be adjusted so that:

- **Institutions' HEIF strategies show how all local SMEs that could benefit from working with an HEI are enabled to do so**
- **The five-year allocation period does not entail excluding institutions which do not qualify for more than a year.**

The method of determining institutions' allocations should be reviewed to sharpen the incentive to engage with innovative SMEs.

The impact weighting in the Research Excellence Framework should be increased to 25 per cent in the next REF, strengthening the incentive on universities to achieve effects such as benefits to local businesses.

University Interaction with SMEs

- 4.20 As indicated above, it is clear that the large majority of universities recognise the benefits that working with SMEs can bring. HEFCE's *Higher Education – Business and Community Interaction Survey 2011-12* reported earlier this year that over 90 per cent of HEIs have enquiry points for SMEs. In 2011–12 these institutions generated a 15 per cent increase in the number of SMEs using facilities and equipment, and a 20 per cent increase in income from Continuing Professional Development activity with SMEs.

University College London has made extensive use of structural funding schemes to help support small businesses through the Higher Education in London (HELO) scheme, whereby UCL students provide technical consultancy for small businesses, and the Selected Mentors and Interims for London Enterprises (SMILE) scheme, which has provided business analysis and a business mentor for more than 150 small businesses.

SME Routes to Universities

- 4.21 In many places universities are by far the biggest channel for European Regional Development Funding (ERDF) funding to the SME population¹⁶. Innovative use of these funds can also drive demand for business support from SMEs, who may not understand what universities can offer them. As Sir Tim Wilson has pointed out, “first contact and creating awareness of the capabilities of the university is a challenge in itself”¹⁷.
- 4.22 As well as examples of effective outreach to SMEs I have witnessed many instances of good practice where universities are adapting to create structures that ‘hide the wiring’ for SMEs and give them a single and accessible point of entry. In some areas, such as the devolved administrations, this has taken the form of intermediary organisations, such as ‘Interface’ in Scotland, or ‘Connected’ in

¹⁶ East Midlands ERDF Business Support Guide, DCLG, 2013

¹⁷ *Review of Business-University Collaboration*, Sir Tim Wilson, 2012.

Northern Ireland. There are other examples where institutions are adapting themselves to provide a managed point of entry for SMEs. The most effective recognise that innovation and knowledge transfer tend to generate skills development needs in the organisations concerned, and are proactive in identifying and meeting these needs.

At Nottingham University, an account management approach is used in guiding SMEs into the university and discussing what they may need – a single SME portal. Lindhurst Engineering was originally a traditional engineering/fabrications business. Their Managing Director attended the university's ERDF funded 'Ingenuity' awareness raising events designed to offer SMEs a quick insight into what they could gain by working with the University. Following this they upskilled key staff through professional development workshops. The company progressively developed relationships with the Engineering Faculty leading to a £750,000 Technology Strategy Board research grant, and secured a Knowledge Transfer Partnership to commercialise the research work. "*Our engagement with the university has turned us into a totally different organisation.*" Martin Rigley, MD

- 4.23 In other words there are a range of examples of successful working already in place. So what is needed is not to create a model of closer engagement, but for universities and LEPs to build on the examples of effective working that already exist, and which have been highlighted in responses to the Review.

Business Schools

- 4.24 One of the resources SMEs may access via a university's single point of entry is its business school. I described in the *Preliminary Findings* examples of university business schools having a transformative effect on SMEs, through practical advice and support on running and developing the business. I also drew attention to Lord Young's report earlier this year, *Growing Your Business*.
- 4.25 Lord Young identifies three key factors required to support innovation and growth in SMEs:
- *Confidence* – not only in the economy and overall prospects for growth, but also in SMEs conviction to make it happen.
 - *Capability* – by improving a firm's skills and performance. The evidence is unequivocal: businesses that seek and engage external help are more likely to grow. But much more needs to be done to encourage firms to invest in their capability.
 - *Coherence* – businesses need support that is designed and marketed in a way that they understand, trust and can find.
- 4.26 I have indicated above the range of ways in which universities may develop the *capability* of small businesses. Through their business schools they are able to provide support that increases the *coherence* of an SME's offer. Lord Young has recommended that business schools are a potential hub for business support, backed with Growth Vouchers. The Association of Business Schools is developing a Charter scheme under which business schools can gain formal recognition for their provision.

- 4.27 I agree with Lord Young that there is a significant opportunity here. Business schools have different attributes and organisational strategies, and the opportunity may not suit all of them. What is needed is to recognise the pre-eminent value of applied business support among business school activities, and to incentivise working directly with local businesses on workable solutions to their practical problems. I welcome the accreditation scheme that Lord Young proposed and that Government is adopting as a means of providing this recognition and incentive.
- 4.28 Realising the potential of business schools to support SMEs does not preclude those universities that offer a range of business support activities to local SMEs from continuing to do so.

The University of the Creative Arts delivers a range of support for SMEs, including the first dedicated support in its region for low carbon innovation in SMEs. As well as supporting businesses to develop sustainable solutions, the University also supports companies' strategic development.

- 4.29 The Government is currently considering the shape of its future business support provision. It will want to take full account of the contribution universities can make.

Recommendation. Universities should put in place a single point of entry for SMEs that 'triages' their needs and directs them to the relevant part of the university. This point of entry should also look to drive up SME demand and engagement, and work with external partners across the locality, as well as within the university. University business schools should be incentivised to prioritise working directly with local businesses on workable solutions to practical problems.

- 4.30 In this chapter I have referred in several places to the role of LEPs, which are responsible for developing local economic plans. Universities taking responsibility for facilitating economic growth will be most successful where the relevant LEP or LEPs are fully engaged. Moreover where universities assume this role that should be reflected in the make-up of their LEPs. I discuss these questions next, in Chapter 5.

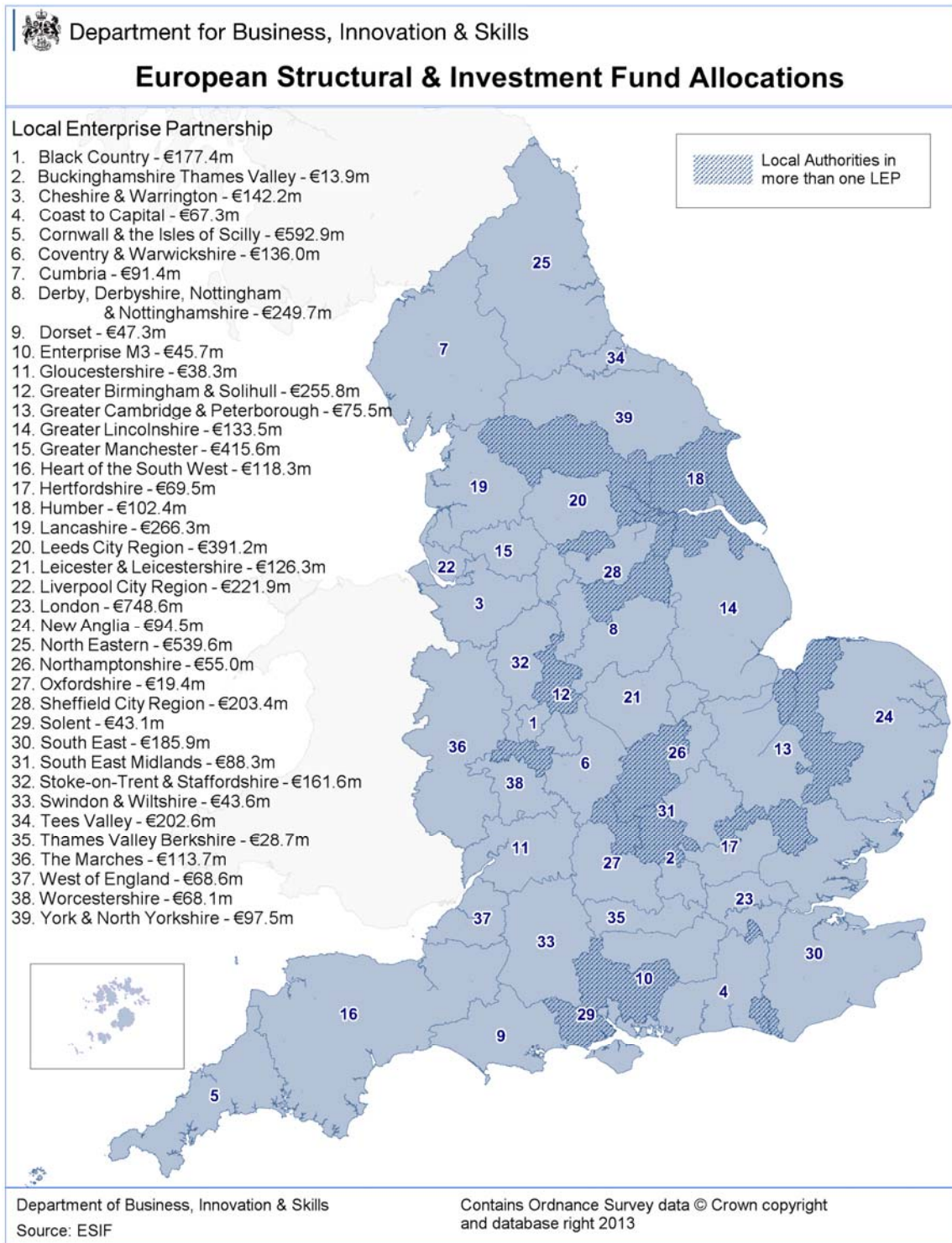
Chapter 5. Local Enterprise Partnerships

Background

- 5.1 There are 39 Local Enterprise Partnerships (LEPs) in England (see Figure 5.1). These are voluntary partnerships between local authorities and business whose overarching purpose is to promote economic growth and job creation. LEPs were set up to help determine local economic growth priorities and to lead job creation in local areas. They are business-led and are required to retain as a minimum 50 per cent private sector membership. Around two-thirds of LEPs have university representatives on their Boards. They were originally set up without public funding although each LEP has since been allocated £500,000 for core funding and developing strategic plans.
- 5.2 LEPs have been asked to undertake a number of new functions and responsibilities since being established in 2010. They have a wide portfolio of interests in areas including transport, skills, enterprise, innovation, employment, housing and the environment. The Review's focus is on one part of their activities – how to make the most of the economic benefits which may be derived from universities in order to promote local growth – a particularly important part, given that their overall purpose is to promote growth. Their role includes providing strategic economic leadership for their areas, bringing public and private sector partners together around a common set of goals. They are important participants in a range of government initiatives such as City Deals and Enterprise Zones, and have been active in preparing bids into various funding schemes such as the Regional Growth Fund Rounds.
- 5.3 LEPs have more recently been invited to produce Strategic Economic Plans as part of the negotiation of Growth Deals with Government. Through Deals, LEPs can seek freedoms, flexibilities and resources from Government, and a share of the new Local Growth Fund to target their identified growth priorities.
- 5.4 In June 2013, the Government announced that it would place more resources under the control of LEPs, guaranteeing at least £2 billion a year over the next parliament. At the same time, the Government announced notional allocations of €6.2 billion of European Structural and Investment funds (ESI) to LEP areas over the period 2014-20¹⁸. It is envisaged that up to €1 billion of ESI Funds will be directed towards innovation and this will need to be matched on an equal basis by contributions from both private companies and public sector finances. I comment later in the chapter on the importance of the Government ensuring that all the funds available to LEPs to invest in innovation and R&D are actually spent on these areas.

¹⁸ More details of ESI Fund allocations can be found on the BIS website: <https://www.gov.uk/government/speeches/european-regional-development-fund-and-european-social-fund-allocations-2014-to-2020>

Figure 5.1



Challenges Facing LEPs

- 5.5 In the *Preliminary Findings* I emphasised the heterogeneity of both LEPs and universities, which have very different local conditions and strengths. I noted too that the majority of LEPs have limited resources, and that as new bodies they are still in the process of establishing networks, ways of working and strategic priorities. During the Review I have heard from a number of LEPs about the difficulties they are experiencing as a result.

Collaboration between LEPs

- 5.6 I have also seen models of collaboration that offer pointers as to how LEPs may overcome some of the difficulties they face.

"We are seeing cooperation with the LEPs. The four LEPs (Greater Birmingham & Solihull, Liverpool City Region, Coventry and Warwickshire, and the Black Country) collaborated in a successful bid for Regional Growth Funds for the Advanced Manufacturing Supply Chain Initiative. They recognise investment in other LEP areas might prove beneficial to their economy." Aerospace, Aviation & Defence Knowledge Transfer Network

In Manchester and elsewhere the creation of Combined Authorities has increased LEPs' impact and economic reach, developing closer working relationships across LEP areas by pooling economic resources for innovation and forming a joint decision-making committee.

- 5.7 I welcome these collaborations, and the Government's measures to encourage them under Growth Deals and European Investment Plans, described in paragraphs 5.3 and 5.4 above. LEPs are to receive allocations which take account of the development of credible and collaborative plans to support growth. The Government has asked LEPs to demonstrate evidence of how their local authorities will work in partnership to support delivery of the LEP plan, by taking collective decisions, pooling and aligning their resources and functions in support of agreed LEP priorities. This way of working seeks to incentivise growth and collaborations through the competitive element of Local Growth Fund. It is also encouraging that Government is seeking assurances that strong governance is in place as part of the assessment process.
- 5.8 I would hope and expect that LEPs with mutual interests that reach across geographical boundaries will deepen their collaborations with other LEPs to maximise the benefits from their joint funding and resources. This extends to ESI investment proposals where there is recognition that innovation opportunities will bring forward new programmes and collaborations that span geographical boundaries. Funding for such programmes should not be hindered by design and geographical boundaries. In some cases shared working across LEPs may lead to some de facto integration, for example through pooling financial resources or forming a joint governance body responsible for co-ordinating activity. Government

should look positively on developments of this kind as being likely to lead to better outcomes for growth.

Collaboration between LEPs will also be necessary. For example in the nuclear industry, the North West contains the vast majority of the decommissioning and waste management expertise and research facilities. This area covers the LEPs for Greater Manchester, Cheshire and Warrington, Lancashire and Cumbria. Many companies, including NNL, have bases in a number of these, and so LEPs should talk to these businesses to ensure their strategic growth plans are not duplicated or conflicting". The UK National Nuclear Laboratory (NNL)

- 5.9 These actual and potential collaborations will help but they will not be enough on their own for all LEPs to meet the challenges. The Government should also consider how to secure the identification, development and spread of the best practice of the most effective LEPs, so that the pursuit of local growth is not hampered by inadequate support for the bodies charged with pursuing it. In the final part of this chapter I suggest one way in which the Government might achieve this.

LEPs and Universities

- 5.10 For many LEPs, universities offer a valuable resource in meeting their challenges. In Chapter 1 I proposed that universities who wish to do so should undertake an enhanced Third Mission of facilitating economic growth, and I outlined some of the implications of this in Chapters 3 and 4. Universities are among the largest economic entities in LEPs' areas. As I commented in the Review's *Preliminary Findings* they will frequently be very important sources of economic advantage – through research insights: provision of a vibrant technology base; international reach which can support exports and help attract inward investment: supply of skills; support and advice to local businesses. This was recognised by some of the respondents to the Review's *Call for Evidence*. In his *Review of Business-University Collaboration* last year Sir Tim Wilson commented that "Universities are the key players in the supply chain for research, innovation and skills; they should be at the heart of a LEP."
- 5.11 The most important task for LEPs is to understand the nature of the economic opportunities available to them. In the *Preliminary Findings* I welcomed the "Smart Specialisation" approach which ESI cases must follow, as it is closely aligned with my proposition that national and local economic growth is best rooted in a sound understanding of a locality's comparative advantage. Universities can support LEPs to develop assessments of local comparative advantage. They are well placed to prepare the necessary evidence needed for strategic plans and investments to show where university and sector strengths lie.
- 5.12 Since the *Preliminary Findings* appeared the Government has issued guidance to LEPs on Growth Deals and developing their ESI cases¹⁹. I welcome the guidance which seeks to ensure LEP cases are evidence-based and encourages

¹⁹ *Growth Deals: Initial Guidance for Local Enterprise Partnerships*, HM Government, July 2013
The Development and Delivery of European Structural and Investment Funds Strategies: Supplementary Guidance to Local Enterprise Partnerships, HM Government, July 2013

collaborative working with other interested parties. Part of the evidence base is an accurate national picture. I have discussed the available information base in Chapter 2, and heat maps showing research centres and economic activity are published with the Review. I believe these information resources will be valuable to LEPs in seeking to make sure their strategic plans fully exploit the opportunities offered by excellent universities and research centres and in indicating other LEPs which might offer collaborative working opportunities.

LEPs' Resources for Research and Development, and Innovation

- 5.13 In the *Preliminary Findings* I encouraged LEPs to direct a large share of innovation funding towards excellent universities and research centres in order to take the opportunities offered by these institutions. I envisaged “a framework which includes development of new infrastructure where university/business interactions can be maximised and economic outcome metrics, and which ties the future flow of funds to outcomes expressing the goal of maximising the economic benefit from the research being supported, such as numbers and value of jobs, underpinned by a plan indicating how these will be achieved, addressing questions such as supply of skills, support for supply chain SMEs, increasing business levels of business investment in R&D and intangible assets, etc.”
- 5.14 Sometimes, as outlined in the *Preliminary Findings* and suggested above, the right approach will be for LEPs to collaborate and to support collaboration with research centres in different parts of the country. Universities and researchers working in them will find opportunities for collaborations with counterparts elsewhere to support innovative business, as many already do. LEPs focussed on taking opportunities to build growth on comparative advantage will look to back such collaborations, and by doing so will achieve more for sustainable local growth than would result from a preoccupation with activity limited to their own locality.

Coventry University, in partnership with Unipart Group Ltd, has been selected as one of the UK Universities to drive a change in the provision of both education and world class research related to Low Carbon Technologies. £8 million of HEFCE Investment is going to unlock £20 million of private sector investment to deliver a number of the Industrial Strategy priorities. This initiative has also been supported with an investment by the Coventry & Warwickshire LEP. £2 million has been allocated from the Growing Places Fund and is aligned to the LEP City Deal submission focusing on the development of skills for the manufacturing sector.

Birmingham Science City is a partnership of public, private and Higher Education sectors that aims to use and promote science and technology to stimulate innovation to improve economic prosperity and quality of life. Its Board has a broad business membership as well as including Greater Birmingham and Solihull (GBS) LEP, Birmingham City Council and four of the eleven universities in the West Midlands. It provides advice to the GBS LEP on innovation and has had a strong role in developing the LEP's *Strategy for Growth*.

University of East Anglia, Cambridge University and the New Anglia and Cambridge LEPs worked together to produce a specific bid into the Regional Growth Fund Round 4, to realise the benefits of common agri-tech sector research activities across their regions with the aim of strengthening their comparative advantage.

- 5.15 Where these collaborations of research centres are part of the “Arrow Projects” described in Chapter 3 – consortium bids to maximise the chance of success in a significant technology-centred international market – LEPs will wish to work with the universities leading those projects to ensure that the translation of cutting edge research into local growth is achieved. I have recommended that bids for Arrow Projects must have LEP participation, and this will give LEPs the means to make sure that there is careful consideration of the local growth dimension. I would expect LEPs to put in resources of their own, and universities to be represented on participating LEPs.
- 5.16 Where the focus of a university's contribution is at a local level, in the way outlined in Chapter 4, there is the potential for the LEP to become involved in projects to ensure more targeted, local impact. I would encourage LEPs to adopt as a strategic goal that every innovative SME in the locality that could benefit from university engagement should do so. This could embrace a range of activities that might include the provision of particular skills needed in the region, targeted help for small businesses in a specific growing sector, or funding to support universities in raising the innovation performance of local SMEs.

Recommendation. LEPs have up to €1 billion of European Structural and Investment Funds to invest in innovation. They should look to direct a large share of innovation funding towards excellent universities and research centres in order to nurture sustainable growth founded in comparative advantage, including through universities supporting innovative SMEs in their localities. LEPs should do this within frameworks which relate funding to economic outcomes. They should collaborate, and support university collaborations, beyond their own areas wherever these will deliver an economic or research benefit.

Universities and LEP Boards

- 5.17 In Chapter 3 I also noted that where universities assume responsibility for facilitating economic growth this should find institutional recognition in LEPs. University presence in LEP areas varies greatly, from LEPs with no universities to those with many. This means that tailoring to local circumstances will be necessary, but the underlying principle is a general one – where there is a university presence in the locality then that should be reflected in the composition of the LEP, in order that the contributions universities are making can help to shape, and be integrated into, LEPs' strategic leadership of local economic development. Moreover university presence on the LEP Board should enable the LEP to understand and exploit the research strengths of local universities, and will help to illuminate opportunities to align academic and departmental research priorities with local growth plans.
- 5.18 I would expect that all LEPs with universities in their areas should have a university presence on the LEP Board. If, in future, LEPs should acquire statutory character then this should become a statutory requirement. What proportion of the Board will come from universities will naturally vary according to the importance and weight of universities in the area. Where an area has a large number of universities it will obviously not be possible for all to sit on the Board (though there should be a strong university presence on such Boards) and they will need to agree among themselves who among them should become Board members. Where a LEP is participating in

an Arrow Project led by a university in its area then it may well be appropriate for the university to provide co-chairmanship of the LEP. I would also expect university members to be prominent, and commonly to chair, LEPs' Innovation or R&D and Innovation sub-committees.

- 5.19 University membership of the Board should not diminish the role of business. I would expect to see the key sectors important to LEPs represented on their Boards and feeding in to their priorities for growth.
- 5.20 I envisage the business people who lead LEPs will welcome this enhanced engagement of universities. LEPs would benefit from university capacity and capability in preparing economic plans, bids and delivering projects using European and other funding mechanisms. Universities would bring additional support that LEPs require to prepare Strategic Economic Plans and ESI Investment Plans. LEPs should make full use of the universities in their areas to help them develop the evidence base to determine comparative advantage and where best to place innovation funding. Strategically, fuller university engagement will strengthen the LEP focus on realising the potential of R&D and Innovation to drive economic growth.

Recommendation. Ministers should write to the chairs of all LEPs with universities in their areas setting out the expectation that these LEPs should have a university presence on the Board. Where a LEP is participating in an Arrow Project led by a university in its area then it may well be appropriate for the university to provide co-chairmanship of the LEP. University members should be prominent in, and may often chair, LEPs' Innovation or R&D and Innovation sub-committees.

Local Authorities, Enterprise Zones and Growth Hubs

- 5.21 In the first part of this chapter I have highlighted the part that universities may play in the pursuit of local growth, and how LEPs may work with them. LEPs are only one part of the local growth landscape. Local authorities sit on the LEP Boards and provide much of the delivery capability to translate LEP intentions into action. It is thus very important that local authorities are oriented to the pursuit of growth in their participation in LEPs.
- 5.22 The Government has taken a number of steps to encourage this, including provision for local authorities to retain up to 50 per cent of growth in business rate receipts and the creation of 24 Enterprise Zones which enjoy fiscal incentives and simplified planning arrangements intended to make them attractive to business. Where there are Enterprise Zones centred on research centres their potential to support growth derived from research should be utilised. Where there are Enterprise Zones in the vicinity of universities the opportunities to connect them should be taken to benefit the breadth of work that universities do with SMEs in particular, from creating spin-offs via research, to the more generalised business support offer. In such cases I would like to see universities represented on Enterprise Zone management boards.

Sci-Tech Daresbury – Enterprise Zone

Sci-Tech Daresbury is a location for hi-tech business and science. Home to the Daresbury Laboratory and a high performance computing group, as well as over 100 hi-tech companies, Sci-Tech Daresbury is one of two national science and innovation campuses.

It is home to companies in sectors such as biomedical, advanced engineering, clean-tech and security, ranging from start-up to mid-size SMEs to corporates such as IBM. Twenty per cent of campus companies are from overseas. It is also a private-public sector joint venture, which includes Halton Borough Council. The Universities of Lancaster, Liverpool and Manchester are all active partners on the site.

- 5.23 The Government has also introduced Growth Hubs as part of its City Deals process. These bring together local partners including universities, LEPs, local authorities, Chambers of Commerce and business, to ensure alignment between national and local business support schemes and run programmes that target key sectors and supply chains. For the reasons already given in this report I would like to see universities playing a prominent role in the design and delivery of Growth Hubs.

“...The development of the Greater Ipswich and Greater Norwich Growth Hubs will provide tailored support and finance to the key sectors such as the agri-tech cluster in the East of England. The Hub will seek to facilitate the development of the Norwich Research Park (NRP). It will bring together landowners, University of East Anglia, Norwich University of the Arts and University Campus Suffolk and local authorities. The NRP will use funding arrangements to both facilitate effective business connectivity and supply chain development. The New Anglia LEP is developing an innovation vouchers scheme and establishing an early stage loan fund to support commercialisation of ideas...” Chris Starkie, New Anglia LEP

GAIN is a growth hub founded by Plymouth University, with Plymouth City Council and Tamar Science Park. It brings together more than £120 million of business infrastructure, world class research facilities and expertise in a network focused on growth and investment. It seeks to join up physical assets, services and products to assist people with ideas, business that want to grow and create deal flow for investors. The model connects the far South West to the largest urban conurbation in the greater region, and there is the potential for global connections to be forged, attracting inward investment and assisting exports.

- 5.24 The intent behind these various government measures is positive. Time will tell how effective they are, and I would encourage the Government to focus in particular on assessing how far practice shows that the alignment of incentives on local authority (and other LEP members) to pursue growth is achieved. This alignment is a prerequisite for LEPs to be successful since, as already noted, they are reliant on local authorities as a key means to translate intentions into action.

Overall Coherence of LEP Plans

- 5.25 I noted at the start of this chapter that there are 39 LEPs, and the desirability of brigading similar activities across LEPs to maximise effectiveness has been a theme of the chapter. In the *Preliminary Findings* I reported concerns among stakeholders that there would be sub-optimal duplication among LEP plans. I noted the need for a mechanism to achieve co-ordination and coherence at a national level – a need which a number of respondents also identified.
- 5.26 The Government will soon be assessing LEP ESI Fund Investment Plans. The process will seek to ensure LEP proposals meet European Regulations and follow the Smart Specialisation approach. It is putting in place arrangements to advise the National Growth Programme Board – the high level Committee of interested parties steering the EU programme – on the innovation elements of the proposed LEP investment plans, including involvement of relevant organisations drawing in the necessary expertise.
- 5.27 The objective should be to ensure plans avoid duplication and missed opportunities to collaborate. It is more likely that sub-optimal outcomes will be avoided if there is a recognised source of authoritative advice to inform such decisions, and to whose opinions national and local bodies granting funds can refer. I envisage a body which would advise Ministers and the National Growth Board on the strength of LEP proposals, and be a source of advice to LEPs themselves in seeking to devise strong plans. LEPs may be very knowledgeable about their areas, but many will lack the wider knowledge to put their economic capabilities in the context of national ones in order to determine where their sources of comparative advantage truly lie. This body should also be a means of meeting the longer term need to support LEPs, universities and others setting collaborative priorities and making investment decisions on R&D and Innovation with an understanding of the national context, and how to promote coherence in these decisions.
- 5.28 In addition it will be well placed to recognise those LEPs which are proving most effective, and to identify the associated good practice. It should capture these insights and include them in its advice to the National Growth Board, Ministers, and LEPs, so that each can take the opportunities available to them to bring all LEPs up to the level of the best.
- 5.29 It will need to include individuals of sufficient seniority and weight to command respect for its views. These might be drawn from backgrounds including the Research Councils, industry and academia. I would expect the Technology Strategy Board to play a leading role.
- 5.30 However, the most obvious risk of missed opportunities does not lie in failure of coordination as such, but in LEPs failing to invest as much as they could in Innovation and R&D. It is essential to avoid this risk because of the importance of Innovation and R&D to growth, which is LEPs' overarching objective. The Government should exercise its assessment function so as to ensure that the risk does not materialise.

Recommendation. The Government should ensure that all the funds available to LEPs to invest in Innovation and R&D are spent on these areas. It should establish an authoritative advisory capability to advise it and LEPs and other relevant decision-takers on how strongly LEP proposals are based in a sound assessment of comparative advantage, and to identify and communicate the best practice of the most effective of LEPs so that the Government and LEPs can work to bring all LEPs up to the level of the best.

Chapter 6. The Role of National Innovation Support Organisations

The Innovation Infrastructure

6.1 In the *Preliminary Findings* I highlighted several government or government-supported organisations whose roles make them central to the Review. The box provides a more complete overview of the organisations supporting research, innovation and associated economic activity. They, the resources they manage, and the legal frameworks for which a number of them are responsible are sometimes described as the “innovation infrastructure.”

The Research and Innovation Landscape: Key Government-Supported Organisations

- **Technology Strategy Board** stimulates and supports UK business-led innovation.
- **UK Trade & Investment** helps UK firms succeed in international markets, and encourages overseas ones to invest here.
- Each of the seven **Research Councils** fund research and training activities in a different area of research, ranging across the arts and humanities, social sciences, engineering and physical sciences and the medical and life sciences in universities and research institutes.
- **Higher Education Funding Council for England (HEFCE)**, and the equivalent Councils in the devolved administrations, distributes public money to universities and colleges for higher education teaching, research and related activities.
- **Design Council** supports the application of good design in business and the public sector.
- **Intellectual Property Office** provides an IP framework enabling creators, users and customers to benefit from knowledge and ideas.
- **National Measurement Office** and the National Measurement Institutes provide accepted standards of measurement.
- **UK Accreditation Service** accredits bodies assessing conformity with formal standards.
- **British Standards Institution** provides the process for standards to be developed by expert committees.
- **Nesta** is an independent charity with a mission to help people and organisations bring ideas to life.

- 6.2 I have previously said that I would expect the objectives of these organisations to reflect the Government's Industrial Strategy and its policy of supporting local growth. This would ensure that, allowing for the differences arising from their distinct functions, there is an overarching commonality of purpose in relation to supporting growth through the Industrial Strategy and local growth. To achieve this I would expect all of these organisations to assess the implications for them of the Industrial Strategy and of the local growth agenda, and of Arrow Projects supported by the Government. I particularly encourage each to consider carefully whether they are doing all they can to support opportunities for growth emerging from our excellent universities. One manifestation of overarching commonality of purpose should be in effective joined-up working where a project or initiative engages the interests of several of these organisations.

Connecting Activity to Support the Space Sector

The Harwell Oxford campus is part of the Oxfordshire "Science Vale" Enterprise Zone. It provides a geographic focal point for the promotion of rapid, large-scale growth of the space sector. The UK Space Agency is tasked with growing the Harwell Space Cluster on the campus, working in partnership with the Technology Strategy Board, through the Satellite Applications Catapult, and the Science and Technology Facilities Council (STFC), whose Rutherford Appleton Laboratory is based on site. The Harwell Oxford campus is being developed as a joint venture including STFC and the United Kingdom Atomic Energy Authority, which owns much of the land.

The Harwell Space Cluster is focused on steering and developing the existing space activity at Harwell, and working with devolved administrations and LEPs around the country to promote and foster growth across the whole of the UK's space economy. There are regular cluster steering group meetings to ensure targets for engagement are being met. Key activity in the UK alongside Harwell is delivered through a number of universities including Strathclyde, Surrey, Reading, Leicester and Nottingham.

Important elements within the Harwell Space Cluster are the rapidly-expanding ESA facility 'ECSAT' (European Centre for Space Applications and Telecommunications), STFC's 'RAL Space' facility (with involvement in over 200 space missions to date) and the TSB-supported Satellite Applications Catapult. The Catapult aims to support UK industry and become a world class centre for the development and commercial exploitation of space and satellite-based products, services and applications. It has its own objectives, many of which are aligned with the aspiration to use Harwell to support and develop a vibrant UK space sector through supporting SMEs, linking to universities around the UK, and ensuring that the space cluster is relevant to the UK as a whole.

Oxfordshire LEP has identified space as one of its key strengths and priorities within the advanced engineering sector. The development of growth plans and EU investment strategies provide LEPs with an ideal opportunity to set out how they will support the sector and work with stakeholders, including business, other LEPs and the wider public sector to realise the full potential of space to the UK economy.

The Technology Strategy Board and UK Trade & Investment

- 6.3 A number of these organisations are responsible for managing legal frameworks such as those for measurement, or intellectual property. Others, notably the Technology Strategy Board (TSB) and UK Trade & Investment (UKTI), have more discretion to apply their resources to selected priorities. TSB, as the UK's innovation agency, and UKTI, as the body charged with promoting exports and winning inward investment, are central to the Arrow Project proposition, as they are to many of the Industrial Strategy sectoral strategies. In the remainder of this chapter I concentrate on TSB and UKTI, and how they should apply their resources to advancing economic growth derived from universities. Much of what I say is applicable to other contexts, for example to how UKTI can support Industrial Strategy sectors including those which are not technology-centred. I also comment on the role of Government's proposed Local Growth Teams in supporting local partners to pursue economic opportunities, and how they can help facilitate innovation-led growth.

The Technology Strategy Board

- 6.4 The TSB is the UK's national innovation agency and exists to assist businesses across the UK to develop technologies from concept to commercialisation. It does this through a number of programmes, summarised in the box (and described in more detail at Annex 1 in Part 3 of the Review). Many of its activities are jointly funded with research councils, government departments and the devolved administrations. It aims to help companies take concepts through to commercialisation, drawing where appropriate on the research base, tackling the barriers to innovation, reducing risk and promoting collaboration and knowledge exchange by making connections and bringing people together. In the recent Spending Round for 2015-16 the TSB was allocated an additional £185 million, an increase on its current budget of around 60 per cent, which will allow it to extend its existing programmes and develop new ones.
- 6.5 Many of the respondents to the *Call for Evidence* recognised the TSB's role and importance to the research and innovation landscape. Its contribution is clearly welcomed. The TSB's competitions, the Catapults, Innovation Vouchers and Knowledge Transfer Partnerships are products that appear to be particularly valued.
- 6.6 The Review also heard that some businesses found the suite of products confusing and difficult to understand. SMEs in particular reported that they did not have the time or other resources to understand the products fully. A detailed analysis of the TSB's role was not part of the scope of this review and I am not in a position to offer conclusions on the number of products or how they are communicated to business. On the basis of what I have heard there appears to be a case for the TSB to examine these questions, especially in relation to SMEs.

Key Technology Strategy Board Tools and Support Programmes

- Support for business through investment in collaborative research and development and demonstration programmes
- A network of Catapults, centres of excellence designed to transform the UK's capability for innovation in specific areas – high value manufacturing, cell therapy, offshore renewable energy, satellite applications, connected digital economy, future cities and transport systems (<https://catapult.innovateuk.org>). Locations of the Catapults are shown in Part 2 of the report of the Review
- The Small Business Research Initiative (SBRI) which connects innovative businesses with public sector bodies involved in procurement
- Innovation Vouchers – grants of up to £5,000 for SMEs to pay for knowledge or technology transfer from a new supplier in three priority sectors
- Smart – an R&D grant targeted at smaller businesses engaged in strategic areas of science, engineering and technology
- Launchpad – supporting the development and strengthening of clusters of high-tech companies in specific technologies and geographical locations
- The Biomedical Catalyst – a £180 million programme jointly operated with the Medical Research Council, offering funding to SMEs and academics looking to develop innovative healthcare solutions
- Support for link-ups with other schemes in the European and international arena, including special missions to the USA, showcasing new technologies to potential investors and customers
- Knowledge Transfer Networks and Knowledge Transfer Partnerships, which bring together businesses, academics and the research community to stimulate innovation through the sharing of knowledge, technology and expertise.

The Technology Strategy Board and Local Growth

- 6.7 The TSB allocates its funding competitively on the basis of the excellence of projects regardless of location. I agree with this approach as it recognises the strategic importance of innovation and technology to the economy, and chimes with my emphasis on building on comparative advantage wherever it is found. As I have said at paragraph 6.2 above it is also incumbent on the TSB to assess the implications for it of the Government's local growth agenda. I note that in his 2012 report *No Stone Unturned in Pursuit of Growth* Lord Heseltine said that the TSB needs to do more to explain how it will work with local partners, and others, to better connect national strategy with local initiative, a recommendation which the Government accepted.
- 6.8 During the Review TSB officials described action they are taking to achieve this kind of connection. I heard examples where the TSB has started to discuss with some LEPs how they may work together to support local innovation. This is positive, but I would encourage the TSB to set its sights higher. As an illustration, I believe it should be proactive in trying to ensure that every LEP's Strategic

Economic Plan is informed by the evidence about, and insight into, the character and location of innovation capability that the TSB possesses.

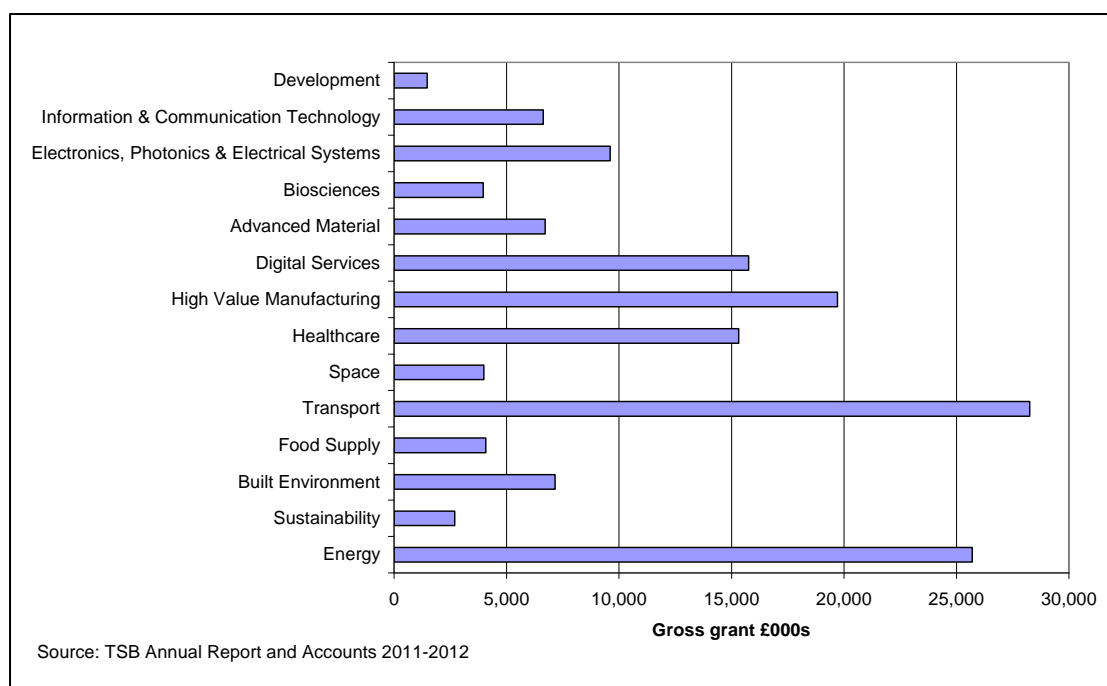
Technology Strategy Board Local Data

The TSB is making a large amount of data on its investments available to inform LEPs developing European Structural and Investment Fund strategies and increase awareness of its activities throughout the UK. The data are being shared on _connect, which is the TSB online business networking and open innovation portal ²⁰.

The Technology Strategy Board and National Priorities

- 6.9 Before providing a new programme, including competitions, the TSB will seek advice from experts and interests in relevant fields across business, academia and government departments. Industrial Strategy priorities are one of the factors it takes into account in its processes for determining which innovation challenges and technologies to support, as are the priorities of the devolved administrations.
- 6.10 I support this approach. The test of it must be the quality of the resulting fit between the programmes the TSB runs and national priorities, including those defined in the Industrial Strategy, by the devolved administrations, or adopted as Arrow Projects to win in global markets. Figure 5.1 shows that, at least in high level terms, there is a measure of commonality between the Industrial Strategy priorities and the TSB's allocations of resources.
- 6.11 Just as the TSB should be proactive in working with LEPs I would expect it also to be proactive towards prospective Arrow Projects. Through initiatives such as Innovation Platforms the TSB is familiar with bringing organisations together to address a technology-based challenge, and with providing leadership. It should take opportunities to encourage partners to join Arrow consortia, help them develop their proposals and bring in appropriate expertise, including by offering funding for consortium-building where that is necessary, and make clear where it thinks a proposal is unlikely to succeed. This latter point is important: Arrow Project bids will be multi-party endeavours which unavoidably require significant resources, and bidders should have an informed view of their prospects as early as possible.
- 6.12 I expect that the TSB will dedicate resource to considering how it might support Arrow Projects and incentivise partners to join up actively to pursue the proposition and help maximise the commercial prospects. It might, for example, consult the lead Arrow Project university with a view to framing a competition to provide a particular technology solution tailored to that project, or to explore how the resources of a Catapult Centre might be deployed.

²⁰ <https://connect.innovateuk.org/web/where-innovation-happens/overview>

Figure 6.1 TSB Technology Grants 2011/12 – Thematic Interventions

- 6.13 The TSB will also have an important role in the process of advising on bids for funds to support Arrow Projects. As indicated in Chapter 3, I would expect the TSB to be an essential member of the bid assessment committee.
- 6.14 The overarching aim is that the TSB's resources – its knowledge of the character and location of innovation capability, its definition and timing of relevant programmes, its networking and convening power to shape and influence proposals coming forward – will in practice be thrown fully and proactively into supporting LEPs in formulating strong plans, and into advancing strategic national industrial priorities. This aim should be captured in the objectives of the organisation, shaping its actions and against which it is held to account for its performance.

Recommendation. The Technology Strategy Board's objectives should include advancing national strategic economic priorities so that its contribution to the Industrial Strategy, to Arrow Projects and to the growth priorities of the devolved administrations is central to its accountability for its performance. This role should include:

- **Supporting and advising on the development of Arrow proposals**
- **Identifying and taking opportunities to ensure its programmes benefit Arrow Projects**
- **Contributing to the assessment of bids for Arrow status**
- **Building awareness on innovative capability within each LEP area and sharing its knowledge to help make LEP local economic plans as strong as possible.**

- 6.15 UKTI aims to help UK-based businesses succeed in international markets, and to encourage the best overseas companies to see the UK as partner of choice. It delivers through offering expertise and contacts through an extensive network of specialists in the UK, and in British embassies and other diplomatic offices around the world. It seeks to provide companies with the tools they require to be competitive on the world stage. The box below summarises UKTI's services.

UKTI Services

<i>Investment</i>	<i>Exporting</i>
Access and introductions to the right people	Passport to Export for new and inexperienced exporters
Advice and support on setting up in the UK	Gateway to Global Growth for more experienced exporters
In-depth report tailored to your business needs	Export marketing Research Scheme to investigate a potential export market
Help selecting the best location	Business opportunities email alerts
Tax advice	Overseas Business Risk advice
Ongoing government support once a business has arrived	Market visits and trade missions
Support with visas and entry to the UK	Overseas Market Introduction Service to access research, identify contacts and plan events
Help finding top quality staff	Seminars, webinars and events in the UK and overseas
Tailored assistance for entrepreneurs	Tradeshaw Access Programme support to attend overseas exhibitions
UK Advisory Network access to trusted commercial providers	Open to Export community-driven website for SMEs
	Export Communications Review to access communication with overseas customers

- 6.16 UKTI has a critically important role in ensuring that we maximise the economic benefit that we derive from our universities: in both supporting businesses to win global contracts arising from the commercial applications of university-led research, and using the high quality of the UK research base as a key selling point to secure inward investment. However, during the Review I have seen only limited evidence of UKTI engagement: for example, few of the responses to the *Call for Evidence*

mentioned UKTI.

- 6.17 In Sir Tim Wilson's *Review of Business-University Collaboration* last year he noted that in UKTI's five-year strategy produced in 2011 there was little mention of the role universities can play in delivering increased benefit to UK plc through international trade and investment. He recommended that UKTI needed to reconsider the role of universities. I also noted that UKTI accepted Lord Heseltine's recommendation from his 2012 review to work with the TSB and the Research Councils to strengthen the marketing of the UK as an inward investment destination on the back of our world-renowned research excellence. UKTI should act on both these recommendations in its pursuit of the Government's ambition of doubling exports to £1 trillion, getting 100,000 more UK companies exporting, and doubling UK foreign direct investment to £1.5 trillion by 2020²¹.
- 6.18 UKTI has taken some initial steps in the right direction. Over the past year it has become more involved in helping deliver the Industrial Strategy. It is participating in the delivery of projects supporting the sector strategies and has had new contacts with universities as a consequence.

UKTI has created Investment Organisations for those Industrial Strategy sectors with the most potential to attract inward investment. These are boosted sector teams, led by senior figures from industry, with the detailed knowledge of internationally competitive local capability in each of their sectors.

The Automotive Investment Organisation (AIO), for example, focuses on attracting inward investment into the UK's automotive sector and its supply chain, which together contribute £12 billion net value-added to the UK economy. The UKTI team is led by the former Chairman of Ford of Britain, and takes strategic direction from the Automotive Council. The AIO works with local partners in those areas with relative strength in the automotive sector to leverage the networks and capabilities of LEPs, universities and others and bring a greater business-focus to their efforts to identify opportunities. So, for example, the AIO is working with Warwick University and Marketing Birmingham to strengthen and emphasise the local offer to inward investors.

- 6.19 In Chapter 4 I highlighted how growth is dependent on SMEs, and noted the scope for universities to draw on their international networks to support SMEs in moving into export markets. Providing support for SMEs to export must be a key priority for UKTI. Although many of UKTI's activities seek to support SMEs and it has contact with thousands of SMEs looking to export, in my view it needs to look again at this challenge. What matters is the overall export performance of the country's SMEs and, as I noted in Chapter 4, here we are not doing as well as we need to do. I expect UKTI to use its entire UK network and close engagement with universities to build greater SME awareness of its services, and actively to target innovative SMEs with the potential to export.
- 6.20 I would like UKTI to assign dedicated resource to realising key UK propositions, in particular to advancing the Industrial Strategy sectors, the Eight Great

²¹ *UKTI at a Glance 2013/14*, UKTI, 2013

Technologies, and Arrow Projects. I would expect this resource typically to be located in the lead Arrow university. This role should be among its organisational objectives and part of its accountability for its performance, and expressed in metrics in relation to overseas investment and/or exports secured, taking account of the character and technology readiness level of the project in question.

- 6.21 In the *Preliminary Findings* I reported concerns voiced by stakeholders that national bodies are insufficiently connected to localities and their priorities. I suspect that UKTI's task, like the TSB's, is made more difficult in this regard by the number of LEPs, Enterprise Zones, and other spatial elements of the economic development landscape in England, as well as the Devolved Administrations and Greater London. Even if geographical units offered a sound starting point for securing local growth, then it would still be impracticable for foreign investors to understand quickly and easily an effective pitch from UKTI which sought to incorporate the merits of dozens of different locations.
- 6.22 I believe increasing its commitment to working with universities also offers UKTI a means of achieving more effective regional engagement. It offers UKTI an approach centred on a limited number of strategically important economic priorities and at the same time a means of connecting locally around sources of comparative advantage. Put simply, constructing its offer to inward investors around such priorities is a prerequisite for UKTI's success; constructing it around geographic locations will not produce results that are good enough.
- 6.23 A stronger focus on universities and a closer relationship with them should also position UKTI better to secure overseas research investment for UK universities. The UK attracts substantially more international research investment than our EU counterparts²². This is to be expected given the quality of the research base described in Chapter 3. What is more difficult is to know whether we are fully realising the potential to attract inward investment for this great national asset. As already indicated few respondents to the *Call for Evidence* referred to UKTI-led activities to secure overseas investment in research. Few universities mentioned UKTI in my meetings with them as part of the Review. I believe UKTI should consider whether they can achieve more in this field.

Recommendation. UKTI's objectives should include advancing national strategic economic priorities so that its contributions to our national SME export performance, to the Industrial Strategy, to Arrow Projects and to the growth priorities of the devolved administrations are central to its accountability for its performance, with associated metrics relating to exports and/or overseas investment. It should assign dedicated resources to these priorities, in each case located so as best to work alongside the key businesses and universities.

²² Eurostat Science and Technology Database, Eurostat, 2013

Local Growth Teams

6.24 In the Government's response to Lord Heseltine's review it committed itself to establishing Local Growth Teams across England to enhance the arrangements in place for cross-departmental working to support LEPs, local authorities and other key local partners. Local Growth Teams will be built on the experience and expertise of the existing BIS Local teams, drawing together other local departmental leads and strengthening links with Whitehall policy colleagues to break down barriers to growth. One of the Local Growth Team's primary roles will be to help LEPs and other economic partners capture opportunities. Plainly Arrow Projects are one such economic opportunity and I would like to see the Local Growth Teams actively working with the LEPs to ensure that each LEP's ambitions and plans align with Arrow Projects. This means helping to ensure that the right local partners are engaged with Arrow consortia and that the broader location issues essential to the realisation of the commercial benefits of Arrow Projects are being addressed, (local infrastructure, planning issues and transport links) by the LEP within its strategic plan for its area.

Part 2: Maps

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Introduction

1. The *Preliminary Findings*²³ of the Review of Universities and Growth included a collection of maps showing the locations of Industrial Strategy²⁴ sector activity, of universities carrying out Research Council funded research in the Eight Great Technologies²⁵, and of UK universities ranked by QS World Rankings²⁶ as being in the top 200 internationally for science, technology, engineering and mathematics (STEM) subjects.

2. It was also announced in the Preliminary Findings that the Review would carry out further work to identify where sectors are located in the UK, and to identify key universities and other research institutions carrying out research relevant to the Industrial Strategy sectors. The results of that work are presented here, and also other work inspired by comments received on the previous maps.

Catapult Centres

3. The Catapult²⁷ network is a series of physical centres where businesses, scientists and engineers work side by side on late-stage research and development in order to transform high potential ideas into new products and services to generate economic growth. They are part of the Technology Strategy Board's support for innovation.

4. The Catapult Centre map shows the location of the 13 existing centres.

University Interaction with Small Business

5. University Alliance²⁸ has analysed data from the Higher Education Business and Community Interaction survey looking at consultancy and contract research, continued professional development, and graduate start-ups. Three maps have been produced which show the 20 universities providing the most support to small and medium enterprises (SMEs) in these areas. An SME is defined as business with fewer than 250 employees.

Industrial Clusters

6. The *Preliminary Findings* presented maps showing the locations of industrial clusters in the UK for six of the Industrial Strategy sectors. The Department for Business has commissioned research from the Enterprise Research Centre²⁹ into industrial clusters, covering the whole economy. The Review has been provided with early information from this research, resulting in the maps published here. They show the location of clusters for

²³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/225442/bis-13-1048-independent-review-universities-and-growth.pdf

²⁴ <https://www.gov.uk/government/policies/using-industrial-strategy-to-help-the-uk-economy-and-business-compete-and-grow>

²⁵ <https://www.gov.uk/government/news/600-million-investment-in-the-eight-great-technologies>

²⁶ <http://www.topuniversities.com/subject-rankings>

²⁷ <https://www.catapult.org.uk/home>

²⁸ <http://www.unialliance.ac.uk/>

²⁹ <http://enterpriseresearch.ac.uk/>

10 Industrial Strategy sectors in England, using Local Enterprise Partnership geographies, in 2008 and 2012.

7. The Department will publish a full report of the research when it is complete.

Citations Analysis

8. The Review commissioned science and health information specialist Elsevier³⁰ to identify which UK universities receive the most citations relating to research in the Industrial Strategy sectors and Eight Great Technologies. With assistance from the Research Councils, Elsevier have identified the top 20 universities in each sector (excluding professional and business services) and technology, and provided maps and other analysis. More information on the methodology used to do this is given on page 97, and in the methodological appendix.

9. It should be noted that this analysis does not recognise where universities work jointly, for example on robotics, UWE and Bristol University are shown separately. In practice, they work jointly as the Bristol Robotics Laboratory.

STEM graduates and income from universities

10. The Higher Education Statistics Agency (HESA) publishes data showing the number of qualifiers (first degree and postgraduate) in their annual publication *Students in Higher Educations Institutions*³¹. The Review has analysed this data for academic year 2011/12 by STEM subject and higher education institution (HEI) and provided a graphical analysis showing which HEIs have the highest number of qualifiers in each subject. The underlying data have also been published in spreadsheet form alongside the Review report.

11. HESA also publish data showing research grant and contract income by source in their annual publication *HE Finance Plus*³². The Review has also analysed this information by STEM subject and HEI for income from industry (both UK and international), and provided a spreadsheet.

³⁰ <http://www.elsevier.com/>

³¹ http://www.hesa.ac.uk/component/option,com_pubs/Itemid,122/index.php?option=com_pubs&task=show_publication_detail&pubid=1&Itemid=286

³² http://www.hesa.ac.uk/component/option,com_pubs/Itemid,122/index.php?option=com_pubs&task=show_publication_detail&pubid=1710&Itemid=286

Catapult Centres Map

1. This map shows the location of the current Catapult Centres.

Cell Therapy³³

2. The Cell Therapy Catapult defines cell therapies as any treatment for a medical condition that employs at its core one or more types of viable human cells. For instance, manipulated cells used in gene therapy, devices used to process human cells for therapy and tissue/biomedical-engineered replacement organs could be within scope.

Connected Digital Economy³⁴

3. The CDE Catapult will build in house capabilities to address gaps in the digital economy innovation landscape and apply these in strategic collaborations with a range of leading business, research and innovation partners with a shared primary focus to deliver tangible benefits to businesses, especially SMEs.

Future Cities³⁵

4. The Future Cities Catapult is focussed on the challenge of urban integration: how cities can take a more joined-up approach to the way they plan and operate, to improve quality of life, strengthen their economies and protect the environment

High Value Manufacturing³⁶

5. The High Value Manufacturing Catapult aims to drive the growth of the manufacturing sector by helping companies of all sizes incubate and develop new technologies through to commercial reality. There are seven HVM centres: Advanced Forming Research Centre; Advanced Manufacturing Research Centre; The Centre for Process Innovation; Manufacturing Technology Centre; National Composites Centre; Nuclear Advanced Manufacturing Research Centre; WMG (University of Warwick).

Offshore Renewable Energy³⁷

6. The ORE Catapult covers offshore wind, wave and tidal energy technologies and will support SMEs of all sizes and academic and research institutions nationwide in moving early stage ideas through the commercial route for use in industry.

³³ <https://ct.catapult.org.uk/>

³⁴ <https://cde.catapult.org.uk/>

³⁵ <https://futurecities.catapult.org.uk/>

³⁶ <http://hvm.catapult.org.uk/>

³⁷ <https://ore.catapult.org.uk/>

Satellite Applications³⁸

7. The Satellite Applications Catapult has been established to support UK industry and become a world class centre for the development and commercial exploitation of space and satellite-based products, services and applications.

Transport Systems³⁹

8. Efficient transport systems are essential to the health and wealth of the UK, its businesses, its economy and its people. The Transport Systems Catapult will support UK industry in exploiting the massive global market for new products and services that will drive the integration of transport and its systems.

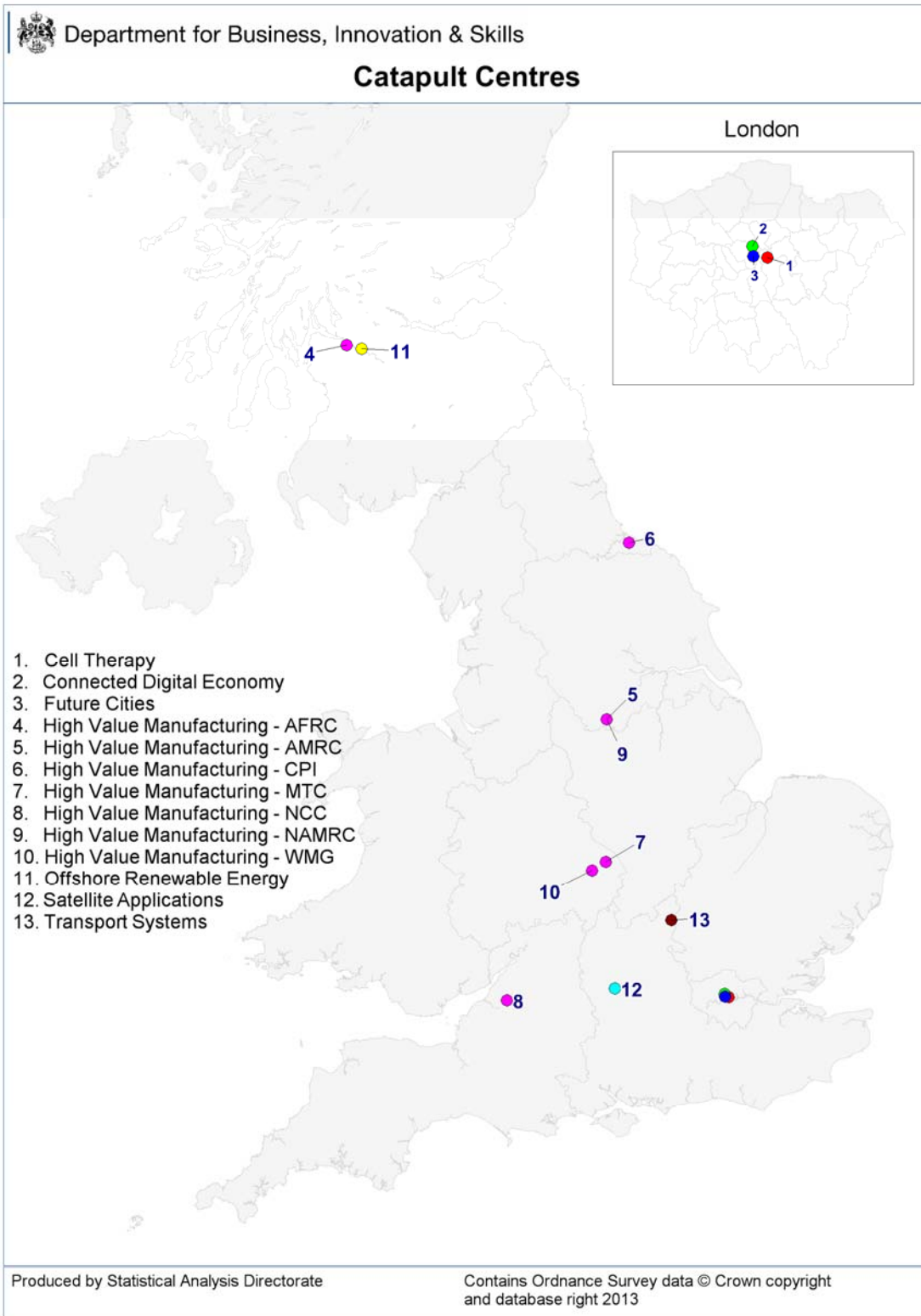
Future Catapult Centres

9. The Government has recently made a commitment to invest in two new Catapults in 2015/16⁴⁰. An Energy Systems Catapult will help innovative UK businesses to tackle the challenge of creating energy systems that meet future supply and demand, both in the UK markets and overseas. A Diagnostics for Stratified Medicine Catapult will help to identify and provide the right care for individual patients, allowing businesses to develop new treatments and reducing the cost of healthcare.

³⁸ <https://sa.catapult.org.uk/>

³⁹ <https://ts.catapult.org.uk/>

⁴⁰ https://www.catapult.org.uk/news-template/-/asset_publisher/tDqW3YjSO45r/content/government-commits-further-investment-to-innovation?redirect=%2F



University Interaction with Small Business

1. The Higher Education Business and Community Interaction Survey (HE-BCI) for 2011-12 found that universities contributed £3.4 billion to the economy through services to business, including commercialisation of new knowledge, delivery of professional training, and consultancy. University Alliance have provided an analysis of HE-BCI data for 2008/09 to 2011/12 which identifies those universities providing support to SMEs in consultancy and contract research, and continued professional development (CPD). The analysis also provides information about turnover from active graduate start-ups.

Consultancy and contract research

2. Businesses are able to commission university researchers to work on problems specific to their needs, including applied research activity driving near market innovation. Universities can also add value through offering specialised knowledge services. These interactions have been measured using the number of research and consultancy contracts with SMEs, for 2008/2012. In total there have been 140,000 such contracts since 2008/09.

Continued Professional Development (CPD)

3. SMEs gain skills development through CPD with universities and spend more on this than on any other interaction. The map shows the value of CPD provision for SMEs by university. Since 2008/09 the total value of CPD provided is £117 million, and the top three universities have generated over £7 million each in CPD provision.

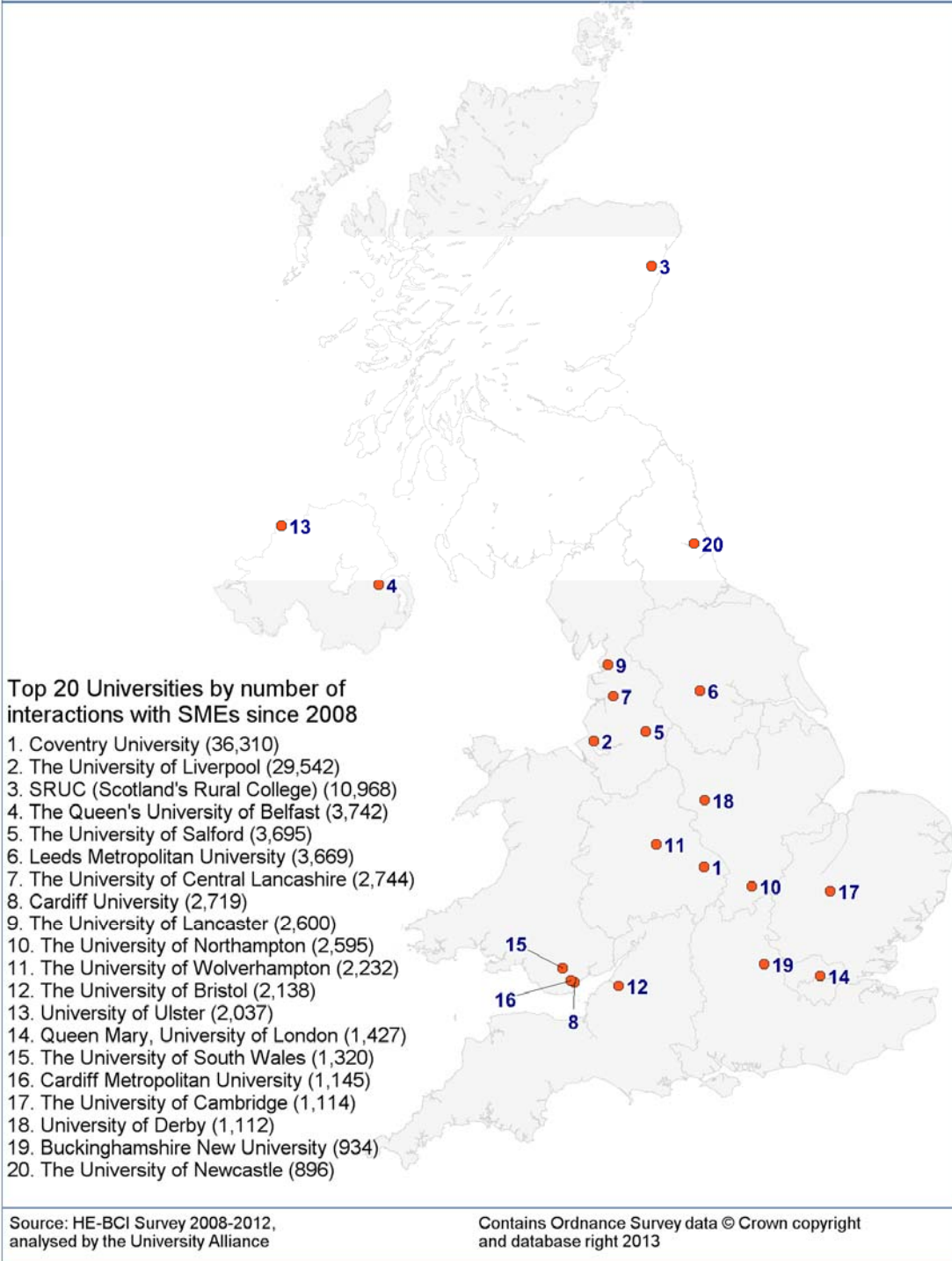
Graduate Start-ups

4. Firms started by graduates are often located either in or close to the university from which they have emerged, boosting the local economy by using local supply chains and offering local jobs. The map shows the estimated turnover from active firms by university. Since 2008/09 turnover from graduate start-ups has more than doubled to an estimated £346 million, of which those from the top two universities account for an estimate of more than £100 million.



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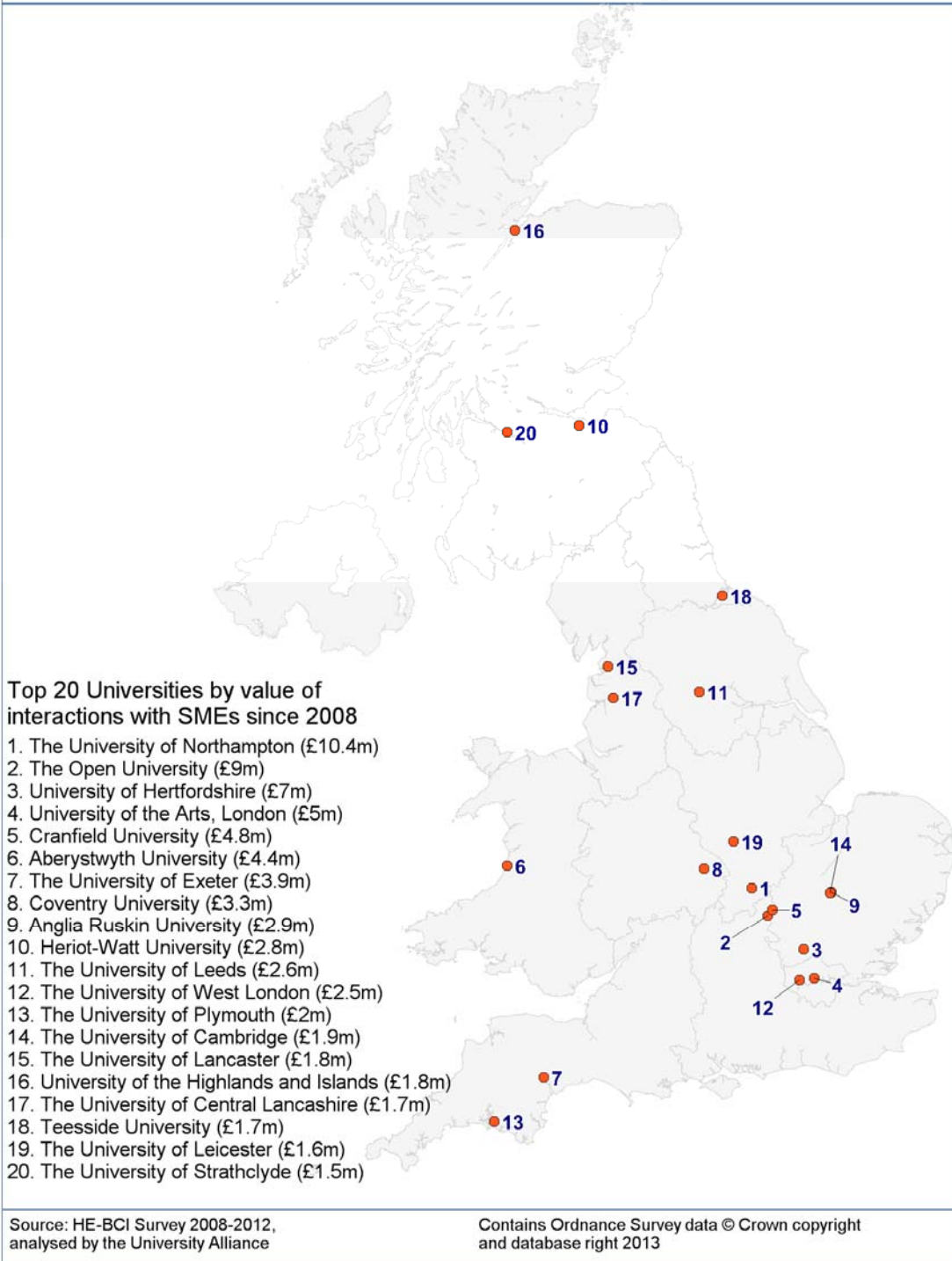
Consultancy & Contract Research

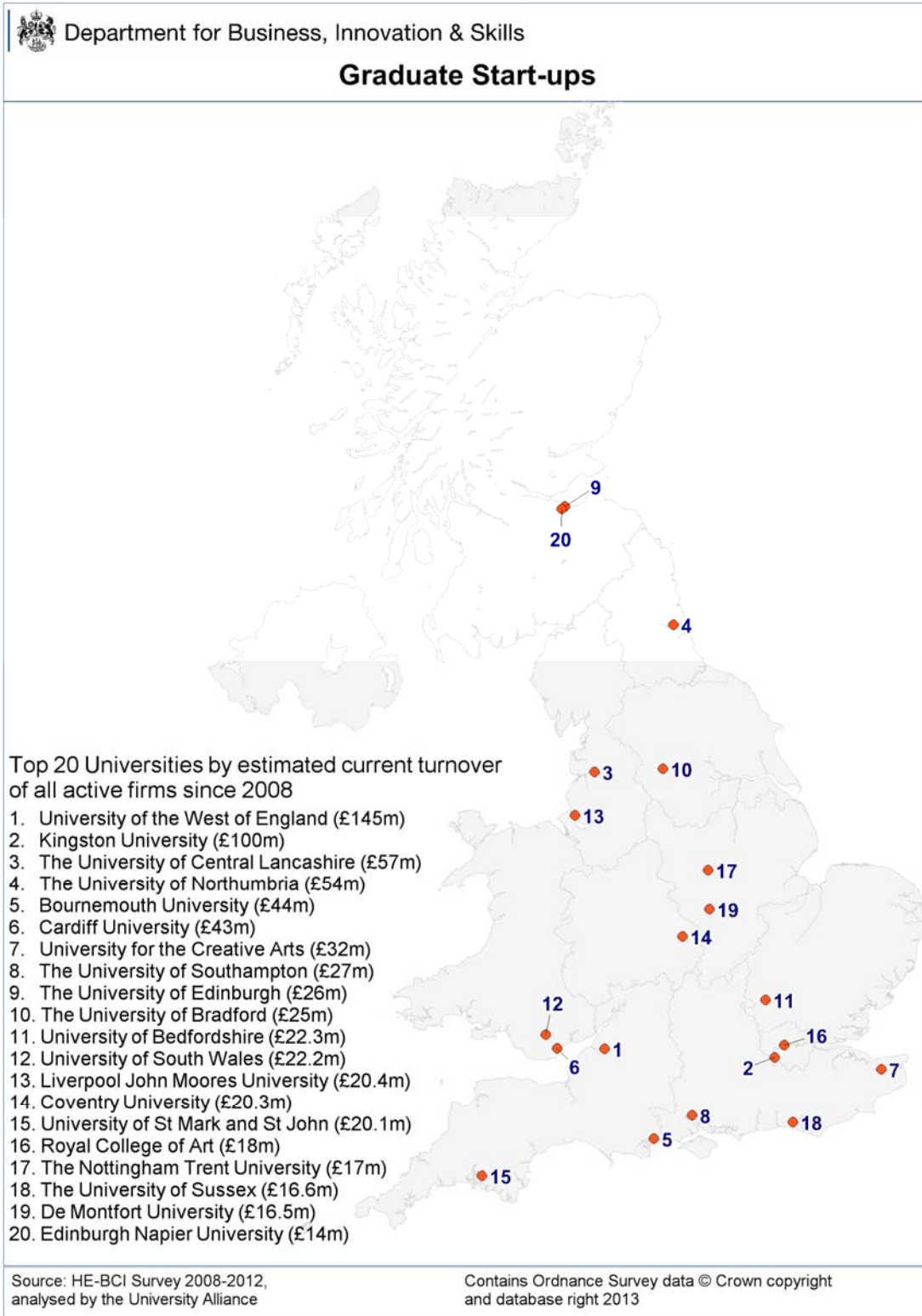




Department for Business, Innovation & Skills

Continued Professional Development





Industrial Clusters

1. The Department for Business, Innovation and Skills has commissioned the Enterprise Research Centre to identify and map industry clusters in the UK. The research uses data from the Inter-departmental Business Register (IDBR)⁴¹ maintained by the Office for National Statistics (ONS) to identify existing clusters by industry, region and sub-region, examine the detailed geography of our existing clusters and highlight the relative industrial strengths of particular areas. It will update two previous pieces of research carried out for the Department in 2001⁴² and 2007⁴³, but will this time include Local Enterprise Partnership (LEP) areas as a geography. The Review has been provided with access to early findings in order to produce maps showing clusters in the Industrial Strategy sectors.

2. The LEP boundaries used are those as at August 2013. The maps have been produced to aid the visualisation of LEP data and are not a true geographical representation of England. Each LEP has been separated from the boundaries of neighbouring LEPs to account for some local authorities being included in two LEPs.

3. The IDBR includes details of 2.1 million businesses in all sectors of the UK economy, representing nearly 99% of UK economic activity. It includes all businesses registered with HM Revenue and Customs for VAT or PAYE⁴⁴, with Companies House (all incorporated business), and with the Department of Finance and Personnel Northern Ireland, and farms registered with the Department for Environment, Food and Rural Affairs.

4. All businesses on the IDBR are classified according to the Standard Industrial Classification 2007 (SIC2007)⁴⁵ which enables a detailed industrial breakdown. SIC2007 is consistent with the European system of industrial classification, NACE⁴⁶.

5. The Department will publish a report of this research in due course, including a detailed industrial analysis of the whole economy. In the meantime, ERC have provided the Review with data showing the locations of Industrial Strategy sectors in England in 2008 and 2012. The Industrial Strategy sectors are listed here:

Advanced Manufacturing

- Aerospace
- Automotive
- Life Sciences

⁴¹ <http://www.ons.gov.uk/ons/about-ons/products-and-services/idbr/index.html>

⁴² <http://www.dti.gov.uk/clusters/map>

⁴³ <http://www.berr.gov.uk/files/file40271.pdf>

⁴⁴ Value Added Tax and Pay As You Earn (income tax and National Insurance contributions)

⁴⁵ <http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/standard-industrial-classification/index.html>

⁴⁶

[http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_\(NACE\)](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_(NACE))

- Agri-tech

Knowledge Services

- Education
- Information economy
- Professional and business services

Enabling sectors

- Nuclear
- Oil and gas
- Offshore wind
- Construction

6. For the nuclear and offshore wind sectors additional analysis was needed, as these sectors are not identifiable using SIC2007. To provide information on the nuclear sector, ERC have carried out a separate analysis using Bureau van Dijk's FAME database⁴⁷ based on company information supplied by BIS. Unfortunately it has not been possible to publish LEP maps for the offshore wind sector as the data are disclosive⁴⁸. Instead the offshore wind map from the Preliminary Findings has been reproduced, showing information provided by RenewableUK⁴⁹. ERC are continuing to work on this, and hope to publish more detail on both the nuclear and offshore wind sectors in their final report.

7. Clusters are identified using Location Quotients. A Location Quotient (LQ) is a way of measuring how concentrated a particular industry, occupation, or demographic group is in an area compared to the nation as a whole. It can reveal what makes a particular area “unique” in comparison to the national average. In the maps we have only shown those LEPs which have an LQ greater than one – that is, those LEPs with a higher than the national average proportion of employment in the relevant sector.

8. The LQ equation is

$$LQ = \frac{e_i / e}{E_i / E}$$

Where:

e_i is sector employment in an area

e is total employment in an area

E_i is national sector employment

E is national total employment

⁴⁷ <http://www.bvdinfo.com/en-gb/products/company-information/national/fame>

⁴⁸ Business Surveys operating within the United Kingdom are governed under the Statistics of Trade Act (1947). Under the Act, participation in the survey is compulsory, and confidentiality requirements that relate to published data are specified in Section 9. This states that tables should not be published that would disclose any information relating to an individual business, unless there is expressed consent in writing from that business. Nor should data be published that would reveal the exact number of respondents contributing to a cell, if there are fewer than five contributors.

⁴⁹ <http://www.renewableuk.com/en/renewable-energy/wind-energy/offshore-wind/>

Sector definitions

9. Definitions of each sector are given below, with SIC2007 codes where applicable:

Aerospace

- 30300 Manufacture of air and spacecraft and related machinery
33160 Repair and maintenance of air and spacecraft

Automotive

- 29100 Manufacture of motor vehicles
29201 Manufacture of bodies (coachwork) for motor vehicles (except caravans)
29202 Manufacture of trailers and semi-trailers
29203 Manufacture of caravans
29310 Manufacture of electrical and electronic equipment for motor vehicles and their engines
29320 Manufacture of other parts and accessories for motor vehicles

*Life Sciences*⁵⁰

- 21000 Manufacture of basic pharmaceutical products and pharmaceutical preparations
26600 Manufacture of irradiation, electromedical and electrotherapeutic equipment
32500 Manufacture of medical and dental instruments and supplies
72110 Research and experimental development on biotechnology⁵¹

Agri-tech

- 01000 Crop and animal production, hunting and related service activities
03200 Aquaculture
20150 Manufacture of fertilisers and nitrogen compounds
20200 Manufacture of pesticides and other agrochemical products
28300 Manufacture of agricultural and forestry machinery

Education

- 85000 Education

Information Economy

- 58200 Software publishing
61000 Telecommunications
62000 Computer programming, consultancy and related activities
63000 Information service activities

Professional and Business Services

- 69000 Legal and accounting activities
70000 Activities of head offices; management consultancy activities
71000 Architectural and engineering activities; technical testing and analysis
72000 Scientific research and development⁵²

⁵⁰ The SIC codes used do not exactly match the official definition of this sector but are very close.

⁵¹ Also included in professional and business services sector.

⁵² 72110 – research and experimental development on biotechnology – is also included in the life sciences sector.

73000	Advertising and market research
74000	Other professional, scientific and technical activities
77000	Rental and leasing activities
78000	Employment activities
82000	Office administrative, office support and other business support activities

Nuclear

The nuclear sector is not identifiable within SIC2007, and these maps have been produced using individual company information supplied by BIS. See paragraph 6 for more information.

Oil and Gas

06000	Extraction of crude petroleum and natural gas
09100	Support activities for petroleum and natural gas extraction
19000	Manufacture of coke and refined petroleum products

Offshore Wind

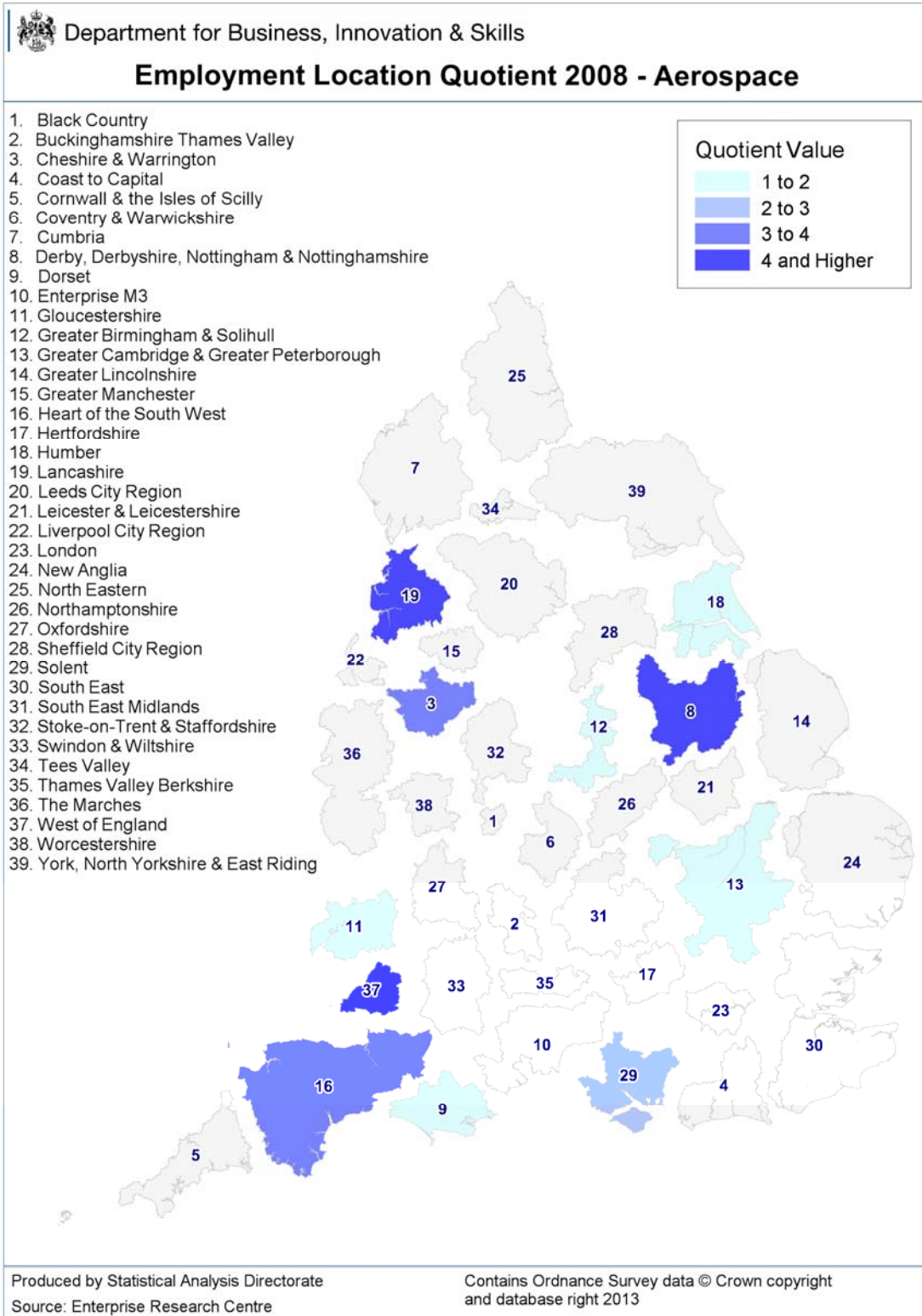
The offshore wind sector is not identifiable within SIC2007, and the map included here has been produced using individual company information supplied by RenewableUK. More details are available in paragraph 6.

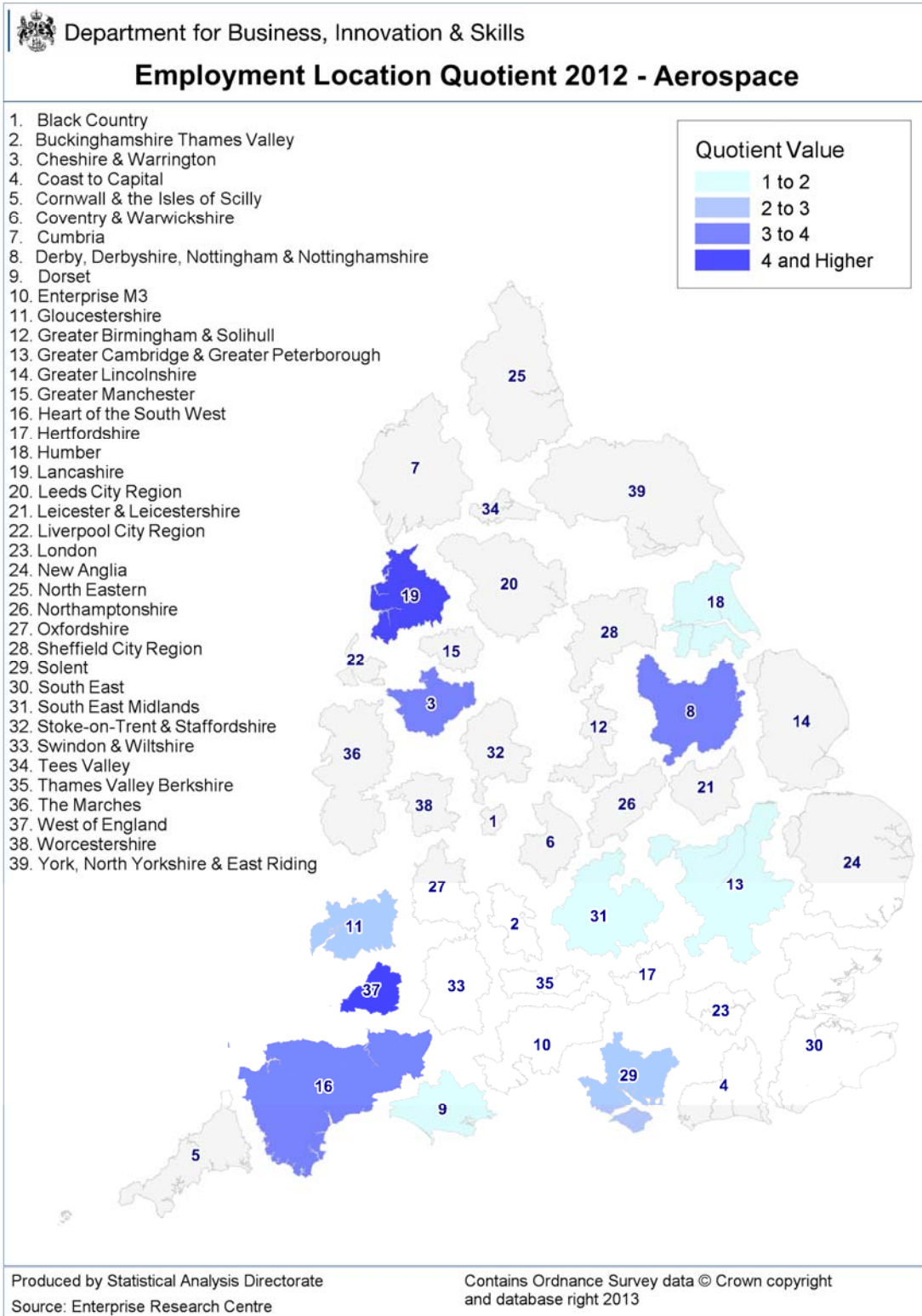
Construction

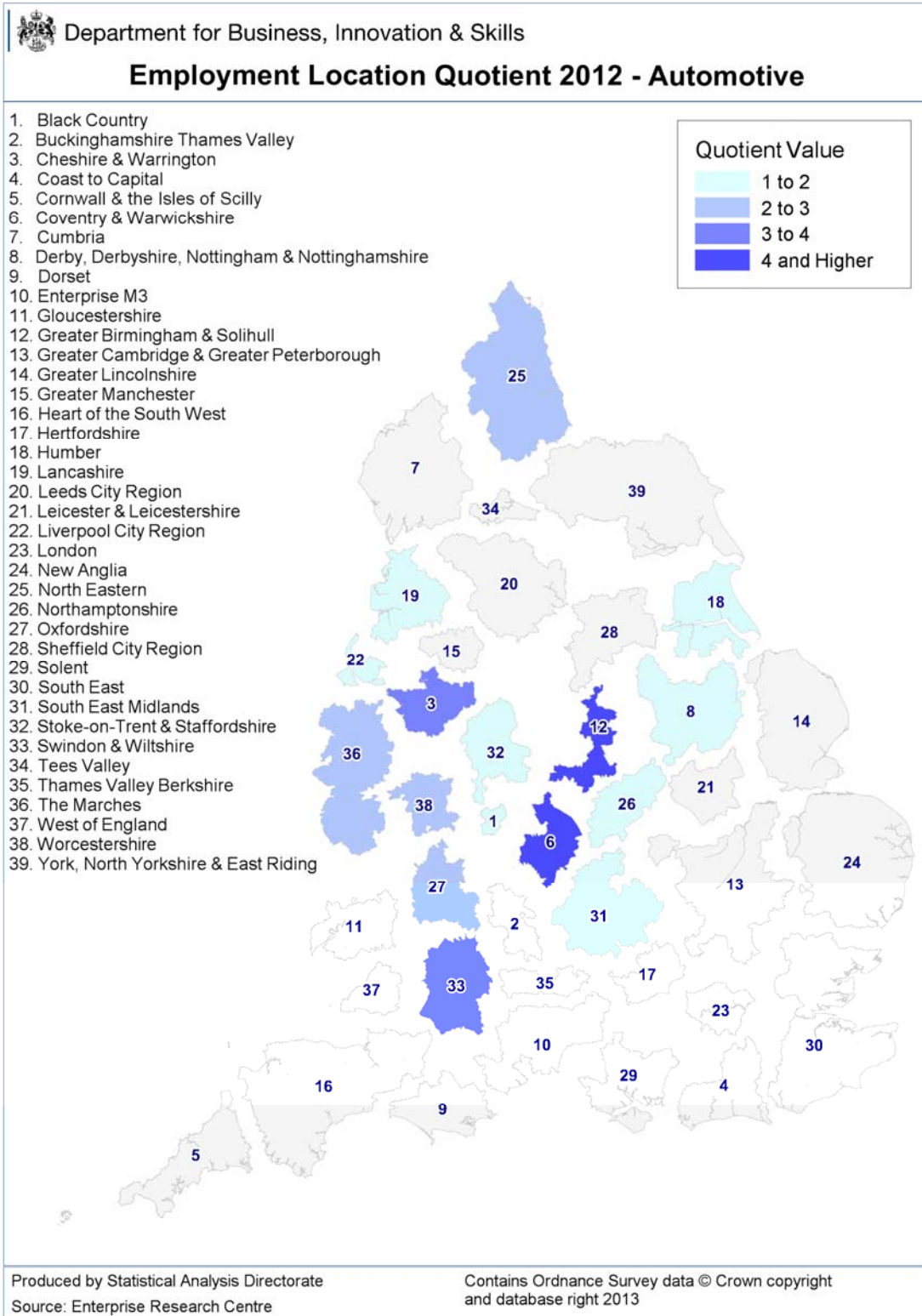
41000	Construction of buildings
42000	Civil engineering
43000	Specialised construction activities

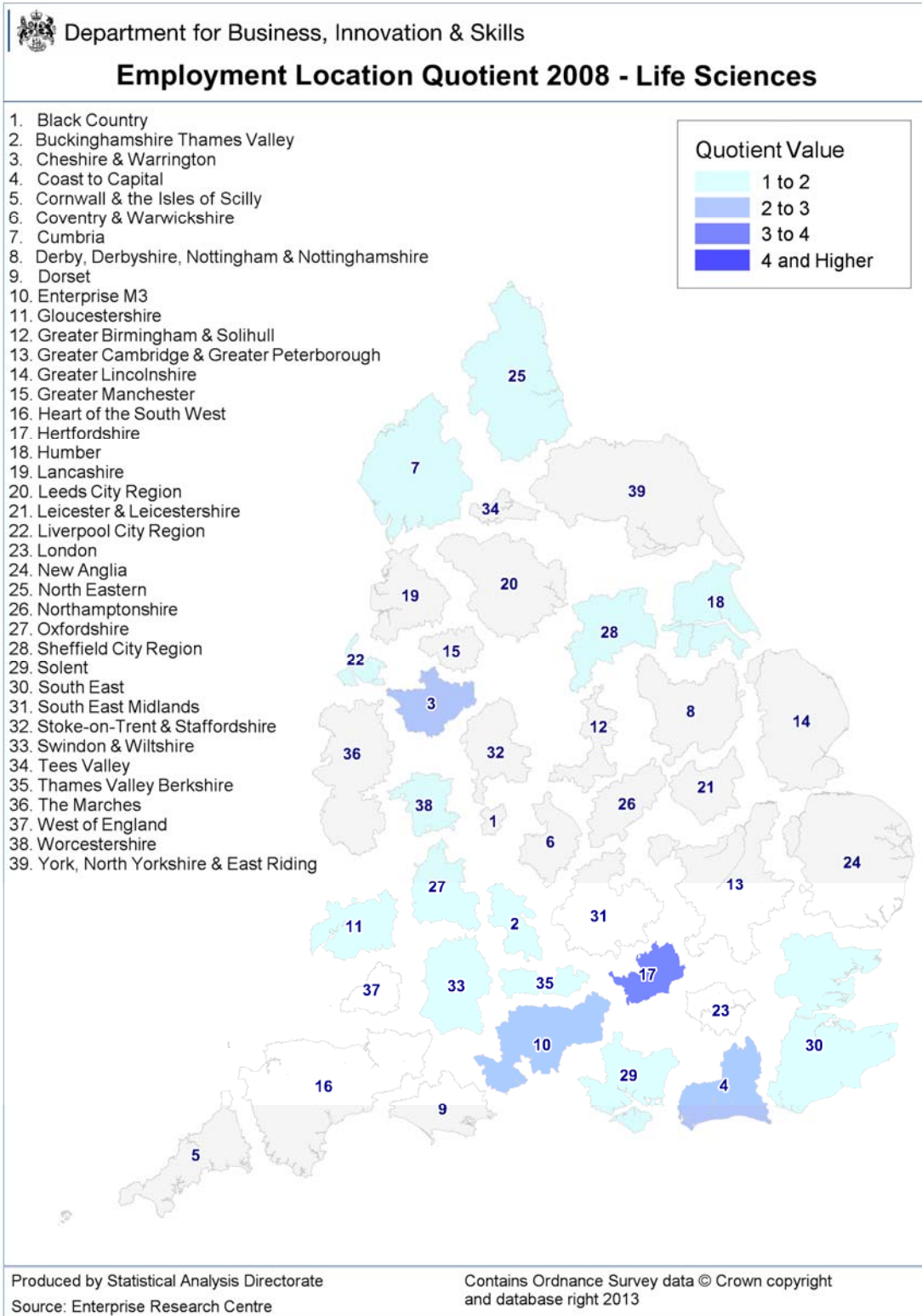
Clusters over time

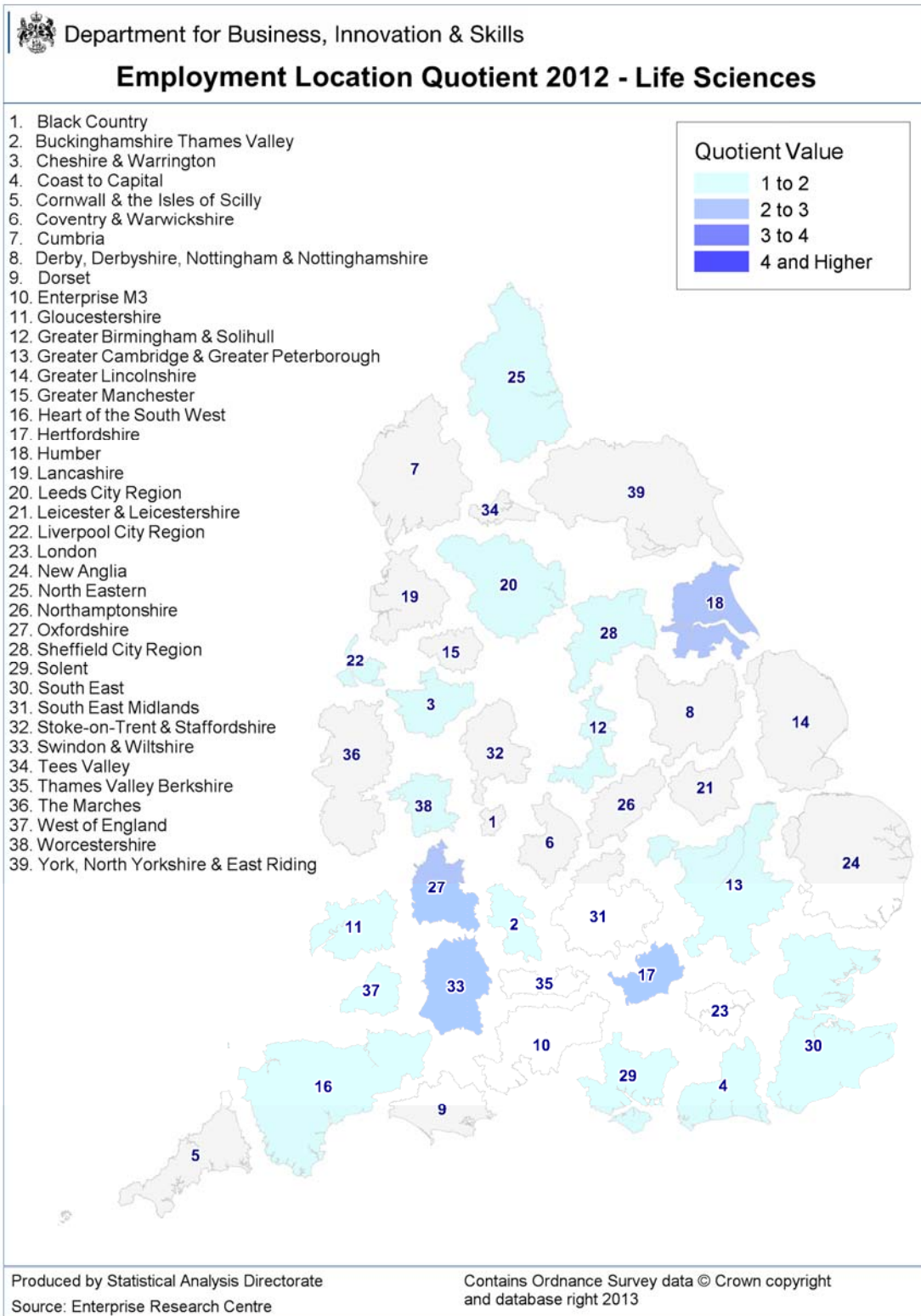
10. The maps show that clustering activity has varied over time in different sectors. In 2012 life sciences and professional and business services saw stronger clustering than in 2008. This was true despite a life sciences cluster in Enterprise M3 disappearing between 2012 and 2008. The reverse was true for most other sectors, although aerospace and agri-tech were unchanged.

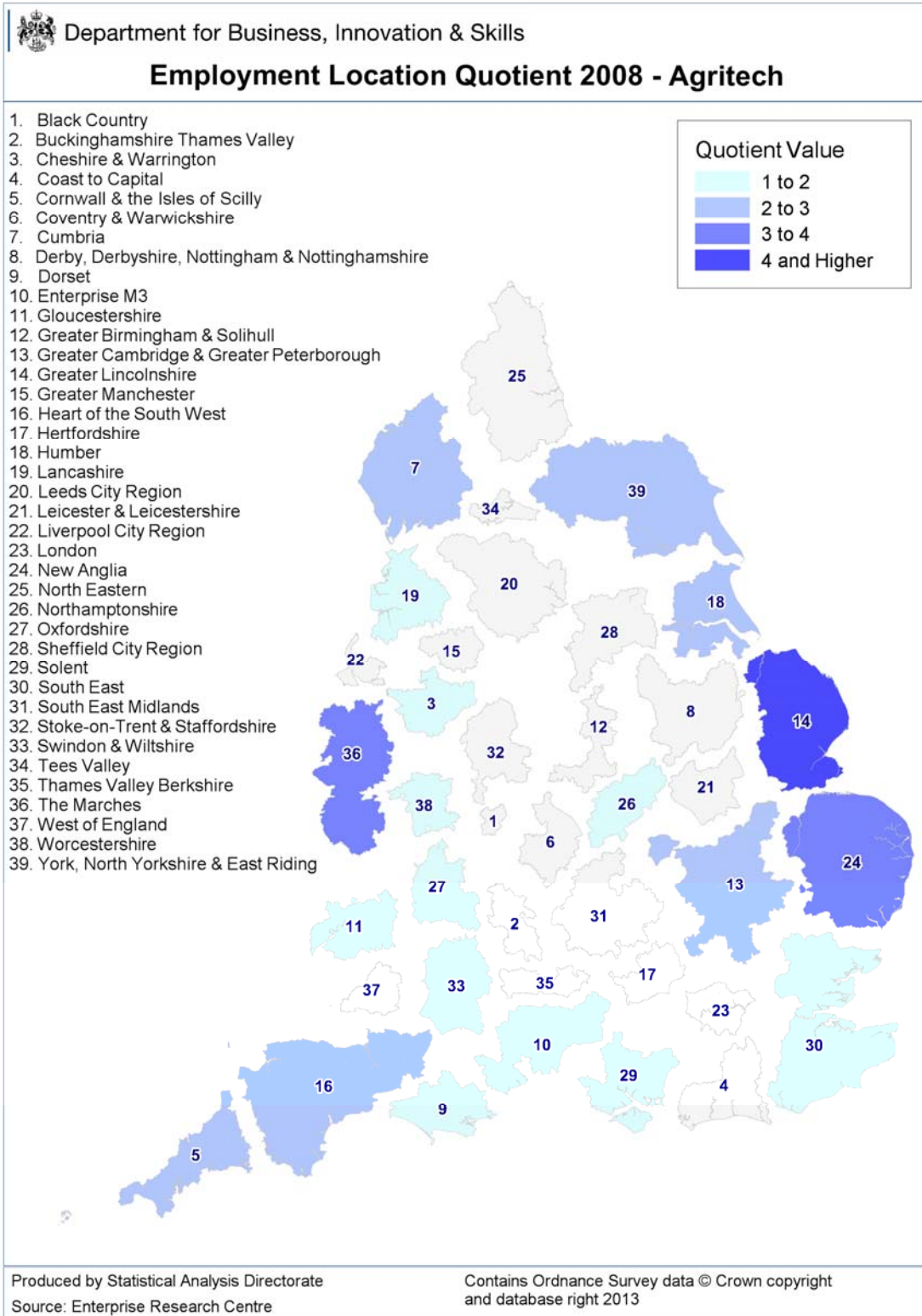


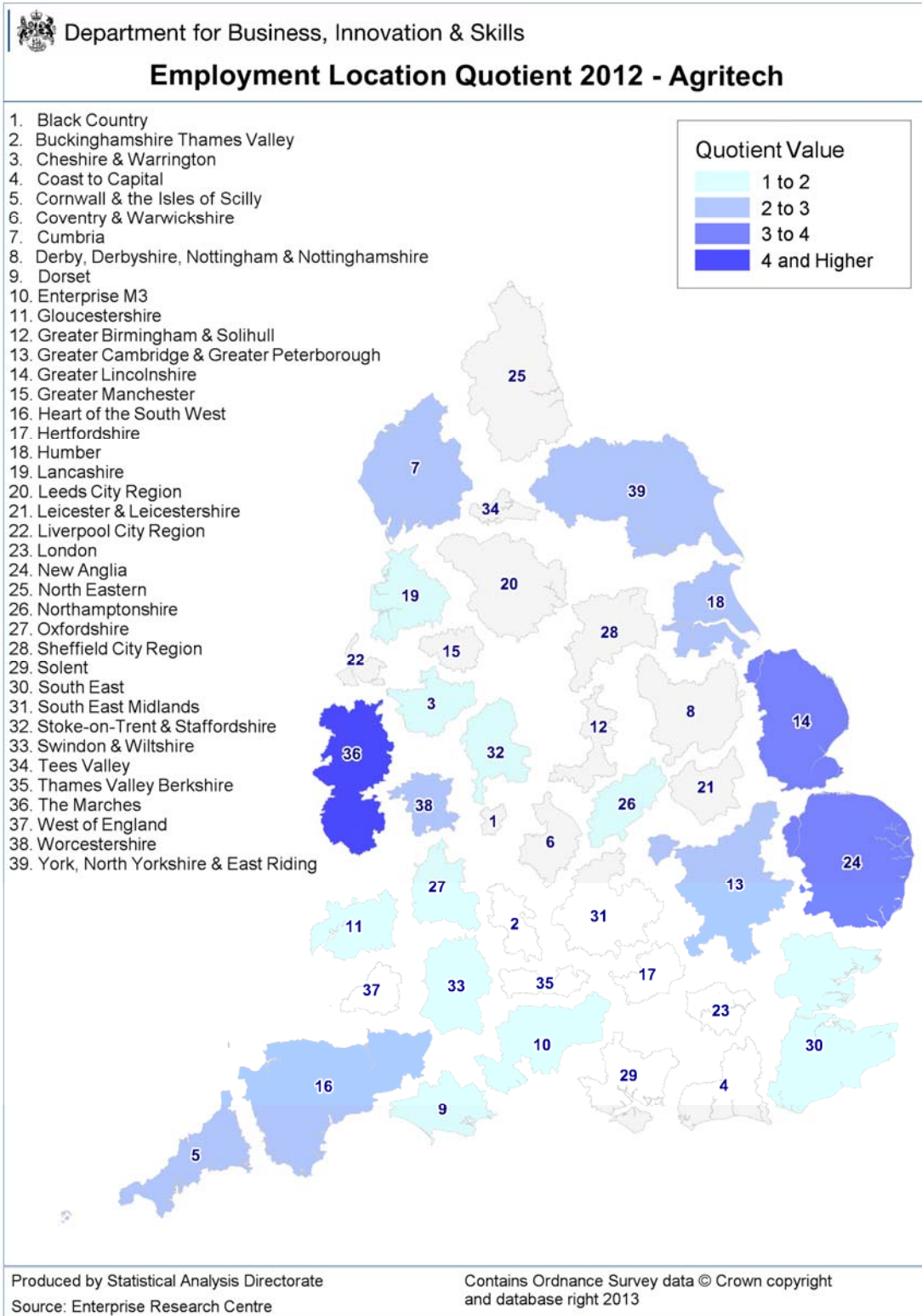


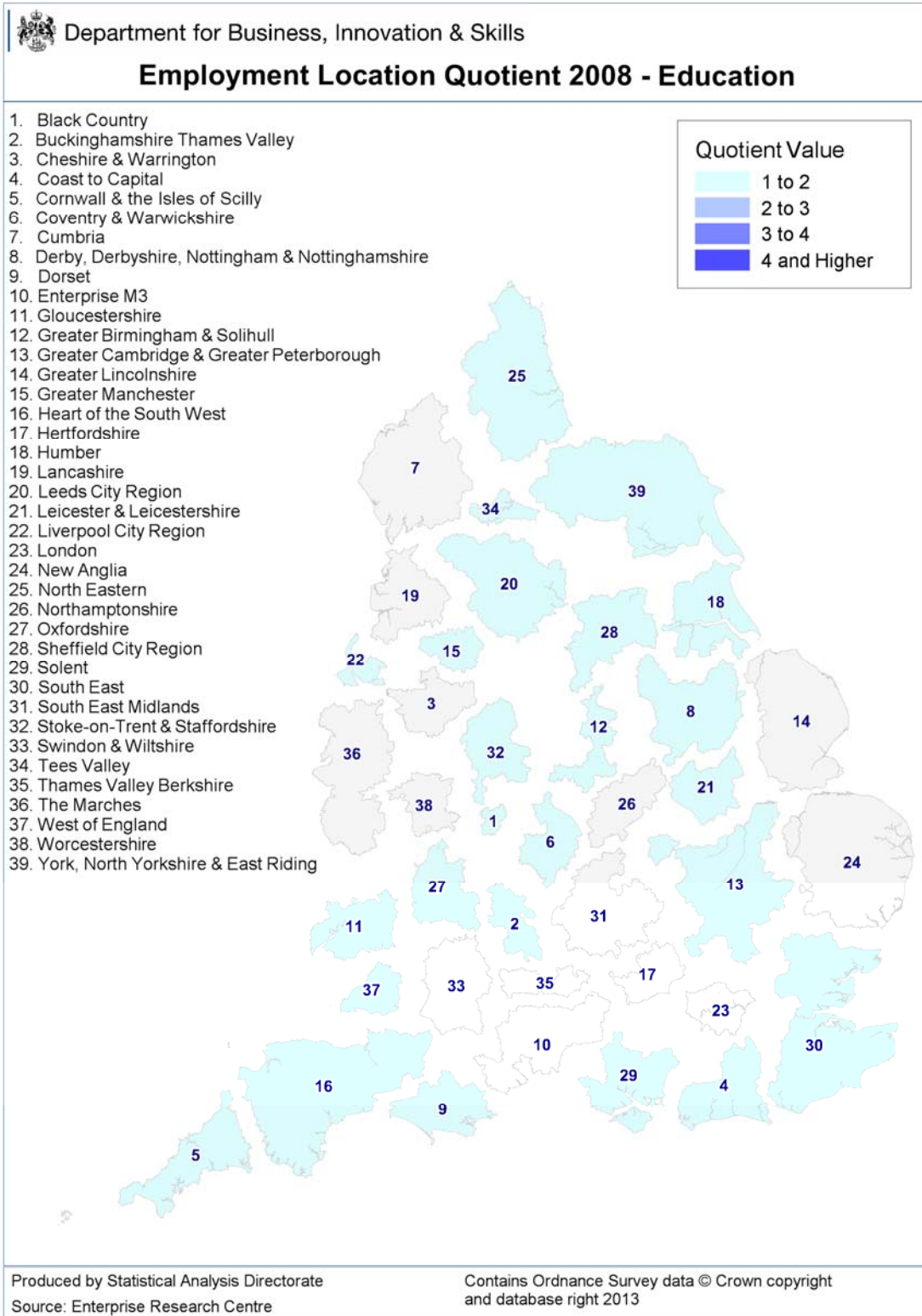


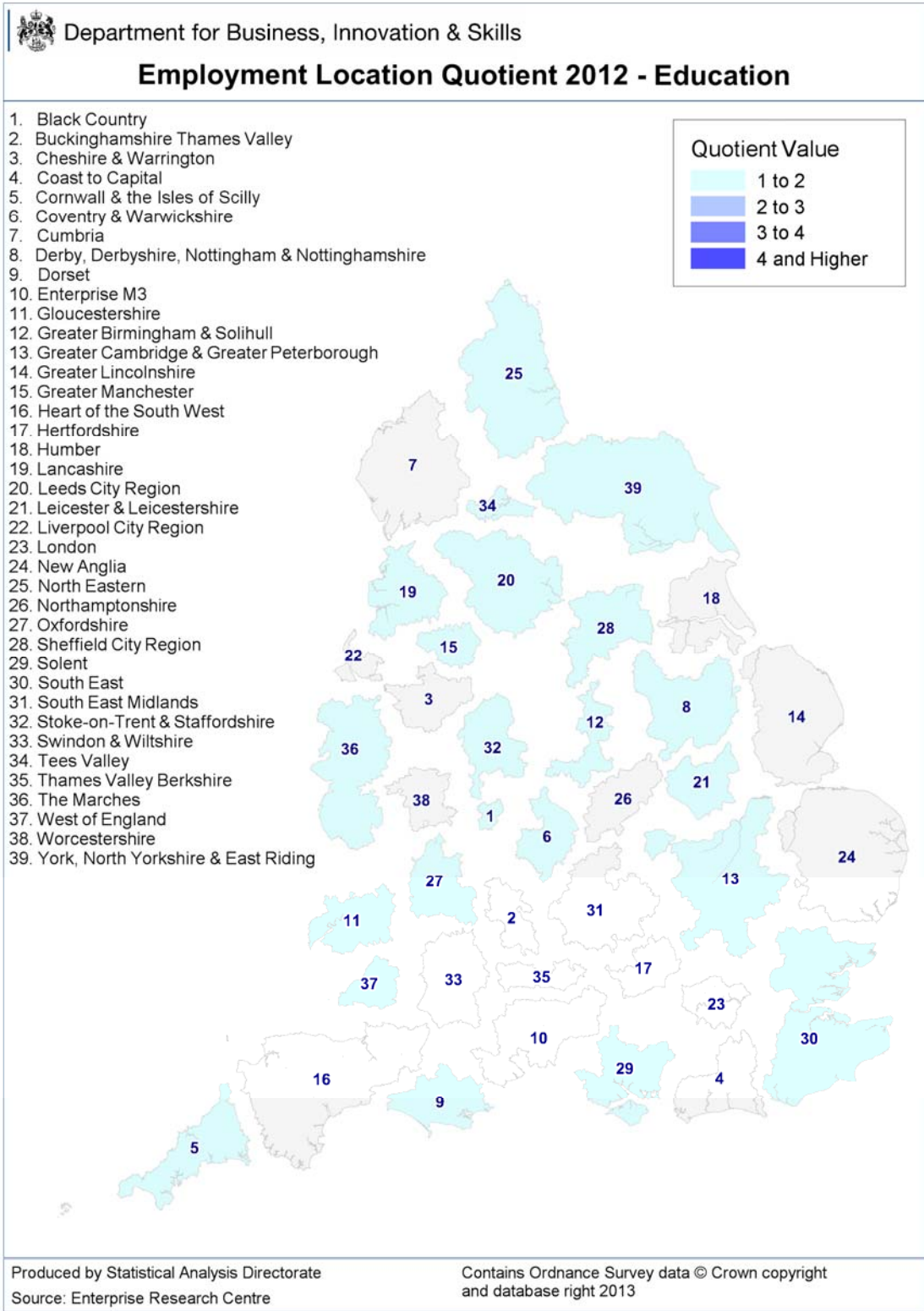










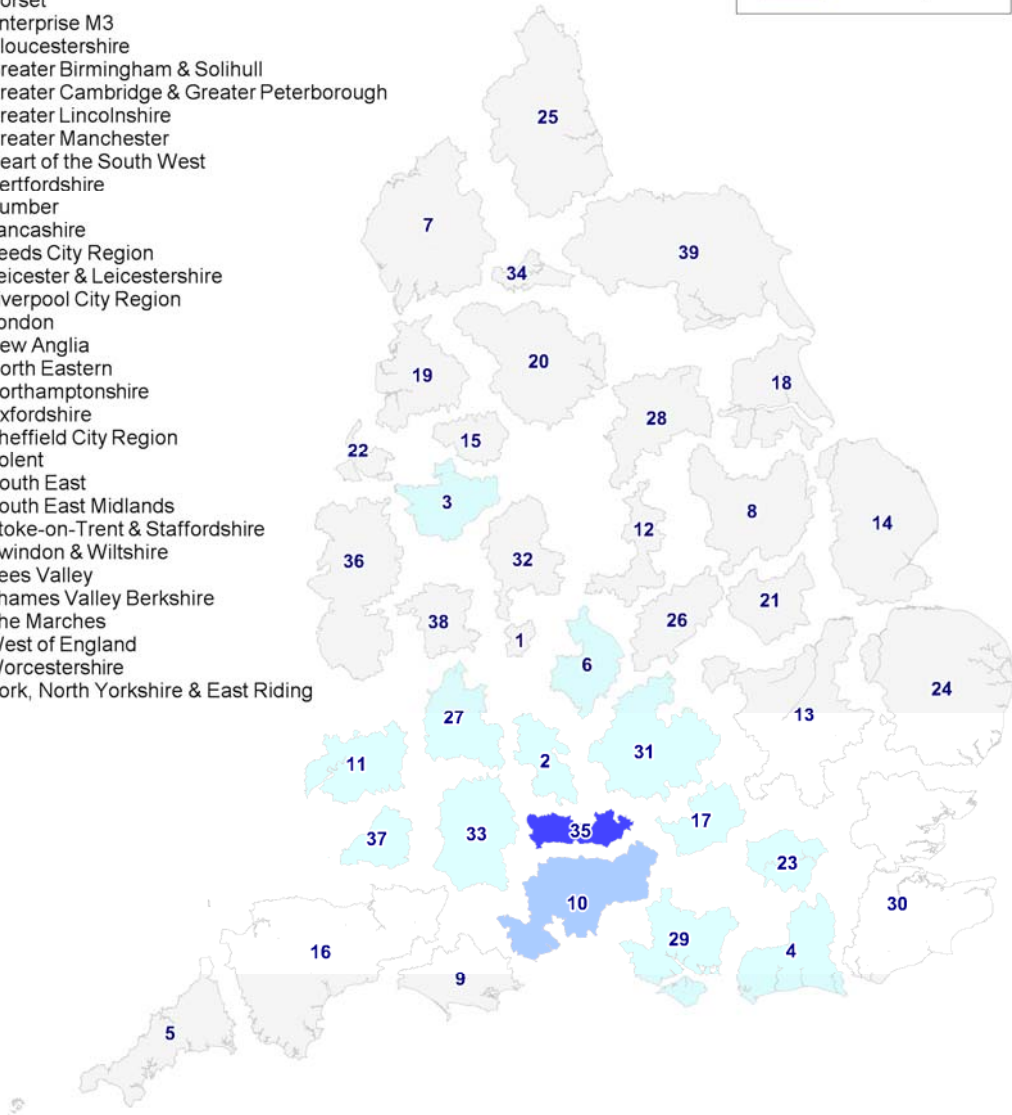
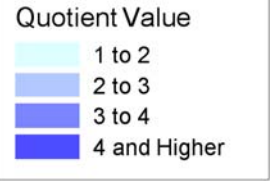




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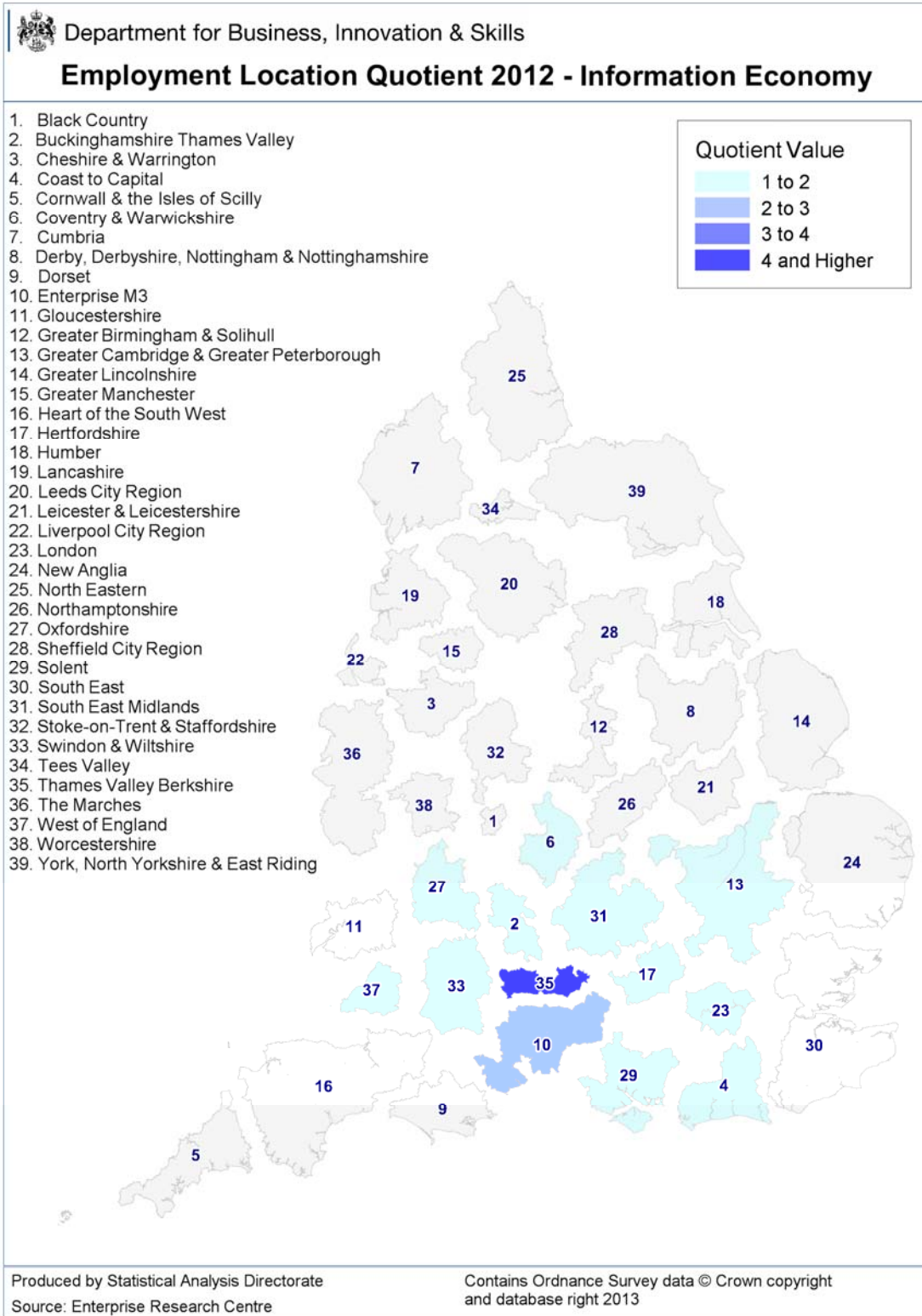
Employment Location Quotient 2008 - Information Economy

1. Black Country
2. Buckinghamshire Thames Valley
3. Cheshire & Warrington
4. Coast to Capital
5. Cornwall & the Isles of Scilly
6. Coventry & Warwickshire
7. Cumbria
8. Derby, Derbyshire, Nottingham & Nottinghamshire
9. Dorset
10. Enterprise M3
11. Gloucestershire
12. Greater Birmingham & Solihull
13. Greater Cambridge & Greater Peterborough
14. Greater Lincolnshire
15. Greater Manchester
16. Heart of the South West
17. Hertfordshire
18. Humber
19. Lancashire
20. Leeds City Region
21. Leicester & Leicestershire
22. Liverpool City Region
23. London
24. New Anglia
25. North Eastern
26. Northamptonshire
27. Oxfordshire
28. Sheffield City Region
29. Solent
30. South East
31. South East Midlands
32. Stoke-on-Trent & Staffordshire
33. Swindon & Wiltshire
34. Tees Valley
35. Thames Valley Berkshire
36. The Marches
37. West of England
38. Worcestershire
39. York, North Yorkshire & East Riding



Produced by Statistical Analysis Directorate
Source: Enterprise Research Centre

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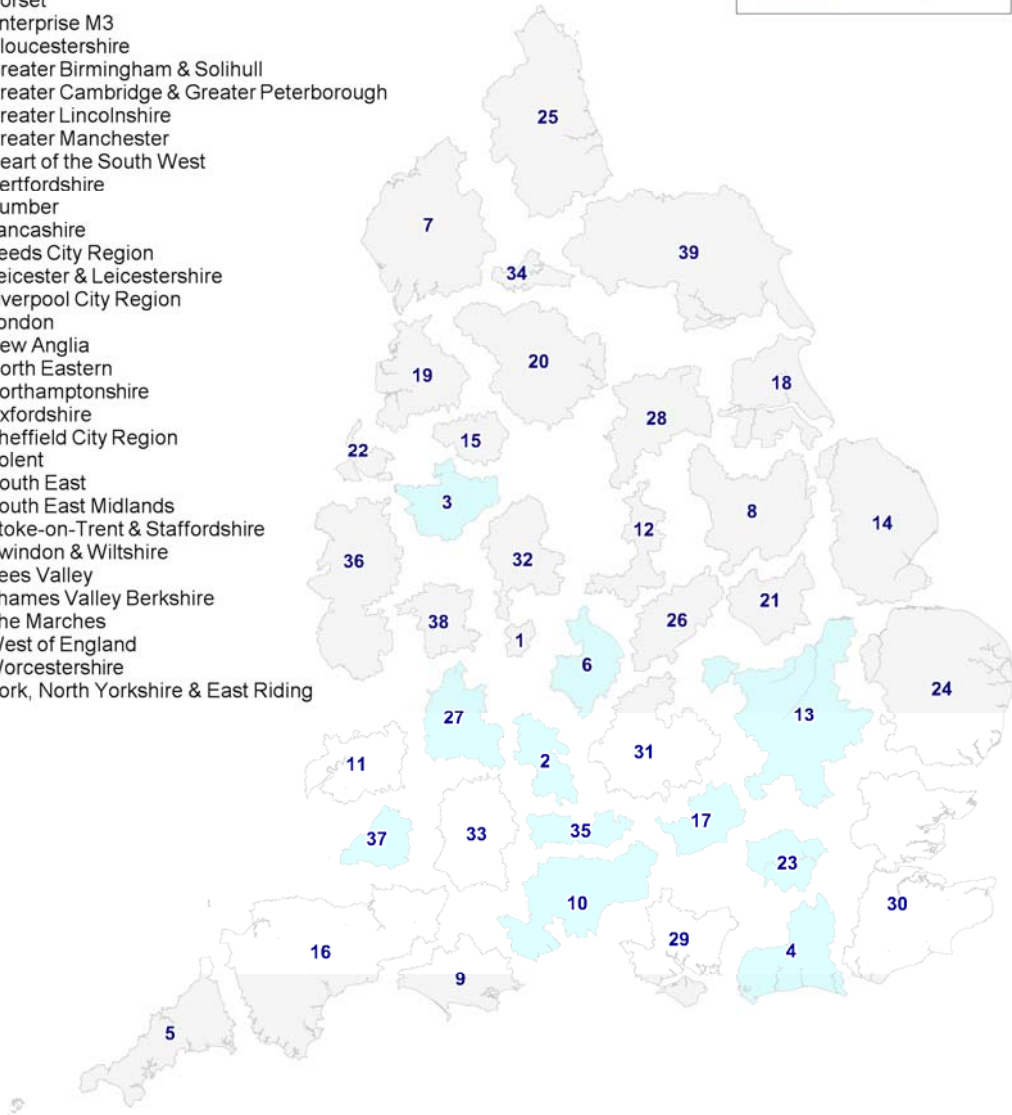
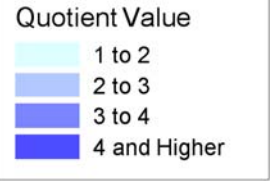




Department for Business, Innovation & Skills

Employment Location Quotient 2008 - Professional & Business Services

1. Black Country
2. Buckinghamshire Thames Valley
3. Cheshire & Warrington
4. Coast to Capital
5. Cornwall & the Isles of Scilly
6. Coventry & Warwickshire
7. Cumbria
8. Derby, Derbyshire, Nottingham & Nottinghamshire
9. Dorset
10. Enterprise M3
11. Gloucestershire
12. Greater Birmingham & Solihull
13. Greater Cambridge & Greater Peterborough
14. Greater Lincolnshire
15. Greater Manchester
16. Heart of the South West
17. Hertfordshire
18. Humber
19. Lancashire
20. Leeds City Region
21. Leicester & Leicestershire
22. Liverpool City Region
23. London
24. New Anglia
25. North Eastern
26. Northamptonshire
27. Oxfordshire
28. Sheffield City Region
29. Solent
30. South East
31. South East Midlands
32. Stoke-on-Trent & Staffordshire
33. Swindon & Wiltshire
34. Tees Valley
35. Thames Valley Berkshire
36. The Marches
37. West of England
38. Worcestershire
39. York, North Yorkshire & East Riding



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Source: Enterprise Research Centre

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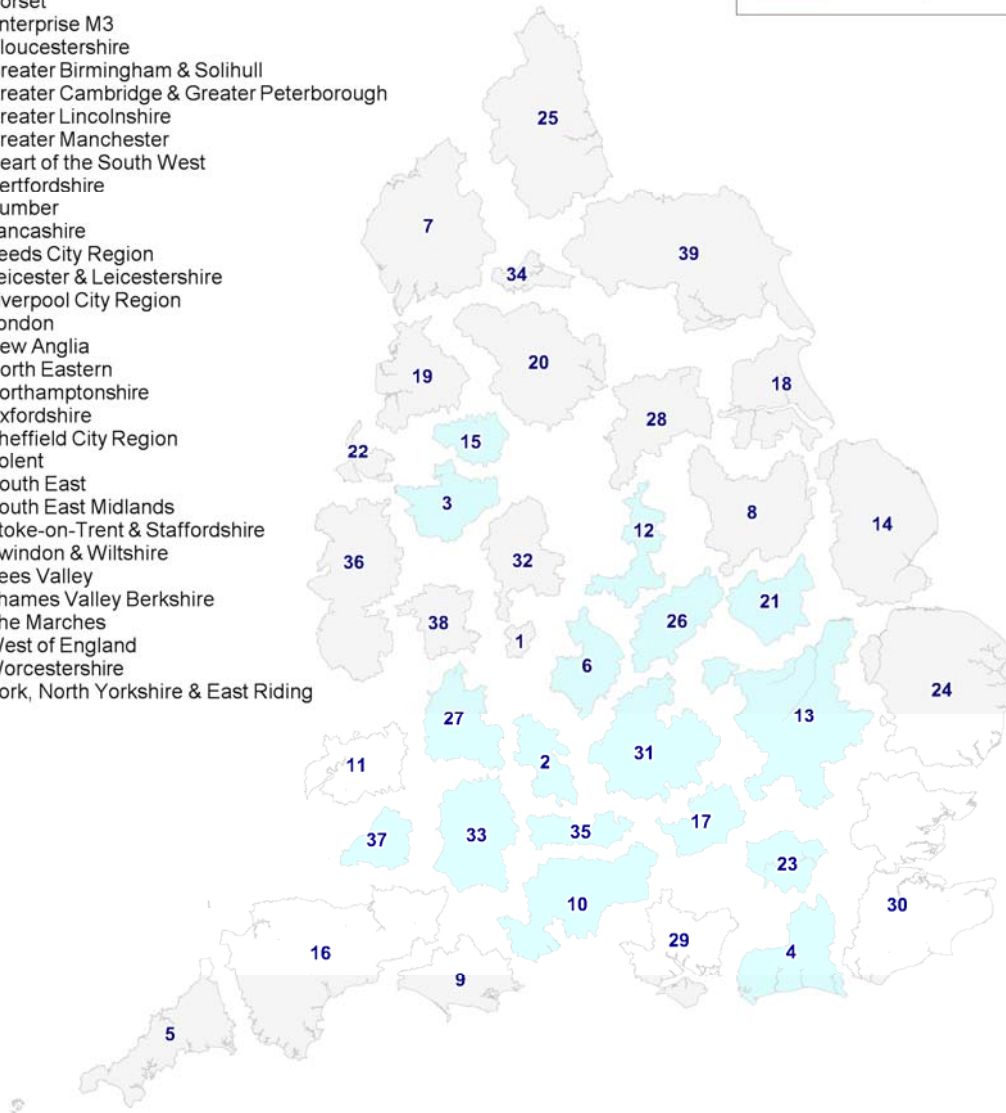


Department for Business, Innovation & Skills

Employment Location Quotient 2012 - Professional & Business Services

1. Black Country
2. Buckinghamshire Thames Valley
3. Cheshire & Warrington
4. Coast to Capital
5. Cornwall & the Isles of Scilly
6. Coventry & Warwickshire
7. Cumbria
8. Derby, Derbyshire, Nottingham & Nottinghamshire
9. Dorset
10. Enterprise M3
11. Gloucestershire
12. Greater Birmingham & Solihull
13. Greater Cambridge & Greater Peterborough
14. Greater Lincolnshire
15. Greater Manchester
16. Heart of the South West
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18. Humber
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26. Northamptonshire
27. Oxfordshire
28. Sheffield City Region
29. Solent
30. South East
31. South East Midlands
32. Stoke-on-Trent & Staffordshire
33. Swindon & Wiltshire
34. Tees Valley
35. Thames Valley Berkshire
36. The Marches
37. West of England
38. Worcestershire
39. York, North Yorkshire & East Riding

Quotient Value



Produced by Statistical Analysis Directorate
Source: Enterprise Research Centre

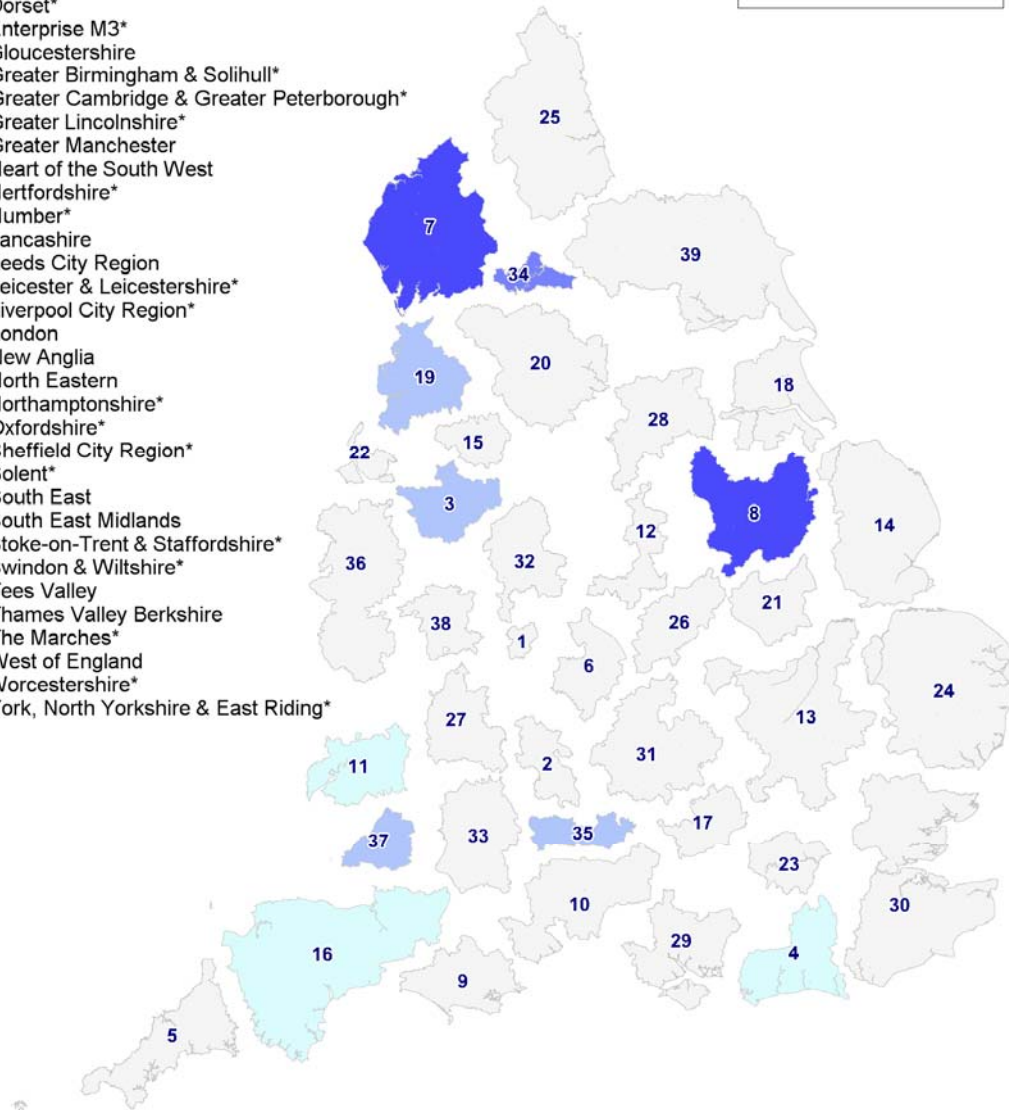
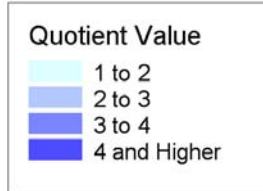
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Employment Location Quotient 2008 - Nuclear

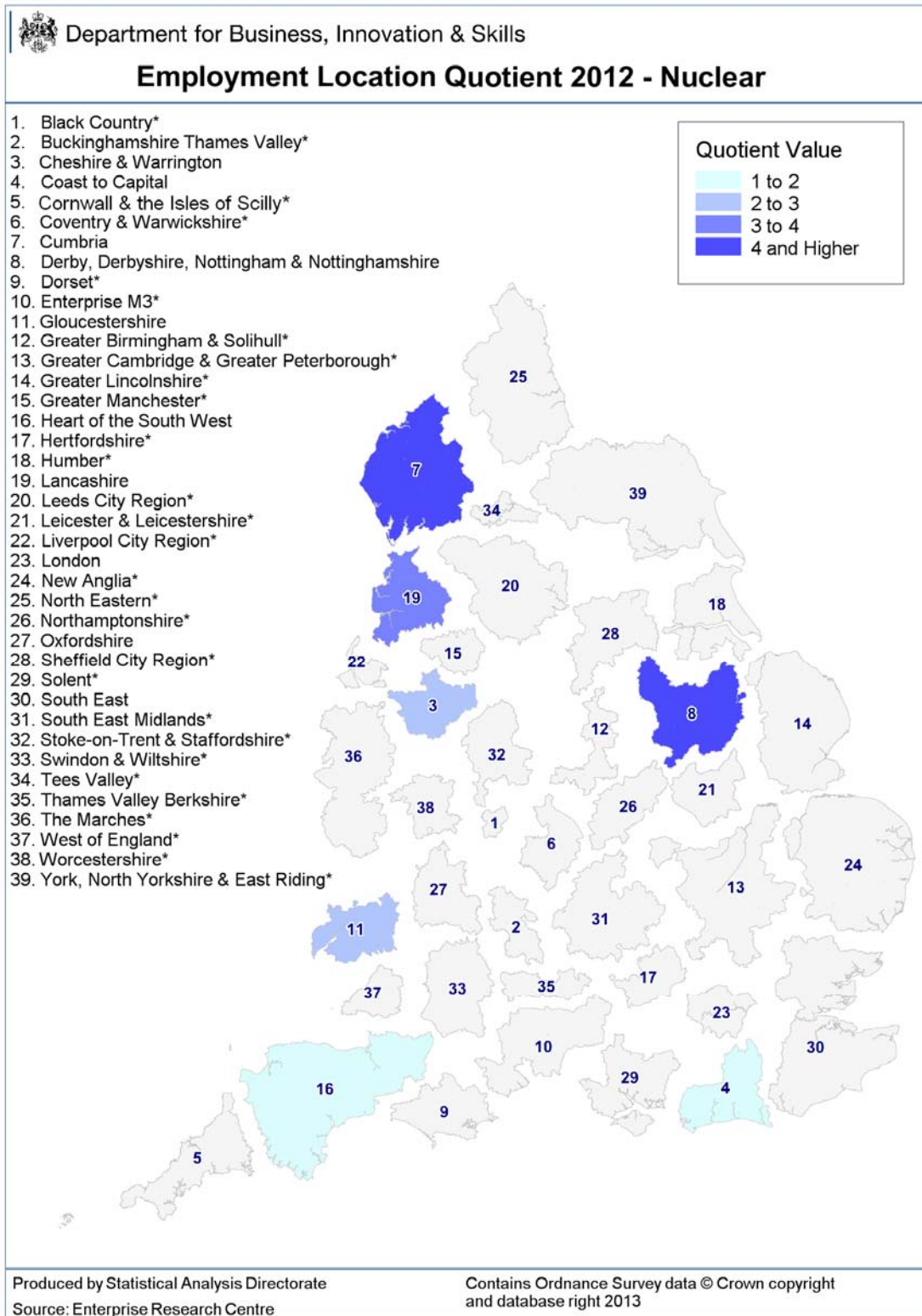
1. Black Country*
2. Buckinghamshire Thames Valley*
3. Cheshire & Warrington
4. Coast to Capital
5. Cornwall & the Isles of Scilly*
6. Coventry & Warwickshire*
7. Cumbria
8. Derby, Derbyshire, Nottingham & Nottinghamshire
9. Dorset*
10. Enterprise M3*
11. Gloucestershire
12. Greater Birmingham & Solihull*
13. Greater Cambridge & Greater Peterborough*
14. Greater Lincolnshire*
15. Greater Manchester
16. Heart of the South West
17. Hertfordshire*
18. Humber*
19. Lancashire
20. Leeds City Region
21. Leicester & Leicestershire*
22. Liverpool City Region*
23. London
24. New Anglia
25. North Eastern
26. Northamptonshire*
27. Oxfordshire*
28. Sheffield City Region*
29. Solent*
30. South East
31. South East Midlands
32. Stoke-on-Trent & Staffordshire*
33. Swindon & Wiltshire*
34. Tees Valley
35. Thames Valley Berkshire
36. The Marches*
37. West of England
38. Worcestershire*
39. York, North Yorkshire & East Riding*



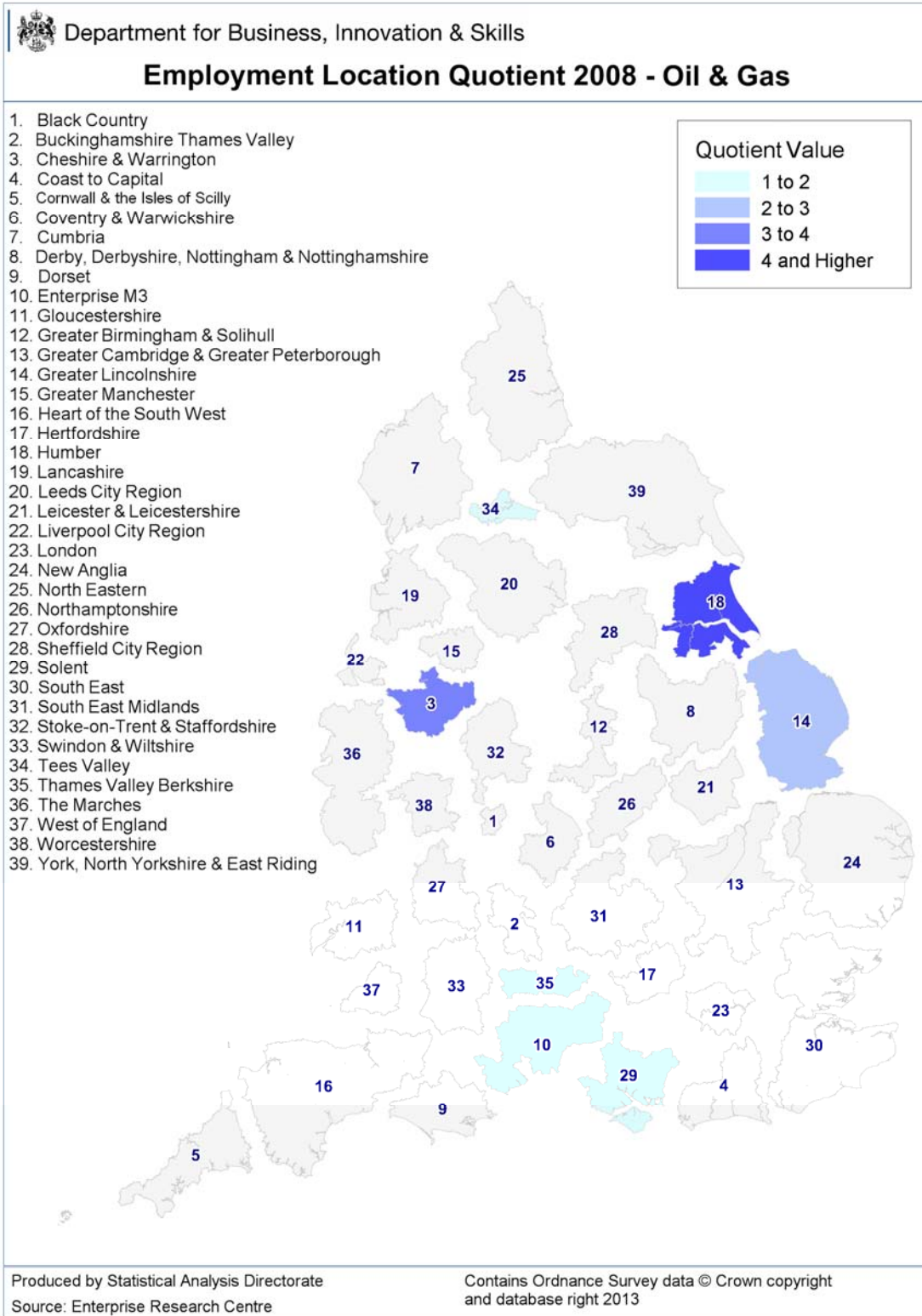
Produced by Statistical Analysis Directorate
 Source: Enterprise Research Centre

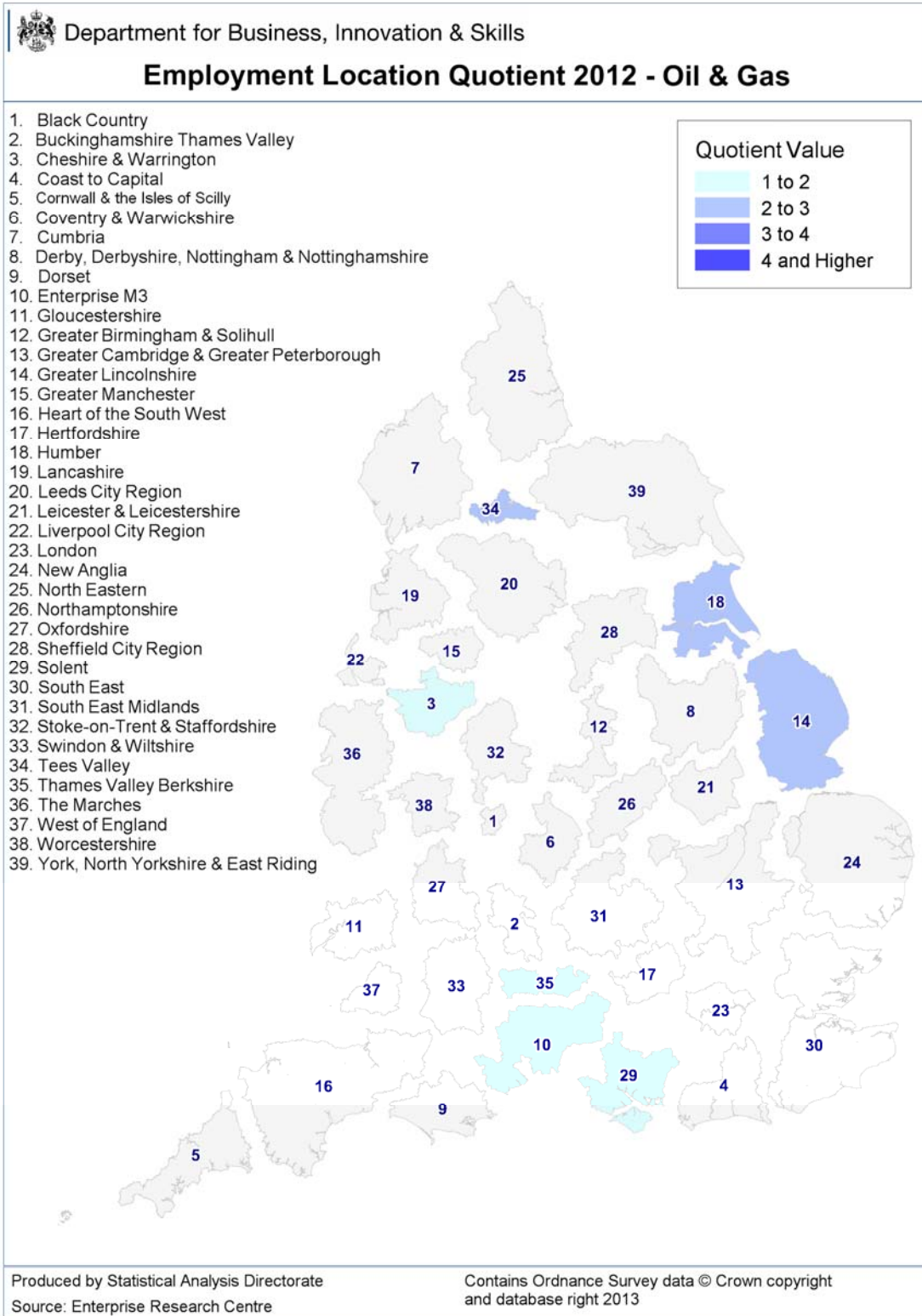
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*Indicates that the data for this LEP have been suppressed (see footnote 48)



*indicates that the data for this LEP have been suppressed (see footnote 48)

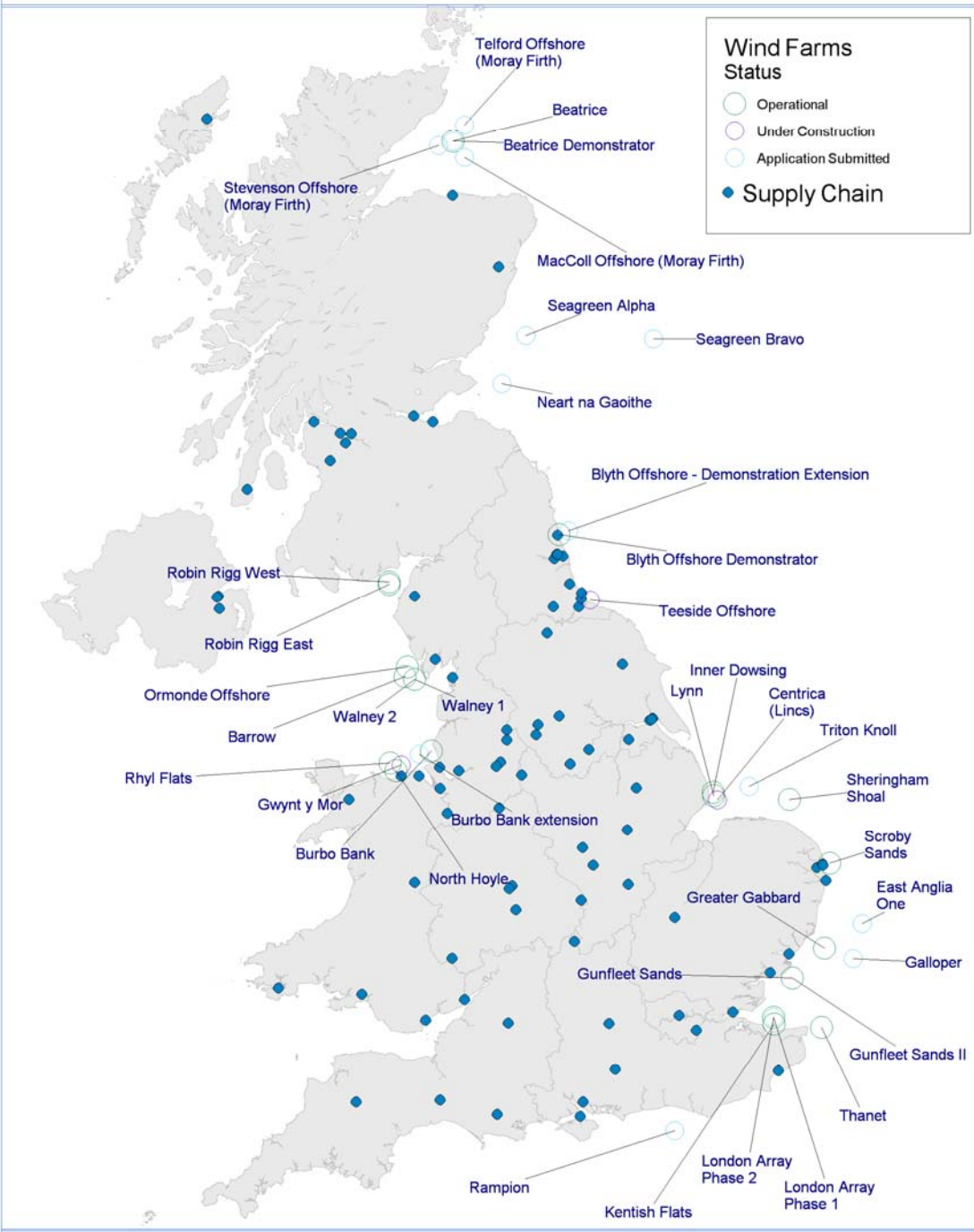






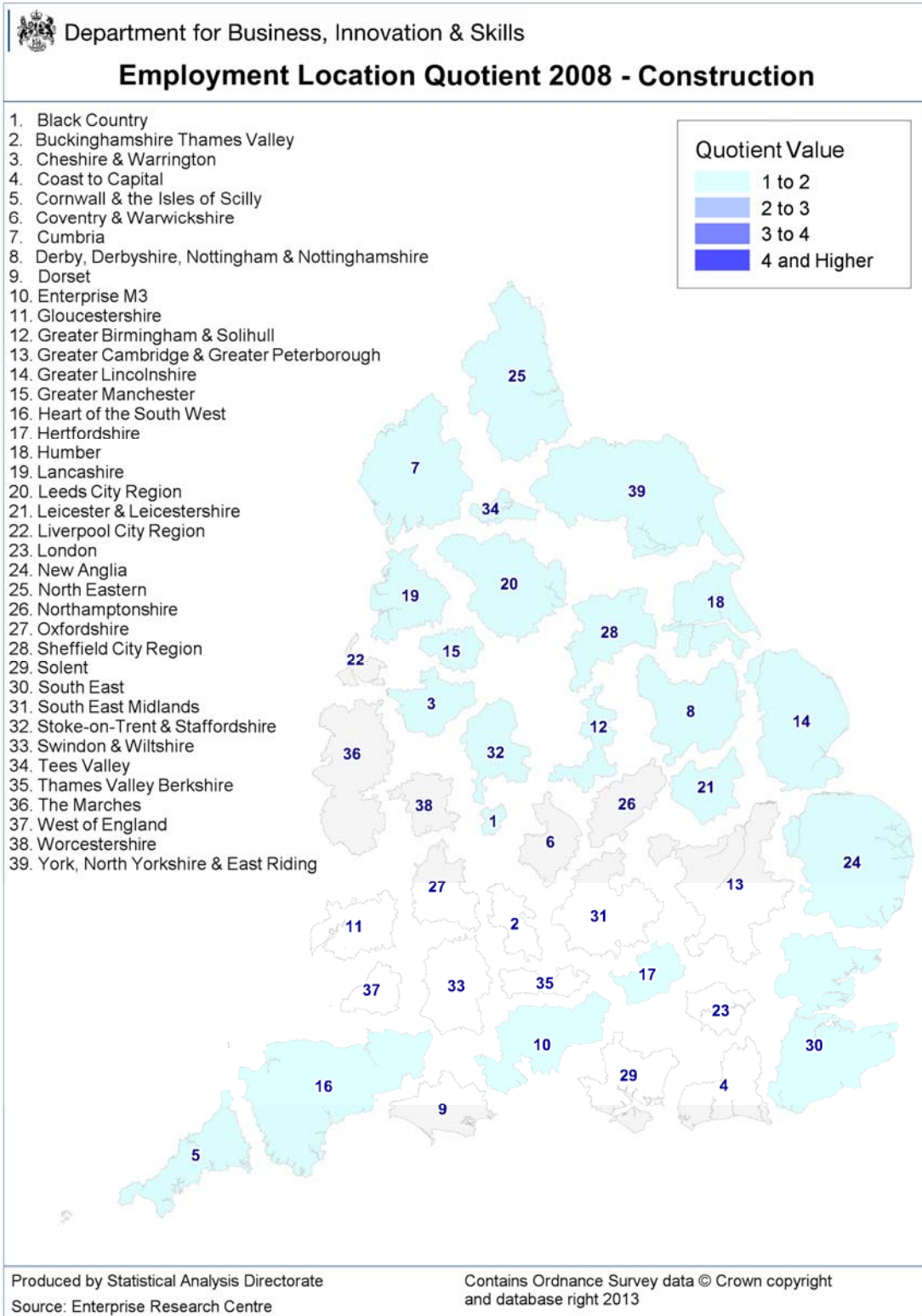
Department for Business, Innovation & Skills

Offshore Wind



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Sources: DECC & RenewableUK

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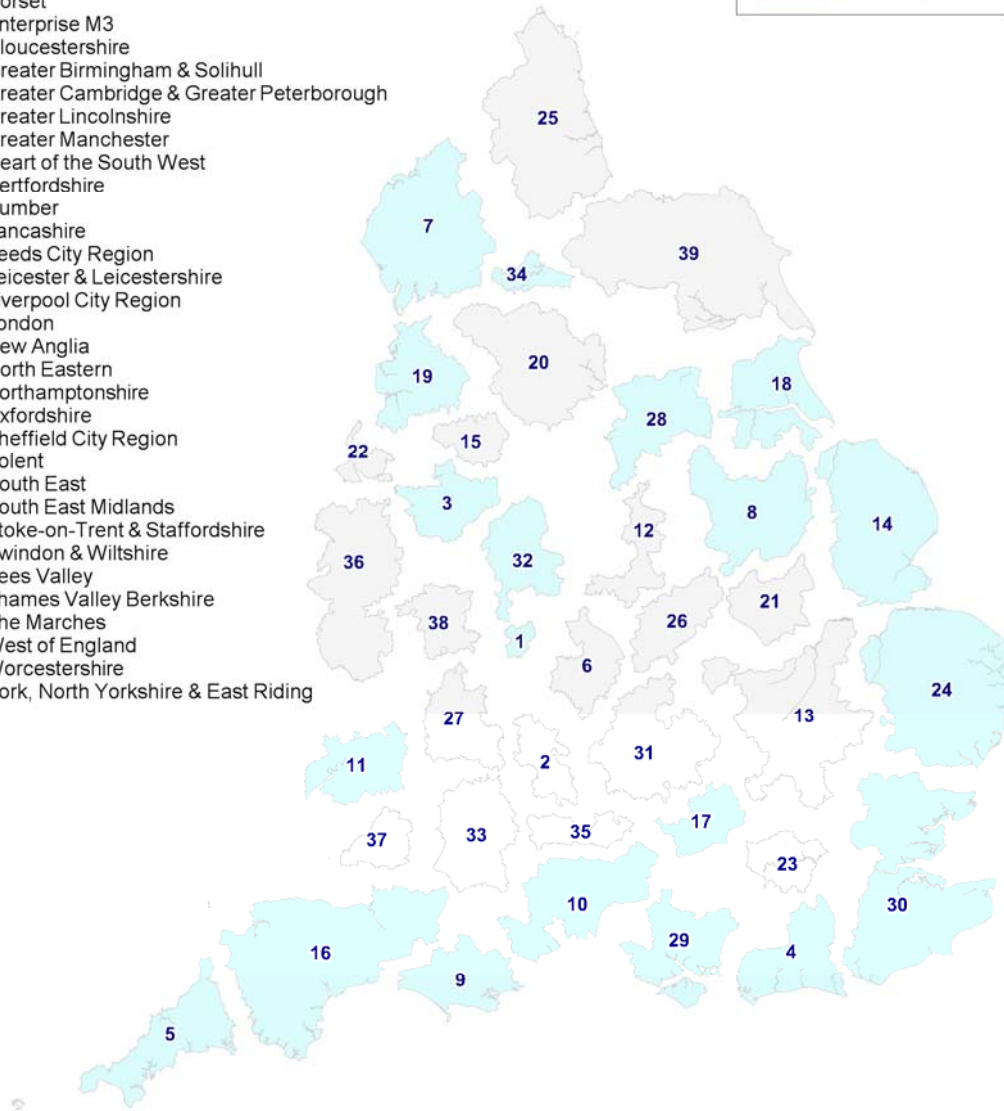


Department for Business, Innovation & Skills

Employment Location Quotient 2012 - Construction

1. Black Country
2. Buckinghamshire Thames Valley
3. Cheshire & Warrington
4. Coast to Capital
5. Cornwall & the Isles of Scilly
6. Coventry & Warwickshire
7. Cumbria
8. Derby, Derbyshire, Nottingham & Nottinghamshire
9. Dorset
10. Enterprise M3
11. Gloucestershire
12. Greater Birmingham & Solihull
13. Greater Cambridge & Greater Peterborough
14. Greater Lincolnshire
15. Greater Manchester
16. Heart of the South West
17. Hertfordshire
18. Humber
19. Lancashire
20. Leeds City Region
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33. Swindon & Wiltshire
34. Tees Valley
35. Thames Valley Berkshire
36. The Marches
37. West of England
38. Worcestershire
39. York, North Yorkshire & East Riding

Quotient Value



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Citations Analysis – Research in Industrial Strategy Fields

1. The Review commissioned science and health information specialist Elsevier to identify which UK universities receive the most citations relating to research in the Industrial Strategy sectors and Eight Great Technologies (the sectors and technologies are described on page 137). With input from the Research Councils, Elsevier have identified the top 20 universities in each Industrial Strategy sector⁵³ and Great Technology. This was done by calculating their Field-Weighted Citation Impact (FWCI), a measure of citation impact that corrects for differences in citation behaviour between fields.

2. To ensure a robust, comprehensive and accurate identification of Scopus publications in the period mentioned above, Elsevier and the Review Team worked jointly to define and deploy the below method:

- a) Following the Review Team's request, UK Research Councils provided a list of relevant researchers per applicable discipline. The researchers were chosen because their published work was viewed as being representative of and therefore defined the scope of the disciplinary areas to be analysed.
- b) Each researcher's name including affiliated organisation was used by the Elsevier SVA team to identify his/her publications in Scopus in the above mentioned period.
- c) The set of all publications of all researchers in a particular discipline was then fed to Elsevier's Finger Printing Engine⁵⁴ (FPE). The FPE engine combines Natural Language Processing techniques together with thesauri and taxonomies across many different disciplines to identify and extract relevant concepts mentioned in the abstract, title and keywords of a publication. Each concept is given a weight based on the number of occurrences in this set of publications but also on the number of occurrences in the entirety of Scopus.
- d) The list of concepts collected from the previous step was examined and refined by subject matter-experts at different Publishing Units within Elsevier. Such a refinement focused mainly on the exclusion of irrelevant or broad terms, e.g. terms like 'model', 'test', 'application', etc.
- e) With the remaining concepts, searches were conducted on Scopus for the above mentioned period to retrieve publications of types⁵⁵: Article, Review and Conference Proceeding.
- f) Subsequently, the publications retrieved were indexed in specific database tables to allow for the calculation of the metrics defined for this project.

3. The columns which are titled "in top 1%" and "in top 10%" refer to the number of publications from each institute that are in the top-cited x% of publications globally in this subject area. The number in parentheses shows what proportion of the institution's total publications in the area this represents.

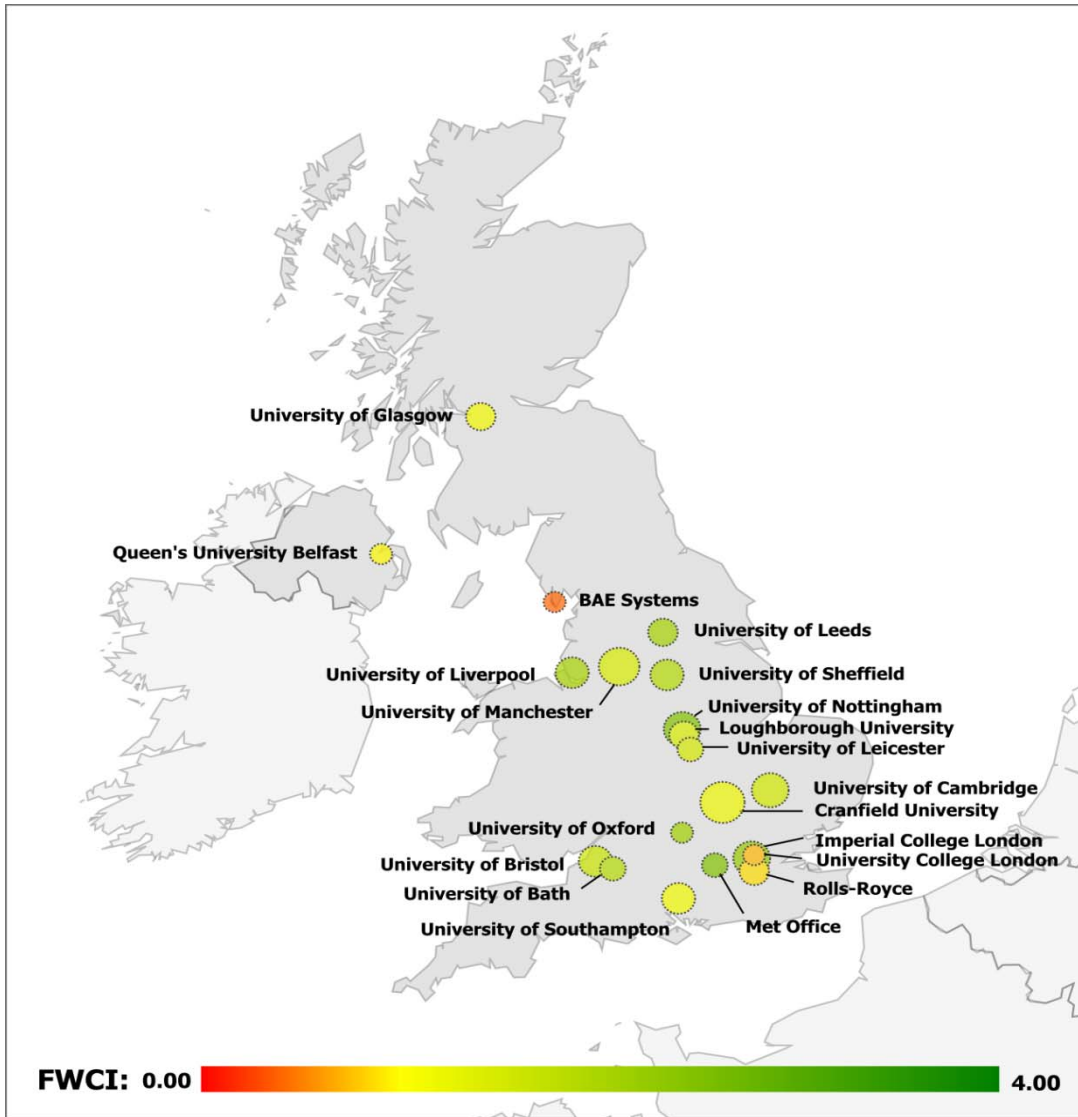
⁵³ The analysis was not carried out for the Professional and Business Services sector as it was not possible to define sufficiently distinct keywords. Elsevier were not asked to analyse the Education sector.

⁵⁴ See <http://info.scival.com/fingerprint> for more details

⁵⁵ Article, Review and Conference Proceeding are commonly used as the standard publication types in any bibliometric study

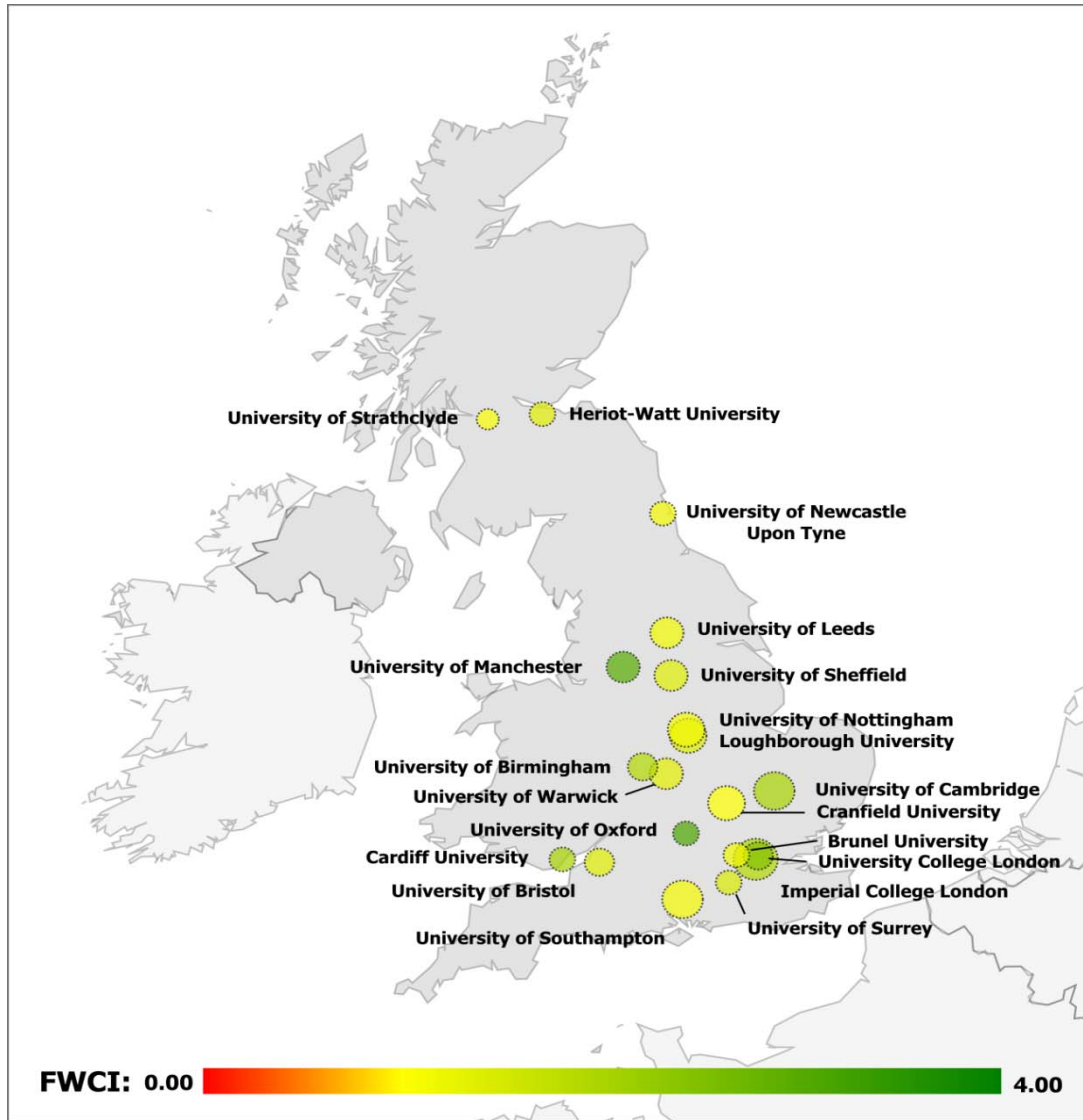
4. It should be noted that this analysis does not recognise where universities work jointly, for example on robotics, UWE and Bristol University are shown separately. In practice, they work jointly as the Bristol Robotics Laboratory.

Aerospace: Top 20 organisations (by publications)



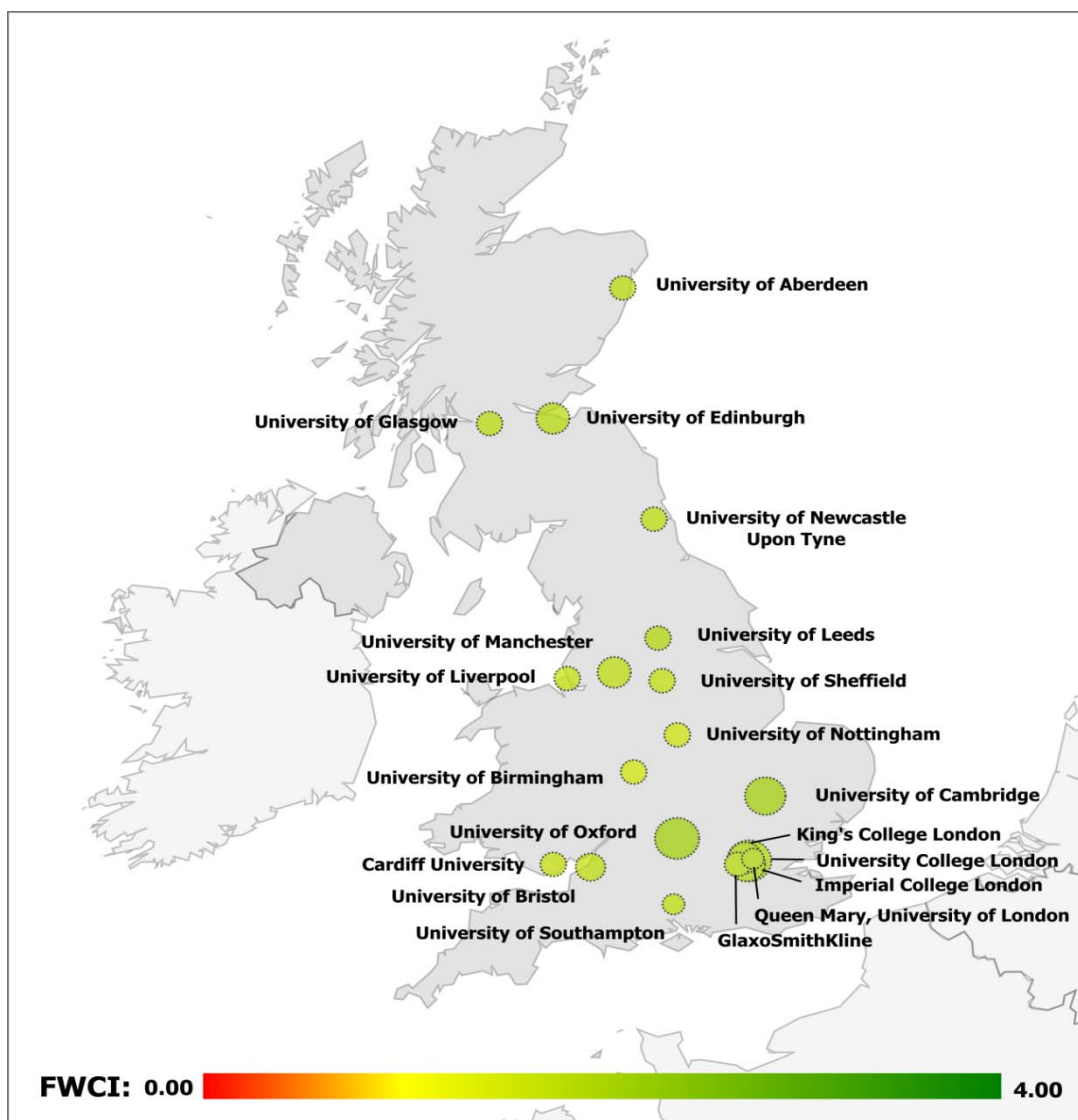
Name	Publications	FWCI	in global top 1%	in global top 10%
Met Office	82	2.48	19 (23.2%)	61 (74.4%)
University of Nottingham	197	2.45	10 (5.1%)	46 (23.4%)
Imperial College London	193	2.22	5 (2.6%)	58 (30.1%)
University of Oxford	77	2.11	5 (6.5%)	32 (41.6%)
University of Leeds	115	2.06	15 (13.0%)	58 (50.4%)
University of Liverpool	152	2.01	0 (0.0%)	28 (18.4%)
University of Sheffield	188	1.90	6 (3.2%)	39 (20.7%)
University of Bath	83	1.86	3 (3.6%)	24 (28.9%)
University of Bristol	172	1.63	6 (3.5%)	39 (22.7%)
University of Cambridge	232	1.54	15 (6.5%)	66 (28.4%)
University of Leicester	81	1.51	4 (4.9%)	26 (32.1%)
University of Manchester	269	1.48	19 (7.1%)	91 (33.8%)
Loughborough University	121	1.47	3 (2.5%)	24 (19.8%)
Cranfield University	315	1.21	2 (0.6%)	47 (14.9%)
University of Southampton	168	1.17	2 (1.2%)	33 (19.6%)
University of Glasgow	111	1.17	1 (0.9%)	15 (13.5%)
Queen's University Belfast	71	0.96	1 (1.4%)	3 (4.2%)
Rolls-Royce United Kingdom	146	0.86	3 (2.1%)	16 (11.0%)
University College London	75	0.71	0 (0.0%)	18 (24.0%)
BAE Systems	65	0.39	0 (0.0%)	3 (4.6%)

Automotive: Top 20 organisations (by publications)



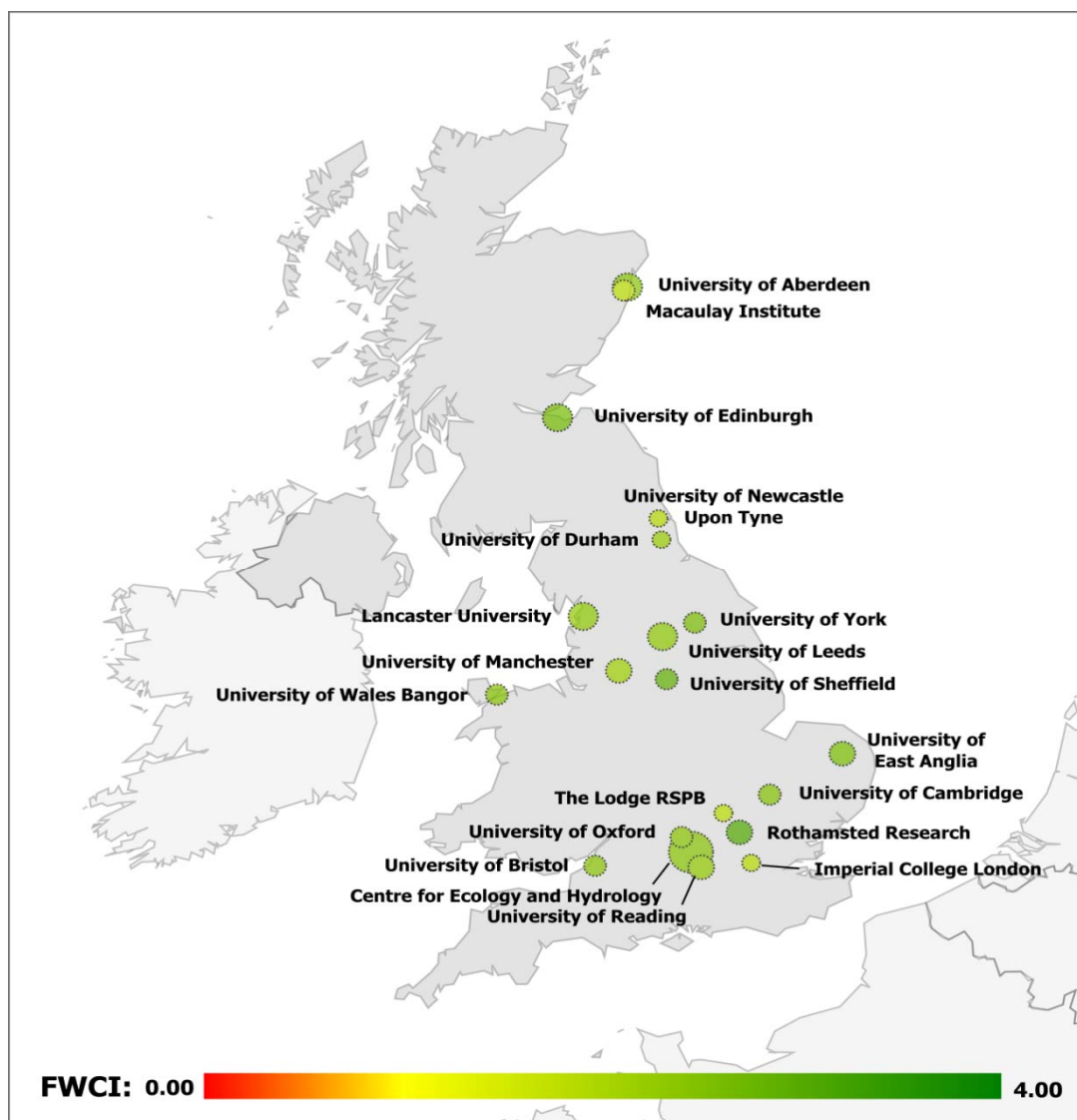
Name	Publications	FWCI	in global top 1%	in global top 10%
University of Oxford	82	3.12	6 (7.3%)	30 (36.6%)
University of Manchester	113	2.98	4 (3.5%)	25 (22.1%)
University College London	85	2.46	4 (4.7%)	32 (37.6%)
Cardiff University	65	2.04	2 (3.1%)	20 (30.8%)
University of Cambridge	178	2.02	2 (1.1%)	54 (30.3%)
University of Birmingham	104	1.90	2 (1.9%)	34 (32.7%)
Imperial College London	235	1.90	7 (3.0%)	83 (35.3%)
University of Surrey	69	1.48	1 (1.4%)	18 (26.1%)
Loughborough University	162	1.37	2 (1.2%)	25 (15.4%)
University of Bristol	106	1.36	1 (0.9%)	24 (22.6%)
University of Sheffield	131	1.36	0 (0.0%)	25 (19.1%)
Heriot-Watt University	68	1.35	1 (1.5%)	7 (10.3%)
University of Warwick	111	1.32	2 (1.8%)	21 (18.9%)
Brunel University	63	1.17	1 (1.6%)	13 (20.6%)
University of Nottingham	144	1.15	2 (1.4%)	30 (20.8%)
University of Leeds	119	1.15	3 (2.5%)	29 (24.4%)
University of Southampton	189	1.12	0 (0.0%)	36 (19.0%)
University of Newcastle upon Tyne	79	1.11	1 (1.3%)	19 (24.1%)
University of Strathclyde	54	1.04	2 (3.7%)	8 (14.8%)
Cranfield University	162	1.00	1 (0.6%)	25 (15.4%)

Life Sciences: Top 20 organisations (by publications)



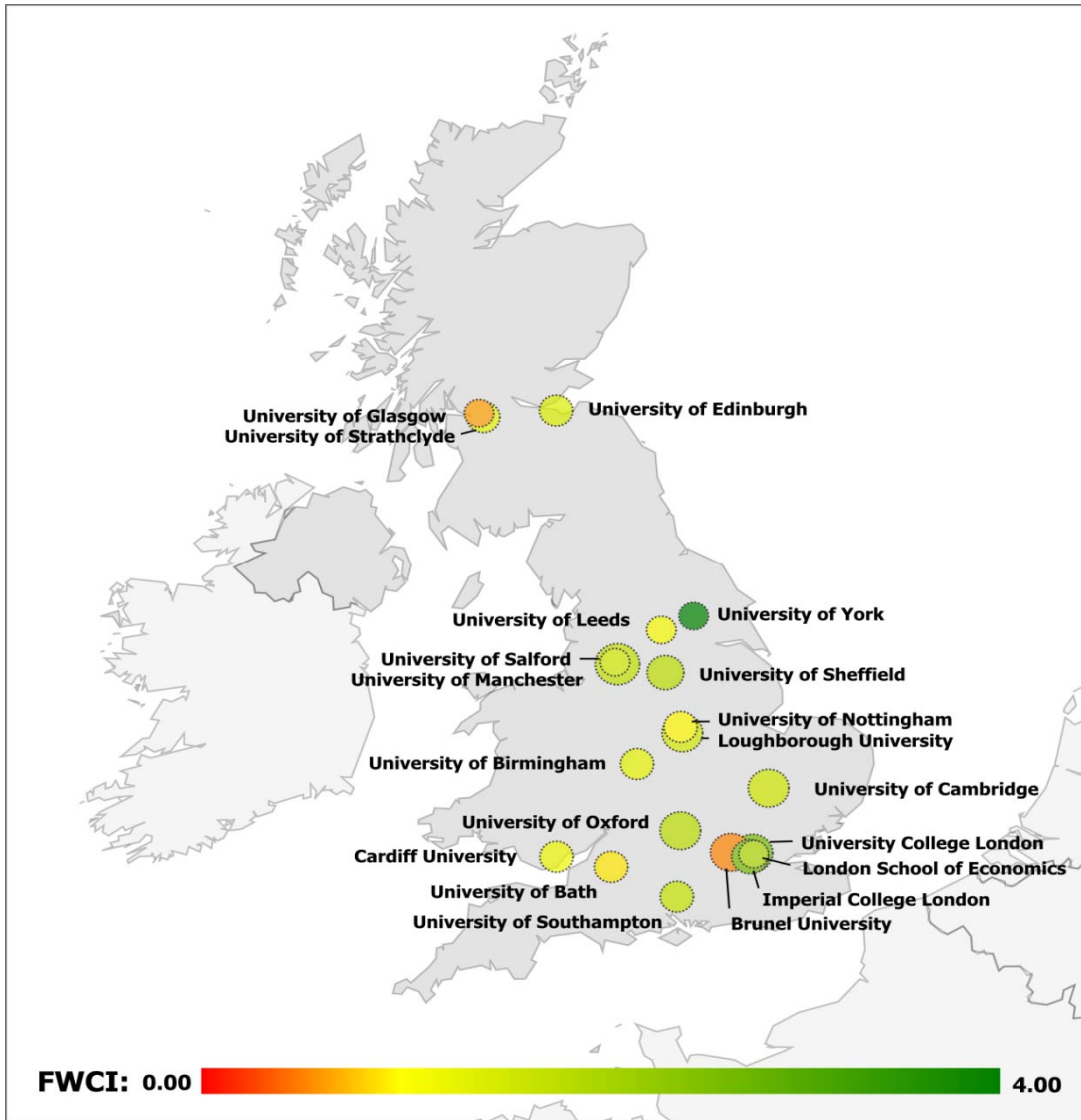
Name	Publications	FWCI	in global top 1%	in global top 10%
University of Cambridge	11,843	2.13	595 (5.0%)	3,481 (29.4%)
University of Oxford	13,345	2.13	588 (4.4%)	3,886 (29.1%)
King's College London	7,728	1.99	353 (4.6%)	2,079 (26.9%)
Queen Mary, University of London	3,274	1.97	139 (4.2%)	870 (26.6%)
Imperial College London	10,205	1.94	401 (3.9%)	2,689 (26.3%)
University of Leeds	4,192	1.94	161 (3.8%)	1,055 (25.2%)
GlaxoSmithKline	3,945	1.90	131 (3.3%)	860 (21.8%)
University of Edinburgh	7,441	1.89	265 (3.6%)	1,836 (24.7%)
University College London	13,911	1.87	451 (3.2%)	3,629 (26.1%)
University of Glasgow	4,748	1.85	127 (2.7%)	1,078 (22.7%)
University of Aberdeen	3,438	1.82	91 (2.6%)	706 (20.5%)
University of Manchester	6,948	1.80	221 (3.2%)	1,653 (23.8%)
University of Newcastle upon Tyne	4,023	1.78	132 (3.3%)	891 (22.1%)
University of Bristol	4,885	1.78	121 (2.5%)	1,019 (20.9%)
University of Southampton	3,417	1.77	95 (2.8%)	744 (21.8%)
University of Sheffield	3,902	1.72	95 (2.4%)	838 (21.5%)
Cardiff University	3,802	1.70	108 (2.8%)	829 (21.8%)
University of Liverpool	4,107	1.69	72 (1.8%)	801 (19.5%)
University of Nottingham	4,863	1.61	95 (2.0%)	940 (19.3%)
University of Birmingham	4,338	1.55	105 (2.4%)	884 (20.4%)

Agri-tech: Top 20 organisations (by publications)



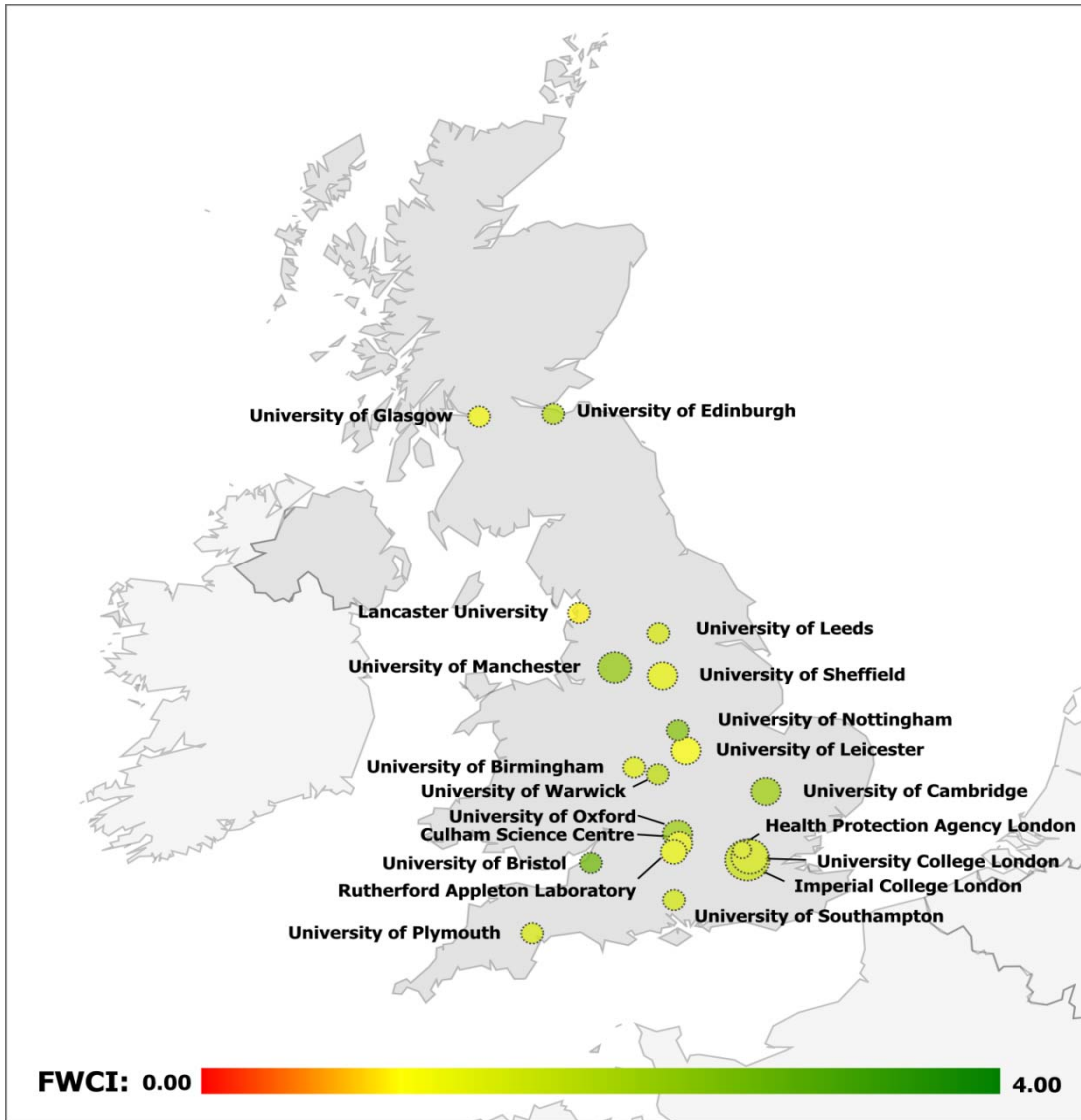
Name	Publications	FWCI	in global top 1%	in global top 10%
Rothamsted Research	117	3.05	4 (3.4%)	33 (28.2%)
University of Sheffield	88	2.87	4 (4.5%)	20 (22.7%)
University of Edinburgh	177	2.64	8 (4.5%)	52 (29.4%)
University of York	92	2.58	8 (8.7%)	22 (23.9%)
University of East Anglia	111	2.55	7 (6.3%)	27 (24.3%)
University of Cambridge	101	2.46	2 (2.0%)	28 (27.7%)
University of Wales Bangor	73	2.44	3 (4.1%)	13 (17.8%)
University of Aberdeen	174	2.41	7 (4.0%)	40 (23.0%)
Centre for Ecology and Hydrology	409	2.41	12 (2.9%)	105 (25.7%)
University of Oxford	91	2.40	2 (2.2%)	21 (23.1%)
University of Bristol	96	2.37	5 (5.2%)	21 (21.9%)
Lancaster University	145	2.33	2 (1.4%)	41 (28.3%)
University of Leeds	188	2.32	6 (3.2%)	49 (26.1%)
University of Reading	105	2.30	0 (0.0%)	24 (22.9%)
University of Durham	65	2.20	1 (1.5%)	14 (21.5%)
University of Manchester	106	2.15	4 (3.8%)	26 (24.5%)
University of Newcastle upon Tyne	61	1.87	1 (1.6%)	11 (18.0%)
Imperial College London	65	1.87	0 (0.0%)	13 (20.0%)
The Lodge RSPB	64	1.80	2 (3.1%)	8 (12.5%)
Macaulay Institute	100	1.79	0 (0.0%)	11 (11.0%)

Information Economy: Top 20 organisations (by publications)



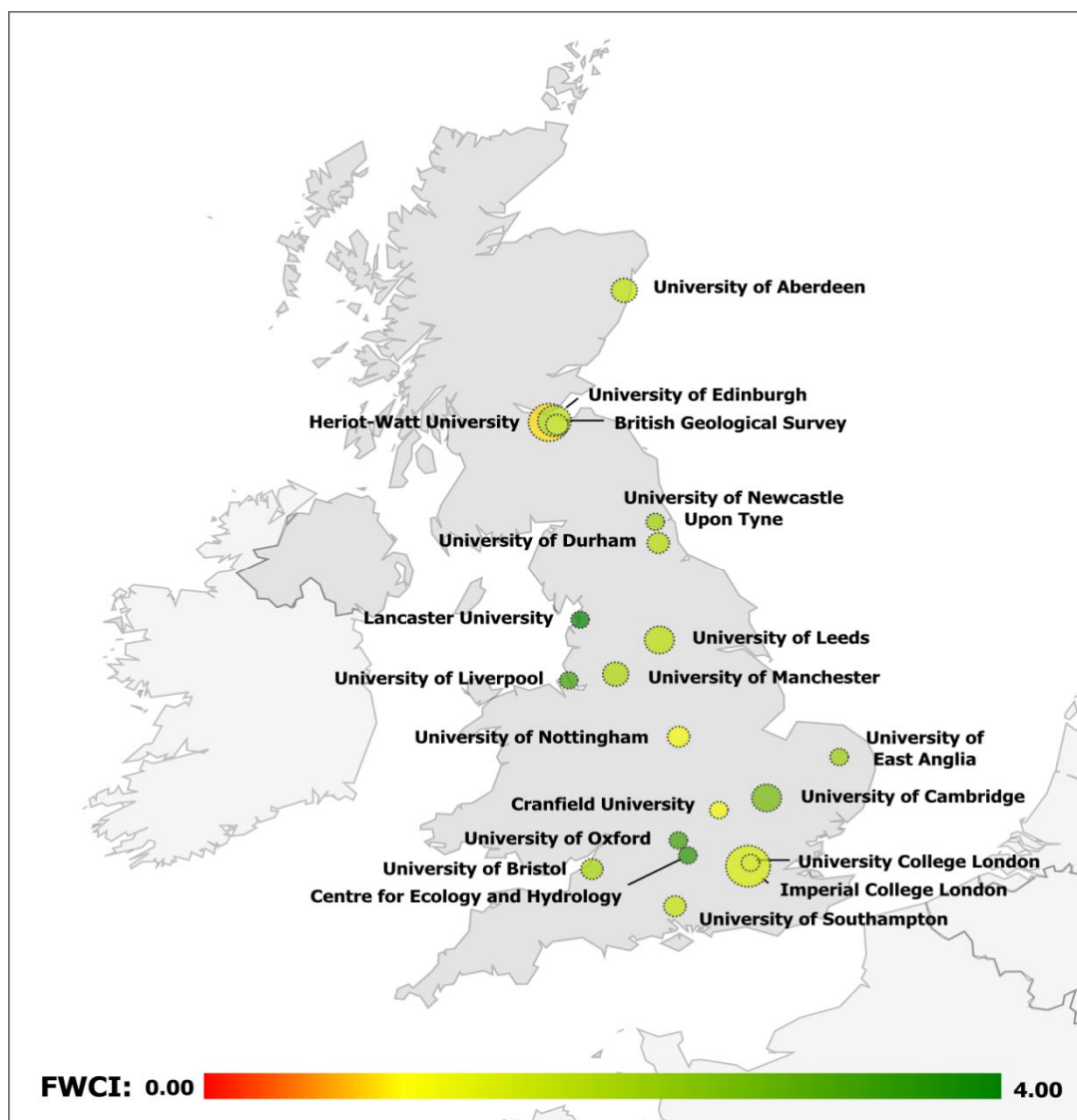
Name	Publications	FWCI	in global top 1%	in global top 10%
University of York	39	4.81	3 (7.7%)	14 (35.9%)
Imperial College London	69	2.65	5 (7.2%)	25 (36.2%)
University College London	91	2.57	3 (3.3%)	27 (29.7%)
London School of Economics	45	1.97	2 (4.4%)	21 (46.7%)
University of Oxford	95	1.81	7 (7.4%)	35 (36.8%)
University of Sheffield	67	1.80	1 (1.5%)	20 (29.9%)
University of Manchester	105	1.72	3 (2.9%)	31 (29.5%)
University of Southampton	63	1.69	1 (1.6%)	22 (34.9%)
University of Cambridge	91	1.56	6 (6.6%)	28 (30.8%)
University of Salford	41	1.55	3 (7.3%)	12 (29.3%)
Loughborough University	91	1.51	1 (1.1%)	19 (20.9%)
University of Edinburgh	60	1.43	0 (0.0%)	11 (18.3%)
University of Birmingham	60	1.31	3 (5.0%)	14 (23.3%)
University of Strathclyde	50	1.28	1 (2.0%)	12 (24.0%)
Cardiff University	52	1.22	1 (1.9%)	13 (25.0%)
University of Leeds	44	1.11	1 (2.3%)	13 (29.5%)
University of Nottingham	57	0.97	0 (0.0%)	14 (24.6%)
University of Bath	58	0.90	0 (0.0%)	13 (22.4%)
University of Glasgow	46	0.62	0 (0.0%)	6 (13.0%)
Brunel University	86	0.51	0 (0.0%)	9 (10.5%)

Nuclear: Top 20 organisations (by publications)



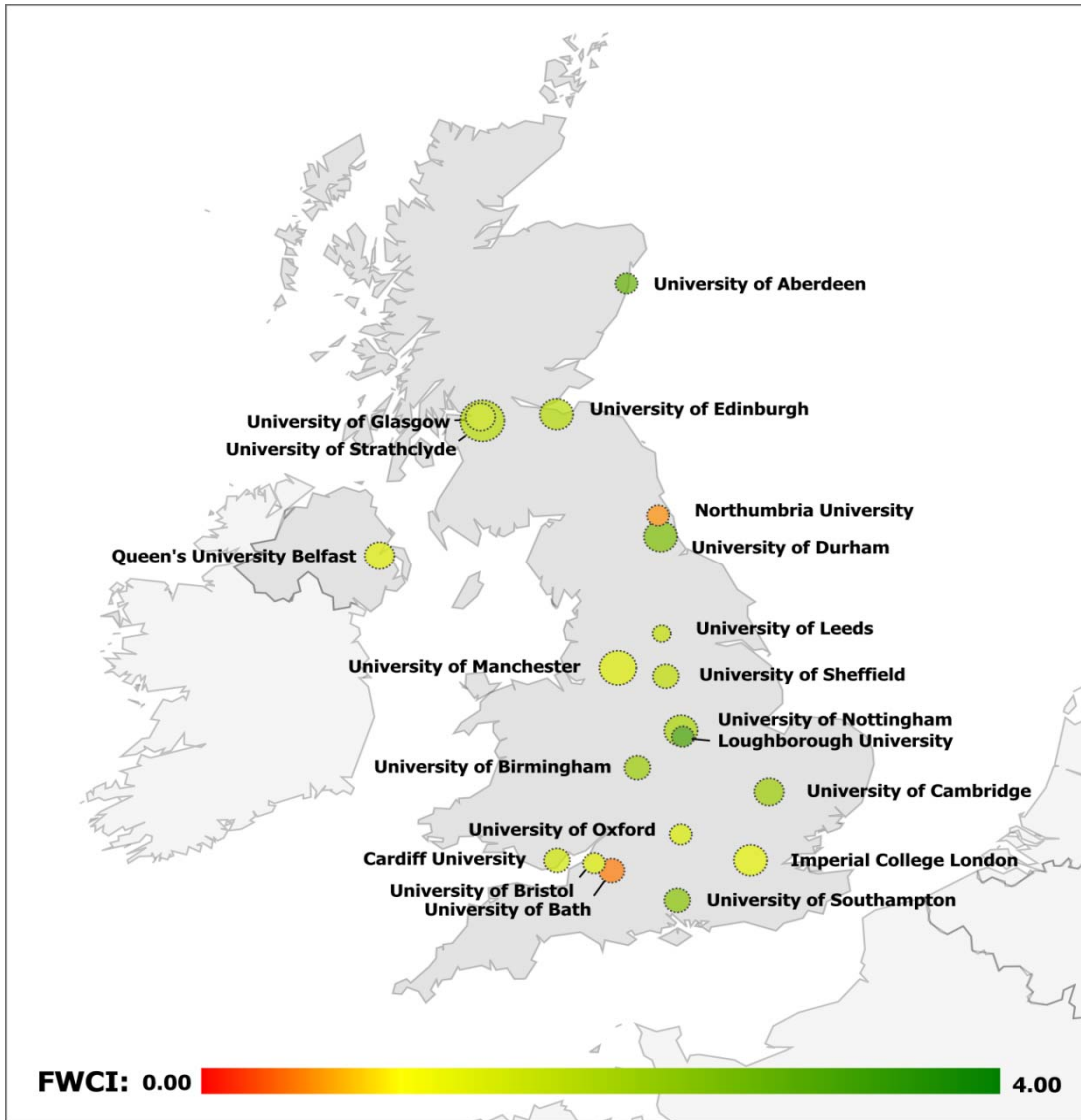
Name	Publications	FWCI	in global top 1%	in global top 10%
University of Bristol	60	2.75	6 (10.0%)	17 (28.3%)
University of Nottingham	59	2.46	1 (1.7%)	18 (30.5%)
University of Manchester	204	2.29	6 (2.9%)	45 (22.1%)
University of Oxford	153	2.19	10 (6.5%)	44 (28.8%)
University of Cambridge	127	2.18	5 (3.9%)	41 (32.3%)
University of Edinburgh	78	1.89	4 (5.1%)	23 (29.5%)
University of Warwick	81	1.79	2 (2.5%)	18 (22.2%)
Imperial College London	357	1.66	10 (2.8%)	79 (22.1%)
University of Southampton	65	1.54	1 (1.5%)	12 (18.5%)
University of Leeds	67	1.51	0 (0.0%)	13 (19.4%)
University College London	242	1.49	5 (2.1%)	50 (20.7%)
University of Plymouth	61	1.46	1 (1.6%)	10 (16.4%)
Health Protection Agency London	57	1.45	0 (0.0%)	9 (15.8%)
University of Birmingham	68	1.36	0 (0.0%)	13 (19.1%)
University of Sheffield	138	1.27	1 (0.7%)	10 (7.2%)
Culham Science Centre	118	1.26	1 (0.8%)	18 (15.3%)
Rutherford Appleton Laboratory	114	1.24	1 (0.9%)	22 (19.3%)
University of Glasgow	69	1.13	4 (5.8%)	10 (14.5%)
University of Leicester	138	1.02	1 (0.7%)	19 (13.8%)
Lancaster University	77	0.95	0 (0.0%)	10 (13.0%)

Oil & Gas: Top 20 organisations (by publications)



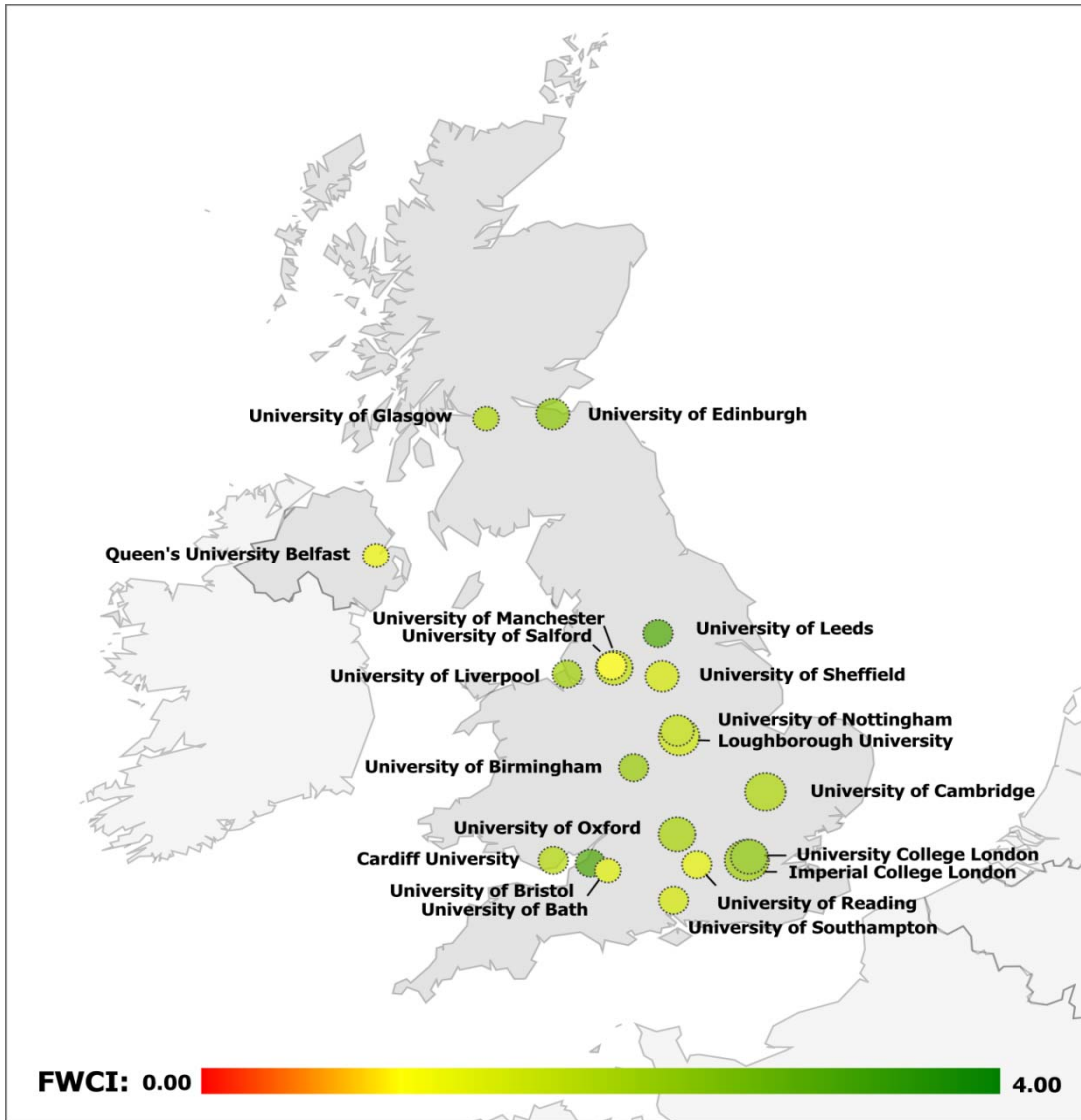
Name	Publications	FWCI	In global top 1%	in global top 10%
Lancaster University	36	4.16	6 (16.7%)	18 (50.0%)
Centre for Ecology and Hydrology	41	3.54	6 (14.6%)	27 (65.9%)
University of Oxford	42	3.24	3 (7.1%)	22 (52.4%)
University of Liverpool	40	3.23	5 (12.5%)	19 (47.5%)
University of Cambridge	114	2.67	6 (5.3%)	54 (47.4%)
University of East Anglia	35	2.17	3 (8.6%)	14 (40.0%)
University of Newcastle upon Tyne	46	2.12	2 (4.3%)	16 (34.8%)
University of Bristol	57	2.05	4 (7.0%)	19 (33.3%)
University of Manchester	101	1.96	3 (3.0%)	37 (36.6%)
University of Edinburgh	151	1.92	5 (3.3%)	42 (27.8%)
University of Durham	77	1.86	1 (1.3%)	23 (29.9%)
University of Leeds	133	1.80	6 (4.5%)	42 (31.6%)
University of Aberdeen	111	1.73	4 (3.6%)	31 (27.9%)
British Geological Survey	76	1.72	0 (0.0%)	10 (13.2%)
University of Southampton	75	1.67	2 (2.7%)	22 (29.3%)
University College London	41	1.50	0 (0.0%)	10 (24.4%)
Imperial College London	318	1.46	6 (1.9%)	55 (17.3%)
Cranfield University	37	1.17	0 (0.0%)	8 (21.6%)
University of Nottingham	52	1.11	1 (1.9%)	12 (23.1%)
Heriot-Watt University	287	0.87	1 (0.3%)	14 (4.9%)

Offshore Wind: Top 20 organisations (by publications)



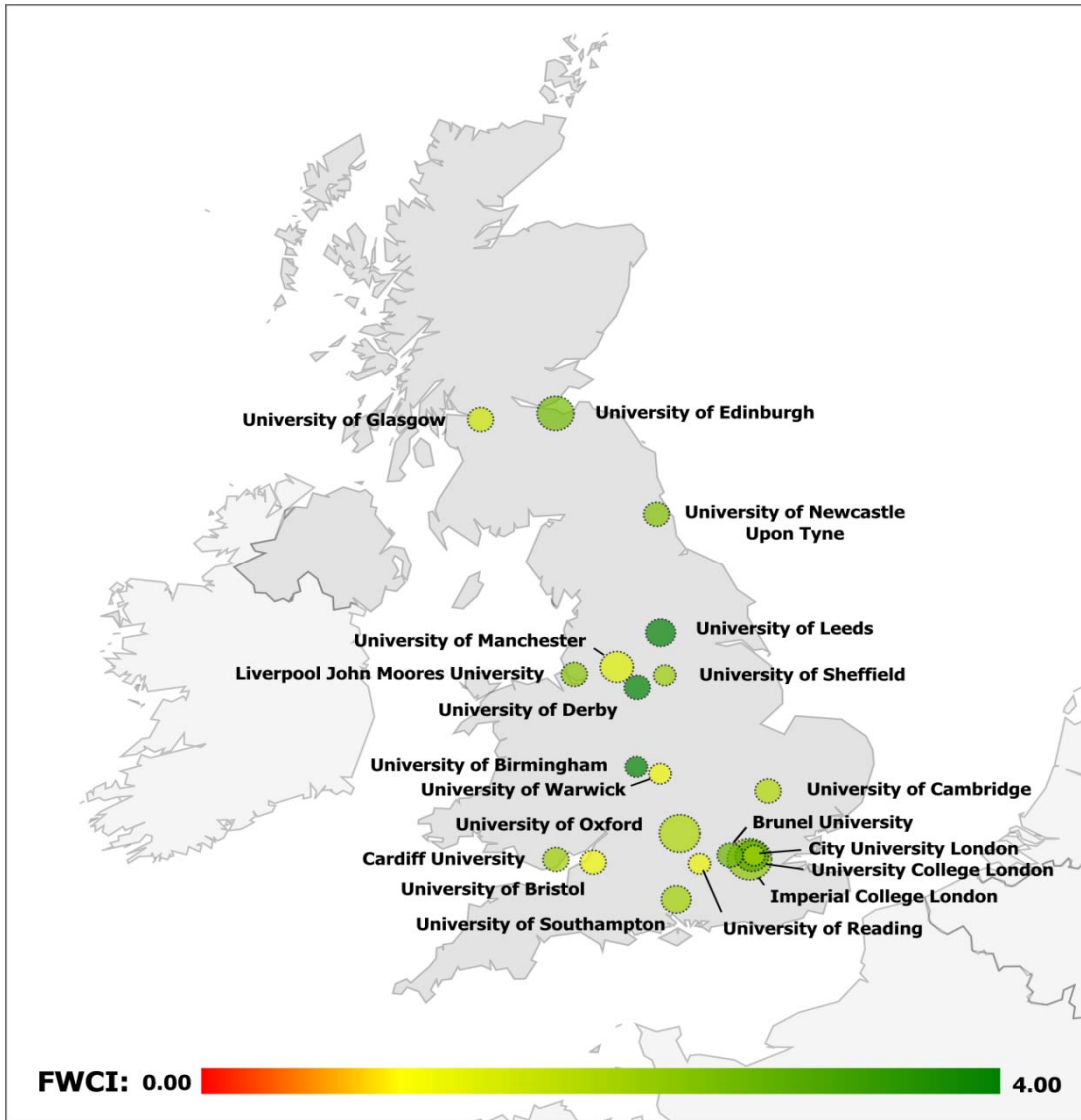
Name	Publications	FWCI	in global top 1%	in global top 10%
Loughborough University	33	3.19	1 (3.0%)	5 (15.2%)
University of Aberdeen	31	2.84	1 (3.2%)	17 (54.8%)
University of Durham	77	2.52	5 (6.5%)	21 (27.3%)
University of Southampton	41	2.37	0 (0.0%)	8 (19.5%)
University of Birmingham	42	2.19	0 (0.0%)	21 (50.0%)
University of Cambridge	53	2.15	1 (1.9%)	13 (24.5%)
University of Nottingham	71	1.98	1 (1.4%)	16 (22.5%)
University of Edinburgh	79	1.87	3 (3.8%)	20 (25.3%)
University of Strathclyde	148	1.81	4 (2.7%)	22 (14.9%)
University of Sheffield	50	1.77	2 (4.0%)	11 (22.0%)
University of Leeds	24	1.72	1 (4.2%)	10 (41.7%)
University of Glasgow	63	1.62	1 (1.6%)	14 (22.2%)
Cardiff University	41	1.56	1 (2.4%)	12 (29.3%)
University of Oxford	33	1.43	1 (3.0%)	11 (33.3%)
University of Manchester	104	1.40	2 (1.9%)	17 (16.3%)
University of Bristol	35	1.39	0 (0.0%)	10 (28.6%)
Queen's University Belfast	67	1.37	3 (4.5%)	15 (22.4%)
Imperial College London	70	1.30	0 (0.0%)	15 (21.4%)
Northumbria University	33	0.56	0 (0.0%)	5 (15.2%)
University of Bath	38	0.48	0 (0.0%)	3 (7.9%)

Construction: Top 20 organisations (by publications)



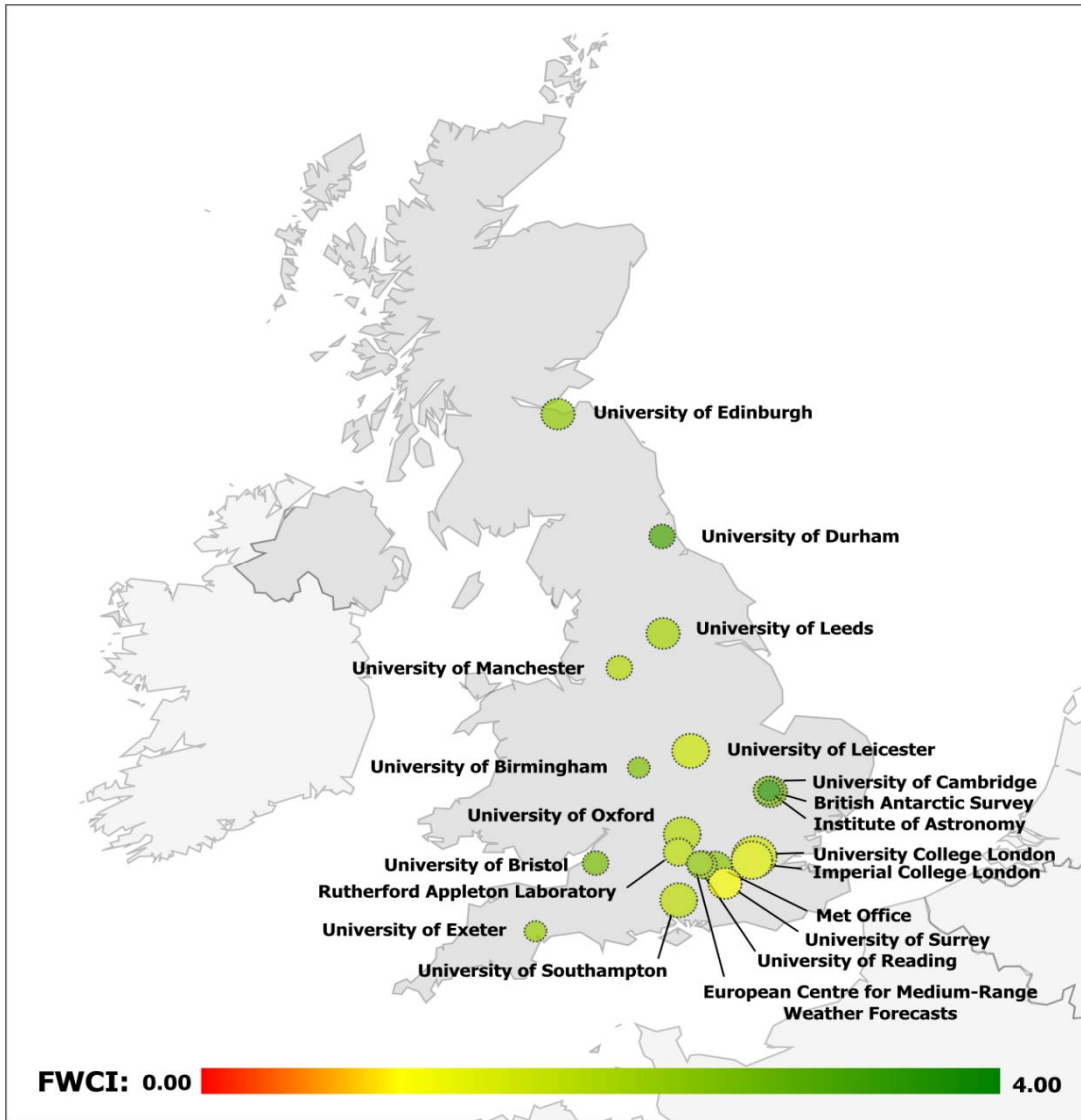
Name	Publications	FWCI	in global top 1%	in global top 10%
University of Bristol	208	3.12	16 (7.7%)	83 (39.9%)
University of Leeds	195	3.09	3 (1.5%)	66 (33.8%)
University of Edinburgh	266	2.33	12 (4.5%)	95 (35.7%)
University College London	283	2.33	13 (4.6%)	97 (34.3%)
University of Birmingham	189	2.22	9 (4.8%)	52 (27.5%)
Imperial College London	467	2.14	16 (3.4%)	137 (29.3%)
University of Liverpool	182	2.09	4 (2.2%)	57 (31.3%)
University of Oxford	336	2.04	17 (5.1%)	124 (36.9%)
University of Cambridge	424	1.96	17 (4.0%)	121 (28.5%)
University of Glasgow	154	1.94	8 (5.2%)	60 (39.0%)
Cardiff University	178	1.90	5 (2.8%)	53 (29.8%)
University of Nottingham	260	1.72	4 (1.5%)	64 (24.6%)
University of Manchester	323	1.68	8 (2.5%)	98 (30.3%)
Loughborough University	382	1.57	2 (0.5%)	70 (18.3%)
University of Sheffield	248	1.52	5 (2.0%)	58 (23.4%)
University of Southampton	209	1.51	5 (2.4%)	53 (25.4%)
University of Bath	163	1.36	4 (2.5%)	36 (22.1%)
University of Reading	167	1.31	5 (3.0%)	38 (22.8%)
Queen's University Belfast	160	1.18	1 (0.6%)	33 (20.6%)
University of Salford	215	1.00	1 (0.5%)	28 (13.0%)

Big Data: Top 20 organisations (by publications)



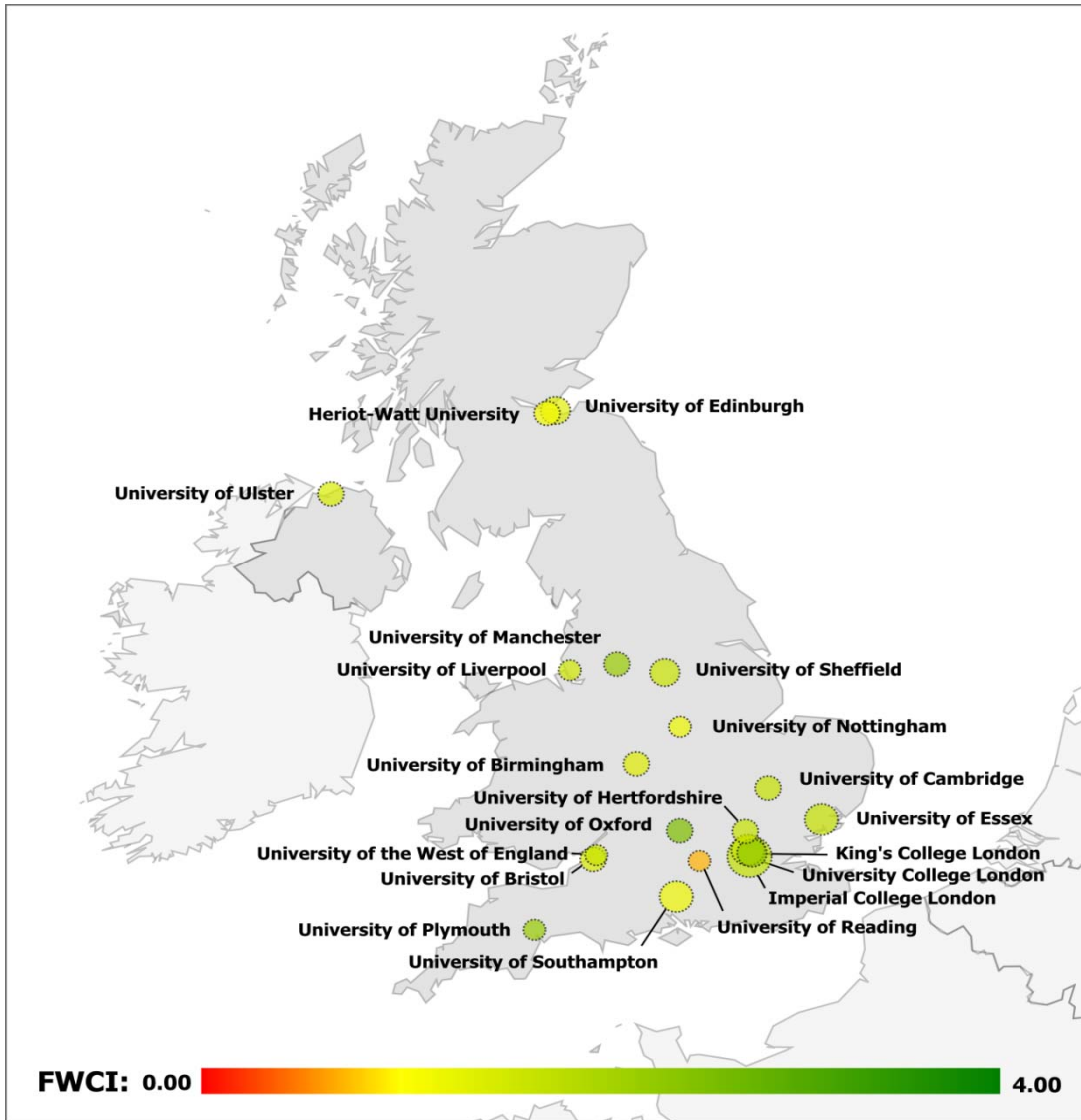
Name	Publications	FWCI	in global top 1%	in global top 10%
University of Leeds	32	11.25	3 (9.4%)	13 (40.6%)
University of Derby	26	5.26	1 (3.8%)	5 (19.2%)
University of Birmingham	16	4.07	0 (0.0%)	5 (31.3%)
University College London	49	3.05	4 (8.2%)	14 (28.6%)
Brunel University	29	2.78	0 (0.0%)	3 (10.3%)
University of Edinburgh	57	2.63	5 (8.8%)	12 (21.1%)
University of Newcastle upon Tyne	25	2.47	0 (0.0%)	1 (4.0%)
Liverpool John Moores University	23	2.42	0 (0.0%)	4 (17.4%)
Imperial College London	88	2.32	2 (2.3%)	15 (17.0%)
University of Sheffield	18	2.19	0 (0.0%)	4 (22.2%)
Cardiff University	26	2.15	0 (0.0%)	10 (38.5%)
City University London	15	2.12	0 (0.0%)	1 (6.7%)
University of Southampton	33	2.11	1 (3.0%)	5 (15.2%)
University of Oxford	68	1.96	0 (0.0%)	15 (22.1%)
University of Cambridge	27	1.94	1 (3.7%)	4 (14.8%)
University of Glasgow	25	1.63	0 (0.0%)	4 (16.0%)
University of Manchester	51	1.41	0 (0.0%)	8 (15.7%)
University of Reading	17	1.26	0 (0.0%)	5 (29.4%)
University of Warwick	19	1.23	1 (5.3%)	2 (10.5%)
University of Bristol	26	1.21	1 (3.8%)	3 (11.5%)

Satellites: Top 20 organisations (by publications)



Name	Publications	FWCI	in global top 1%	in global top 10%
Institute of Astronomy	106	3.53	19 (17.9%)	60 (56.6%)
University of Durham	128	3.14	20 (15.6%)	72 (56.3%)
University of Cambridge	249	2.60	20 (8.0%)	96 (38.6%)
University of Bristol	132	2.58	3 (2.3%)	56 (42.4%)
University of Birmingham	109	2.46	9 (8.3%)	46 (42.2%)
British Antarctic Survey	166	2.41	8 (4.8%)	66 (39.8%)
Met Office	260	2.33	19 (7.3%)	112 (43.1%)
ECMWF	153	2.30	11 (7.2%)	65 (42.5%)
University of Edinburgh	215	2.27	12 (5.6%)	84 (39.1%)
University of Reading	169	2.20	6 (3.6%)	65 (38.5%)
University of Exeter	103	2.19	8 (7.8%)	42 (40.8%)
University of Leeds	214	2.02	9 (4.2%)	91 (42.5%)
University of Manchester	139	1.90	8 (5.8%)	40 (28.8%)
University of Oxford	307	1.90	16 (5.2%)	106 (34.5%)
Rutherford Appleton Laboratory	198	1.81	8 (4.0%)	52 (26.3%)
University of Southampton	271	1.80	5 (1.8%)	72 (26.6%)
University of Leicester	303	1.60	13 (4.3%)	84 (27.7%)
University College London	448	1.59	9 (2.0%)	121 (27.0%)
Imperial College London	389	1.37	8 (2.1%)	92 (23.7%)
University of Surrey	214	1.12	1 (0.5%)	6 (2.8%)

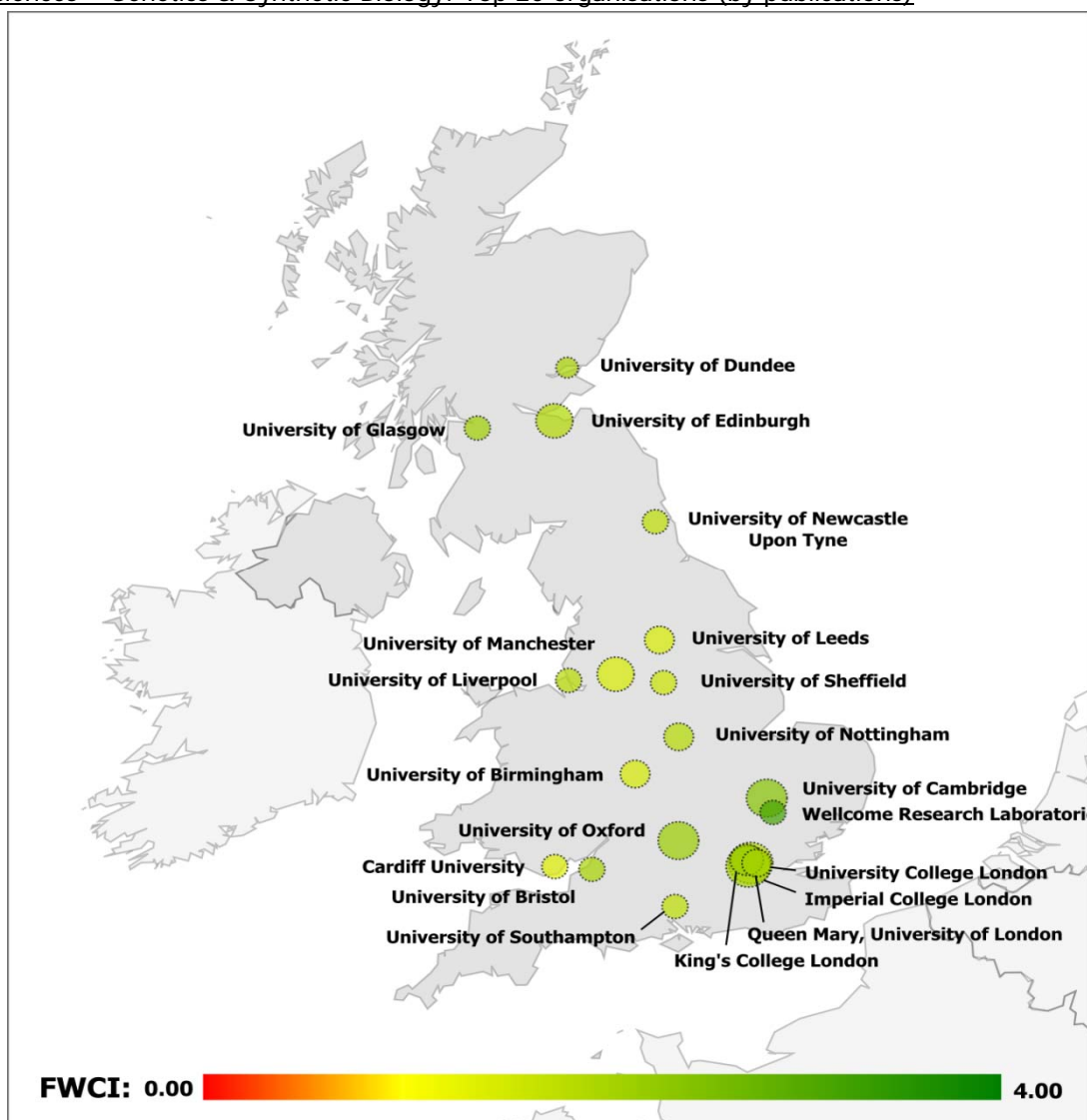
Robotics: Top 20 organisations (by publications)



Name	Publications	FWCI	In global top 1%	In global top 10%
University of Oxford	76	2.54	5 (6.6%)	24 (31.6%)
University College London	112	2.29	4 (3.6%)	34 (30.4%)
University of Manchester	72	2.21	2 (2.8%)	11 (15.3%)
University of Plymouth	58	2.20	0 (0.0%)	10 (17.2%)
Imperial College London	289	1.72	4 (1.4%)	60 (20.8%)
University of Cambridge	95	1.68	3 (3.2%)	27 (28.4%)
University of Essex	166	1.68	3 (1.8%)	17 (10.2%)
University of Hertfordshire	96	1.65	0 (0.0%)	9 (9.4%)
King's College London	141	1.64	8 (5.7%)	31 (22.0%)
University of Sheffield	119	1.64	3 (2.5%)	15 (12.6%)
University of the West of England*	66	1.61	0 (0.0%)	13 (19.7%)
University of Liverpool	64	1.55	0 (0.0%)	8 (12.5%)
University of Ulster	88	1.46	1 (1.1%)	13 (14.8%)
University of Bristol*	89	1.43	2 (2.2%)	10 (11.2%)
University of Birmingham	90	1.40	1 (1.1%)	12 (13.3%)
University of Edinburgh	105	1.37	0 (0.0%)	12 (11.4%)
University of Nottingham	66	1.22	1 (1.5%)	12 (18.2%)
University of Southampton	140	1.20	3 (2.1%)	31 (22.1%)
Heriot-Watt University	90	1.09	0 (0.0%)	1 (1.1%)
University of Reading	60	0.70	0 (0.0%)	4 (6.7%)

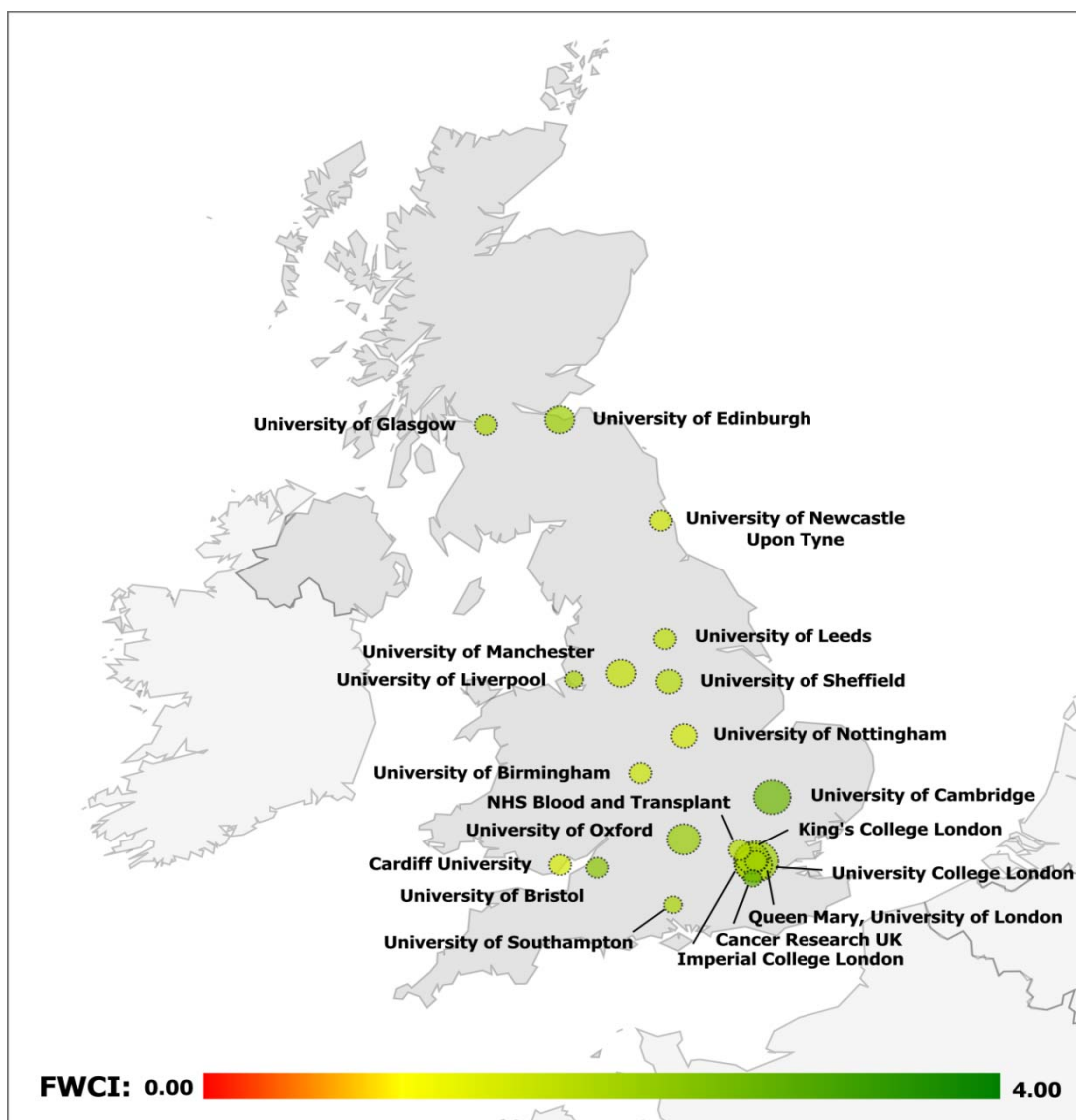
*these universities work jointly as the Bristol Robotics Laboratory

Life Sciences – Genetics & Synthetic Biology: Top 20 organisations (by publications)



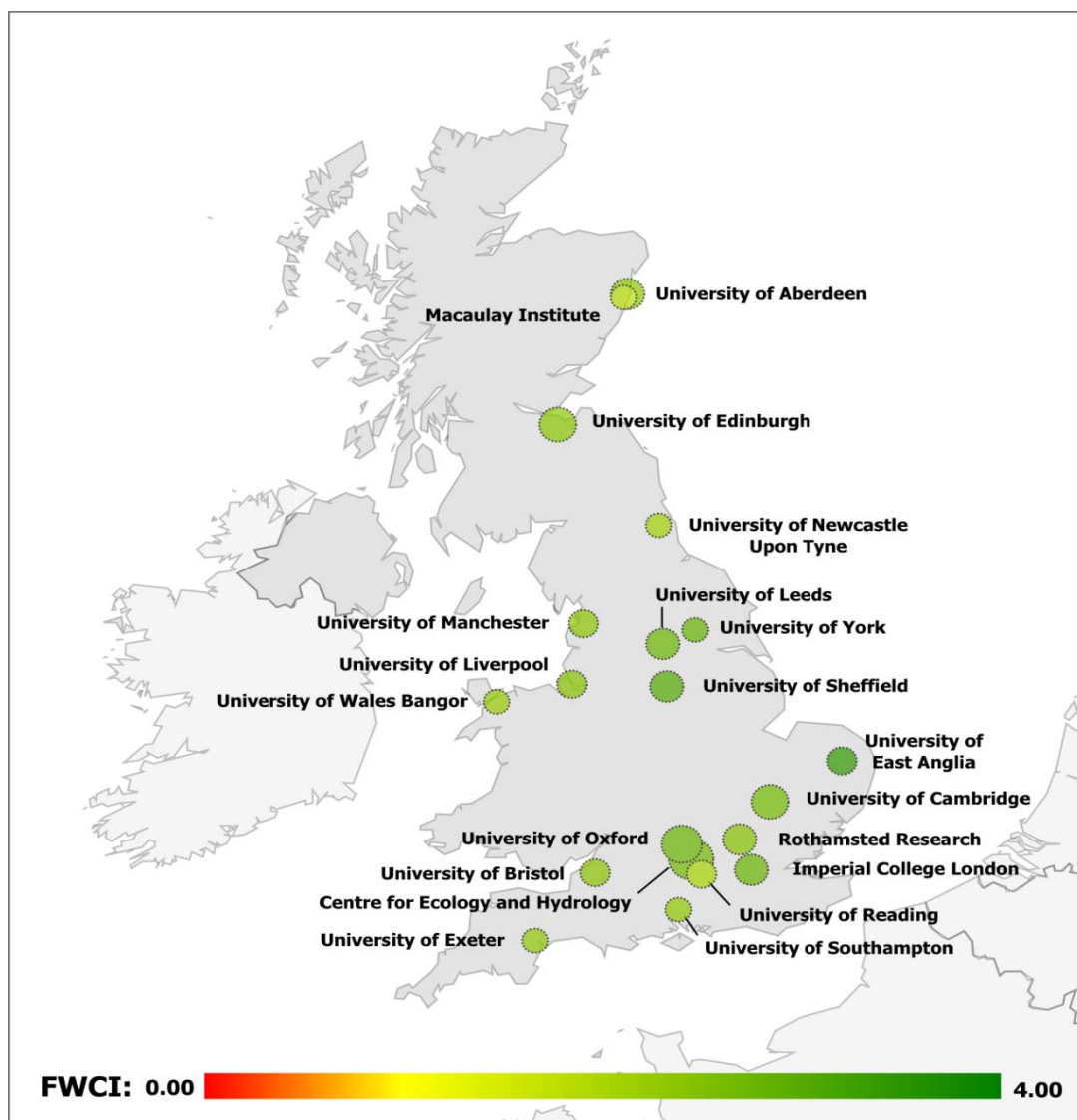
Name	Publications	FWCI	In global top 1%	in global top 10%
Wellcome Research Laboratories	345	3.16	38 (11.0%)	136 (39.4%)
University of Cambridge	1052	2.42	40 (3.8%)	270 (25.7%)
King's College London	615	2.20	19 (3.1%)	128 (20.8%)
University of Oxford	984	2.16	36 (3.7%)	235 (23.9%)
University of Glasgow	373	2.14	10 (2.7%)	72 (19.3%)
Queen Mary, University of London	425	2.06	6 (1.4%)	81 (19.1%)
Imperial College London	1123	2.05	27 (2.4%)	244 (21.7%)
University of Dundee	252	2.02	8 (3.2%)	50 (19.8%)
University of Bristol	395	2.02	9 (2.3%)	67 (17.0%)
University of Edinburgh	712	1.92	21 (2.9%)	137 (19.2%)
University of Nottingham	495	1.86	12 (2.4%)	77 (15.6%)
University of Liverpool	371	1.86	6 (1.6%)	56 (15.1%)
University College London	1153	1.85	30 (2.6%)	202 (17.5%)
University of Newcastle upon Tyne	329	1.76	9 (2.7%)	51 (15.5%)
University of Southampton	303	1.76	7 (2.3%)	42 (13.9%)
University of Sheffield	344	1.63	2 (0.6%)	49 (14.2%)
University of Birmingham	440	1.50	4 (0.9%)	52 (11.8%)
University of Leeds	430	1.47	5 (1.2%)	62 (14.4%)
University of Manchester	719	1.46	7 (1.0%)	85 (11.8%)
Cardiff University	322	1.38	5 (1.6%)	32 (9.9%)

Regenerative Medicine: Top 20 organisations (by publications)



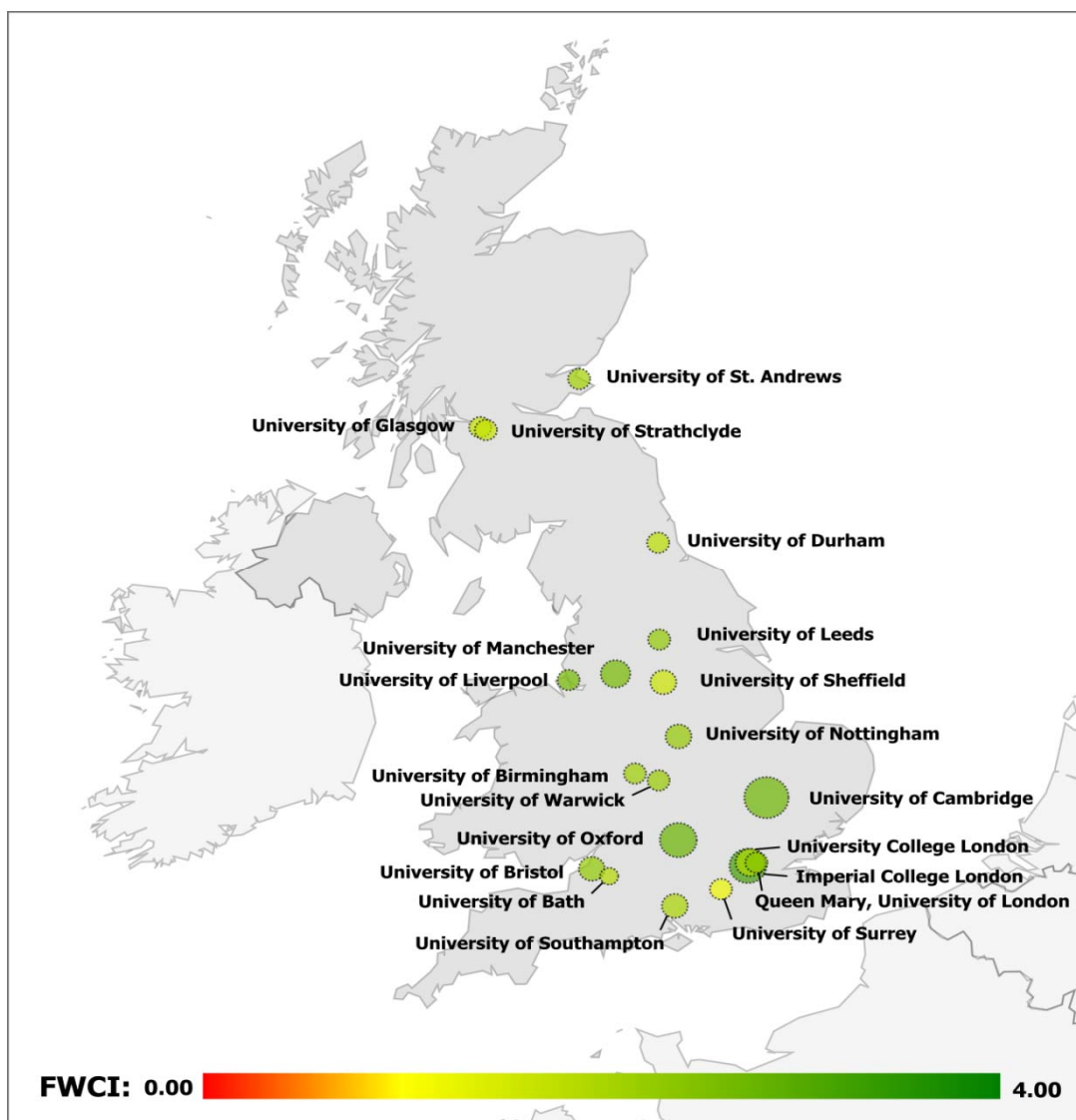
Name	Publications	FWCI	In global top 1%	In global top 10%
Cancer Research UK	155	2.84	10 (6.5%)	50 (32.3%)
University of Cambridge	761	2.72	39 (5.1%)	220 (28.9%)
University of Bristol	190	2.36	1 (0.5%)	33 (17.4%)
Queen Mary, University of London	286	2.32	10 (3.5%)	51 (17.8%)
University of Oxford	586	2.24	12 (2.0%)	128 (21.8%)
University of Edinburgh	456	2.16	18 (3.9%)	96 (21.1%)
University College London	1099	2.12	19 (1.7%)	194 (17.7%)
University of Liverpool	147	2.05	4 (2.7%)	14 (9.5%)
King's College London	529	2.04	10 (1.9%)	105 (19.8%)
University of Glasgow	198	2.04	4 (2.0%)	25 (12.6%)
Imperial College London	681	2.02	9 (1.3%)	114 (16.7%)
University of Southampton	144	2.01	2 (1.4%)	18 (12.5%)
NHS Blood and Transplant	177	1.89	3 (1.7%)	27 (15.3%)
University of Sheffield	306	1.87	6 (2.0%)	42 (13.7%)
University of Leeds	262	1.80	2 (0.8%)	34 (13.0%)
University of Manchester	438	1.74	7 (1.6%)	60 (13.7%)
University of Birmingham	215	1.64	2 (0.9%)	25 (11.6%)
University of Newcastle upon Tyne	247	1.58	1 (0.4%)	43 (17.4%)
University of Nottingham	382	1.56	4 (1.0%)	45 (11.8%)
Cardiff University	190	1.49	1 (0.5%)	17 (8.9%)

Agri-Science: Top 20 organisations (by publications)



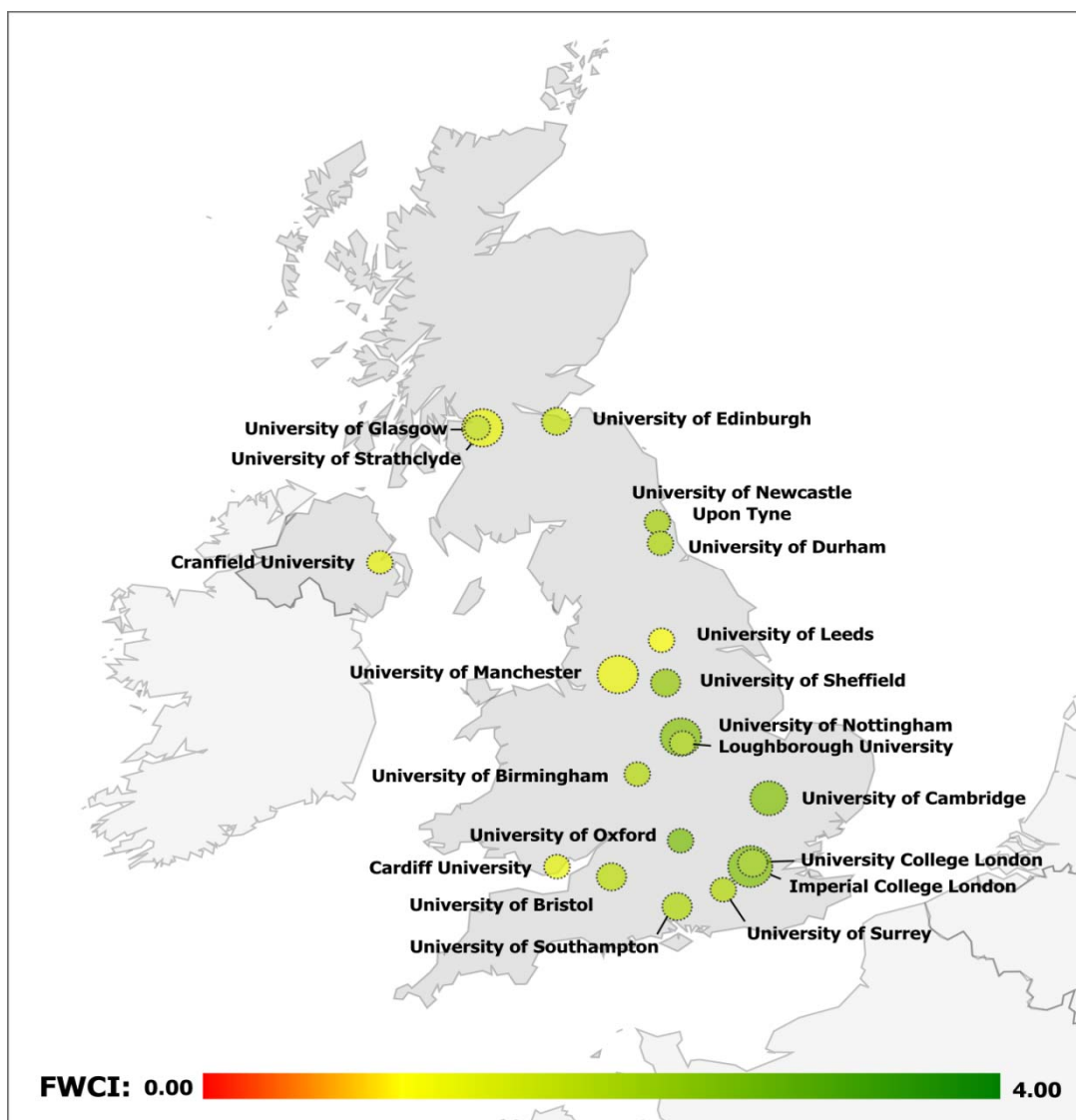
Name	Publications	FWCI	in global top 1%	In global top 10%
University of East Anglia	330	3.40	22 (6.7%)	89 (27.0%)
University of Sheffield	373	3.01	15 (4.0%)	103 (27.6%)
University of York	266	2.79	17 (6.4%)	88 (33.1%)
University of Oxford	580	2.77	32 (5.5%)	175 (30.2%)
Imperial College London	390	2.76	24 (6.2%)	117 (30.0%)
University of Leeds	439	2.75	19 (4.3%)	129 (29.4%)
Centre for Ecology and Hydrology	772	2.65	30 (3.9%)	213 (27.6%)
University of Cambridge	480	2.63	14 (2.9%)	144 (30.0%)
Rothamsted Research	459	2.44	14 (3.1%)	124 (27.0%)
University of Liverpool	300	2.39	9 (3.0%)	81 (27.0%)
University of Bristol	352	2.39	18 (5.1%)	96 (27.3%)
Lancaster University	312	2.37	17 (5.4%)	89 (28.5%)
University of Aberdeen	449	2.34	15 (3.3%)	115 (25.6%)
University of Edinburgh	492	2.33	15 (3.0%)	131 (26.6%)
University of Exeter	223	2.30	10 (4.5%)	58 (26.0%)
University of Southampton	260	2.30	5 (1.9%)	62 (23.8%)
University of Wales Bangor	267	2.21	9 (3.4%)	57 (21.3%)
University of Newcastle upon Tyne	235	2.12	3 (1.3%)	51 (21.7%)
University of Reading	349	2.01	6 (1.7%)	71 (20.3%)
Macaulay Institute	224	1.83	0 (0.0%)	38 (17.0%)

Advanced Materials & Nano Technology: Top 20 organisations (by publications)



Name	Publications	FWCI	in global top 1%	In global top 10%
Imperial College London	943	3.24	35 (3.7%)	198 (21.0%)
University of Oxford	822	2.77	27 (3.3%)	170 (20.7%)
University of Cambridge	1327	2.70	32 (2.4%)	251 (18.9%)
University of Liverpool	270	2.65	9 (3.3%)	60 (22.2%)
University of Manchester	616	2.62	17 (2.8%)	85 (13.8%)
Queen Mary, University of London	248	2.40	8 (3.2%)	42 (16.9%)
University of Bristol	387	2.27	7 (1.8%)	68 (17.6%)
University of Leeds	327	2.27	4 (1.2%)	45 (13.8%)
University of Nottingham	398	2.25	4 (1.0%)	51 (12.8%)
University of Warwick	264	2.22	2 (0.8%)	51 (19.3%)
University of Birmingham	315	2.15	8 (2.5%)	52 (16.5%)
University of St. Andrews	211	2.08	6 (2.8%)	40 (19.0%)
University of Southampton	439	2.00	4 (0.9%)	54 (12.3%)
University College London	561	1.94	7 (1.2%)	75 (13.4%)
University of Bath	201	1.90	5 (2.5%)	24 (11.9%)
University of Durham	221	1.76	2 (0.9%)	34 (15.4%)
University of Glasgow	210	1.69	1 (0.5%)	28 (13.3%)
University of Strathclyde	289	1.67	3 (1.0%)	37 (12.8%)
University of Sheffield	433	1.63	3 (0.7%)	46 (10.6%)
University of Surrey	290	1.20	1 (0.3%)	18 (6.2%)

Energy Storage: Top 20 organisations (by publications)



Name	Publications	FWCI	In global top 1%	In global top 10%
University of Oxford	175	2.56	9 (5.1%)	55 (31.4%)
University of Cambridge	334	2.50	9 (2.7%)	90 (26.9%)
Imperial College London	548	2.49	20 (3.6%)	136 (24.8%)
University of Nottingham	462	2.44	7 (1.5%)	74 (16.0%)
University of Sheffield	226	2.25	1 (0.4%)	40 (17.7%)
University College London	202	2.21	5 (2.5%)	48 (23.8%)
University of Newcastle upon Tyne	153	2.08	2 (1.3%)	33 (21.6%)
Loughborough University	170	2.05	4 (2.4%)	25 (14.7%)
University of Durham	144	1.97	5 (3.5%)	27 (18.8%)
University of Southampton	223	1.93	5 (2.2%)	37 (16.6%)
University of Surrey	139	1.92	1 (0.7%)	18 (12.9%)
University of Birmingham	148	1.89	5 (3.4%)	32 (21.6%)
University of Bath	218	1.78	8 (3.7%)	43 (19.7%)
University of Glasgow	152	1.70	0 (0.0%)	32 (21.1%)
University of Edinburgh	240	1.69	3 (1.3%)	37 (15.4%)
Queen's University Belfast	168	1.30	2 (1.2%)	24 (14.3%)
Cardiff University	150	1.28	1 (0.7%)	27 (18.0%)
University of Strathclyde	469	1.23	4 (0.9%)	48 (10.2%)
University of Manchester	490	1.21	7 (1.4%)	61 (12.4%)
University of Leeds	149	1.04	1 (0.7%)	27 (18.1%)

Science, Technology, Engineering and Mathematics Graduates and Income from Industry

1. The Higher Education Statistics Agency (HESA) publishes data showing the number of qualifiers (first degree and postgraduate) in their annual publication *Students in Higher Education Institutions*⁵⁶. The Review has analysed this data for 2011/12 by STEM subject and higher education institution (HEI) and produced a graphical analysis showing which HEIs have the highest number of qualifiers in each subject. The underlying data have also been published in spreadsheet form alongside the Review report.

2. For the qualifiers analysis, STEM subjects are defined as:

- Medicine and dentistry
- Subjects allied to medicine
- Biological sciences
- Veterinary Science
- Agriculture and Related Subjects
- Physical Sciences
- Mathematical Sciences
- Computer Science
- Engineering and technology
- Architecture, Building and Planning

3. A more detailed breakdown of these subjects is available in the spreadsheet. More information about the definitions used is available from HESA⁵⁷.

4. HESA also publish data showing research grant and contract income by source in their annual publication *HE Finance Plus*⁵⁸. The Review has also provided a spreadsheet with this information by STEM subject and HEI for income from industry (both UK and international).

5. For the income analysis, STEM subjects are defined using HESA Cost Centres⁵⁹ as:

- Clinical medicine
- Clinical dentistry
- Veterinary science
- Anatomy and physiology
- Nursing and paramedical studies
- Health and community studies

⁵⁶

http://www.hesa.ac.uk/component/option,com_pubs/Itemid,122/index.php?option=com_pubs&task=show_publication_detail&pubid=1&Itemid=286

⁵⁷ <http://www.hesa.ac.uk/content/view/1805/296/>

⁵⁸

http://www.hesa.ac.uk/component/option,com_pubs/Itemid,122/index.php?option=com_pubs&task=show_publication_detail&pubid=1710&Itemid=286

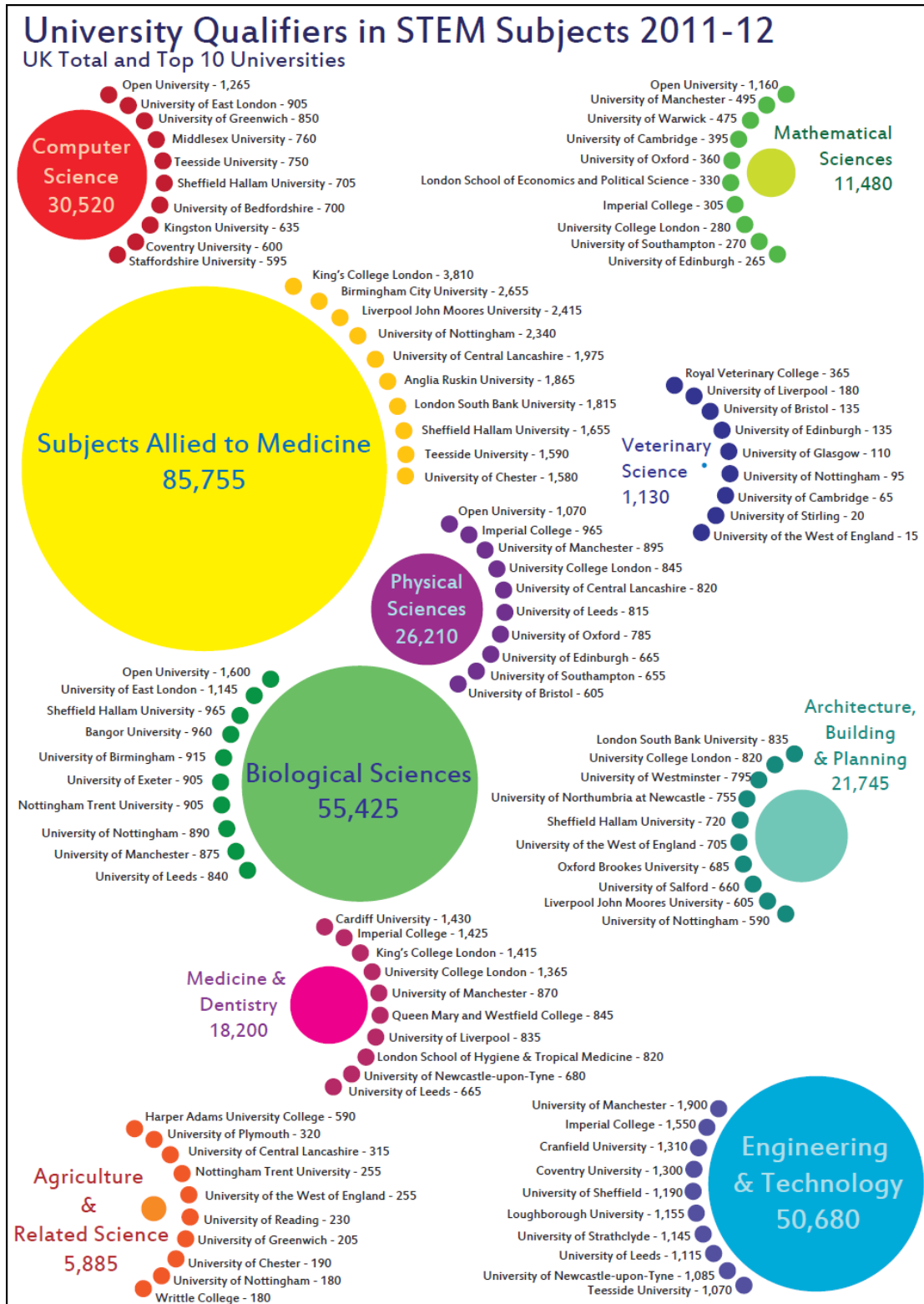
⁵⁹ <http://www.hesa.ac.uk/content/view/102/143/1/1/>

- Psychology and behavioural sciences
- Pharmacy and pharmacology
- Biosciences
- Chemistry
- Physics
- Agriculture and forestry
- Earth, marine and environmental sciences
- General engineering
- Chemical engineering
- Mineral, metallurgy and materials engineering
- Civil engineering
- Electrical, electronic and computer engineering
- Mechanical, aero and production engineering
- Architecture, built environment and planning
- Mathematics
- IT and systems sciences, computer software engineering
- Geography
- Sports science and leisure studies

6. Analysis of this and other data for 2010/11 has also been carried out by Universities UK and published in *Section B – Patterns of Institutional Diversity*⁶⁰, part of *Patterns and trends in UK higher education 2012*⁶¹

⁶⁰ <http://www.universitiesuk.ac.uk/highereducation/Documents/2012/PatternsTrendsInstitutionalDiversity.pdf>

⁶¹ <http://www.universitiesuk.ac.uk/highereducation/Pages/PatternsAndTrendsInUKHigherEducation2012.aspx>



Appendix 1: Citations Methodology

Introduction

The Review of Universities and Growth commissioned the Elsevier's SciVal Analytics (SVA) to undertake a bibliometric analysis of the geographical distribution of excellence for research publications classified under the Eight Great Technologies (8GT) and 9⁶² out of the 11 Industrial Strategy sectors (11IS) included in the Review. This document describes the methodology used to create the excellence map of each of these categories.

Identifying relevant publications in Scopus

In order to conduct any bibliometric analysis it is essential to identify for each category, separately, the relevant articles published in that particular research topic. Aiming at providing a complete and recent view of research output excellence in each area of innovation, Scopus data from the last 5 most complete years were used (i.e. period 2008-2012).

To ensure a robust, comprehensive and accurate identification of Scopus publications in the period mentioned above, Elsevier and the Review Team worked jointly to define and deploy the below method:

- a) Following the Review Team's request, UK Research Councils provided a list of relevant researchers per applicable discipline. The researchers were chosen because their published work was viewed as being representative of and therefore defined the scope of the disciplinary areas to be analysed.
- b) Each researcher's name including affiliated organisation was used by the Elsevier SVA team to identify his/her publications in Scopus in the above mentioned period.
- c) The set of all publications of all researchers in a particular discipline was then fed to Elsevier's Finger Printing Engine⁶³ (FPE). The FPE engine combines Natural Language Processing techniques together with thesauri and taxonomies across many different disciplines to identify and extract relevant concepts mentioned in the abstract, title and keywords of a publication. Each concept is given a weight based on the number of occurrences in this set of publications but also on the number of occurrences in the entirety of Scopus.
- d) The list of concepts collected from the previous step was examined and refined by subject matter-experts at different Publishing Units within Elsevier. Such a refinement focused mainly on the exclusion of irrelevant or broad terms, e.g. terms like 'model', 'test', 'application', etc.

⁶² See Appendix for a full listing of Eight Great Technologies and 10 Industrial Strategy sectors.

⁶³ See <http://info.scival.com/fingerprint> for more details

- e) With the remaining concepts, searches were conducted on Scopus for the above mentioned period to retrieve publications of types⁶⁴: Article, Review and Conference Proceeding.
- f) Subsequently, the publications retrieved were indexed in specific database tables to allow for the calculation of the metrics defined for this project.

Calculating metrics

The relevant metrics agreed upon by Elsevier and the Review Team are:

- A measure of research volume, namely number of publications
- A measure of research impact, namely Field Weighted Citation Impact (FWCI):
Field Weighted Citation Impact: A measure of citation impact, based on the average number of citations received by a group of publications compared to the world number of citations received by the same type of publications. This metric is field weighted in that it adjusts for differing citation practices in different subject fields and therefore for the different subject emphases of comparator countries. Publications have a period of 4 years in which citations can be accumulated, comparing this value of actual citations to the number of expected citations based on the subject in question, the year in question, and the article types in question
- A measure of research excellence, namely number of publications from each institute that are in the top-cited 1% and top 10% of publications globally in the discipline.

All metrics are calculated per organisation (e.g. university, research institute, etc.) in the UK for the entire period of 2008-2012.

Creating the maps

Based on the values calculated, institutions are plotted on the UK map in the form of small circles whereby:

- The size of the circle is determined by the number of publications
- The colour of the circle is based on the value of the FWCI.

⁶⁴ Article, Review and Conference Proceeding are commonly used as the standard publication types in any bibliometric study

Part 3. Annexes

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Annex 1. BIS Support for Universities and Businesses to Collaborate

1. The nature and extent of public funding available to support research and innovation is central to the Review's concerns, and a number of respondents to the *Call for Evidence* commented on it. This annex sets out the funding streams and incentives provided by the Department for Business, Innovation and Skills and its delivery partners to support the translation of university research and the engagement of universities with business to deliver economic growth. It also provides pointers to public support provided from other sources.

Higher Education Funding Council for England

Quality Related Funding and the Research Excellence Framework

2. The Higher Education Funding Council for England (HEFCE) allocates block grant funding to Higher Education Institutions (HEIs) in England on the basis of performance in periodic national assessments of research excellence. This Quality Related (QR) Funding allows institutions to invest strategically to maintain their research capacity, explore new fields and projects which includes working with business – allowing them to leverage in funding and competitively price commissioned research⁶⁵.
3. The Research Excellence Framework (REF) will replace the Research Assessment Exercise (RAE) as the means of periodic assessment of research quality across UK HEIs. As with earlier RAE exercises (conducted every 6-8 years), the outcomes of REF 2014 will inform the selective allocation of research funding to HEIs, provide benchmarking information, establish reputational yardstick and provide accountability for public investment in research and demonstrate its benefits. HEIs submit their best research outputs from the last six years, for peer review by panels of experts drawn from UK and overseas across 36 units of assessment (disciplines). HEFCE has been developing the REF for five years and it will include, for the first time, assessment of impact arising from excellent research, based on expert-review of case studies, enabling researchers to demonstrate their contribution to the economy, society and environment, to public policy and services, and to culture, health and well-being. Impact will account for 20 per cent of the assessment in REF 2014.

Higher Education Innovation Funding

4. Higher Education Innovation Funding (HEIF) supports English HEIs to maintain and build capacity and capability to work with business and other external organisations. HEIF has been reformed to increase the rewards for universities that are most effective in business engagement and increased to £160 million each year until

⁶⁵ As the focus of this review is on England, this annex reports on HEFCE funding streams. There are four funding bodies for Higher Education in the UK, who collaborate on the system of research assessment and use similar but not identical methods for distributing quality-related funding.

2015. It is allocated on a formulaic basis alongside core institutional funding for research and teaching. It supports universities to undertake a wide range of activities working with business and others. Universities use HEIF funding to increase interactions with business (such as collaborative research, consultancy, training); enhance technology transfer activities to help the commercialisation of intellectual property (through spin-outs, licensing); and provide enterprise education for staff and students and support for starting a business.

5. HEIF is an important driver of local activity. Knowledge exchange strategies submitted to HEFCE for HEIF funding in 2011 describe considerable commitment to local innovation – 60 per cent of universities are investing in local innovation infrastructure, 71 per cent increasing work with employers for student placements and enterprise training, 52 per cent providing expertise for local economic development. Three-quarters of universities are also looking for more collaborative and shared service approaches to working with business, much of which is local.

Catalyst Fund

6. HEFCE has funded research collaboration development through its Strategic Development Fund, now renamed the “Catalyst Fund”. This funds collaborations where it is felt that the nature of the challenges in a field are only likely to be tackled through the critical mass of several departments working together, and where there is insufficient present large-scale supply.
7. Of particular current interest are cross-cutting proposals which support economic growth, and unlock private sector investment that would otherwise not be available to higher education. HEFCE also aligns catalyst funding with other funders and new policies in the support of economic growth. HEFCE aims to commit up to £45 million in annual funding in the 2011-15 period. Working in partnership is a key feature. It is already supporting co-investments with LEPs (loans) and other business partners relevant both to the Industrial Strategy and also local innovation.

UK Research Partnership Investment Fund

8. BIS has provided £300 million for the UK Research Partnership Investment Fund (UKRPIF) for universities to accelerate private co-investment in UK university research infrastructure and strategic research partnerships. This funding, together with private co-investment, will deliver at least £1 billion investment in R&D collaborations between universities, businesses and charities. Administered by HEFCE, it provides £10-35 million to universities for large long-term capital projects that have at least double that amount in private co-investment and build on a strong record of research excellence. £220 million was allocated to 14 projects in Autumn 2012 which levered £615 million private co-investment. Following a second call for bids for the remaining £80 million six further projects have been announced. This brings the total number of projects to 20 and the final commitment from RPIF to £301.4 million, leveraging £855 million from business and charities and total investment of £1.156 billion.

Research Councils

9. The seven Research Councils are:
 - The Arts and Humanities Research Council (AHRC)
 - The Biotechnology and Biological Sciences Research Council (BBSRC)
 - The Economic and Social Research Council (ESRC)
 - The Engineering and Physical Sciences Research Council (EPSRC)
 - The Medical Research Council (MRC)
 - The Natural Environment Research Council (NERC)
 - The Science and Technology Facilities Council (STFC).

10. Each Research Council is a Royal Charter body, at arms-length from Government. Together they cover the full spectrum of academic disciplines. All research supported by Research Councils is selected on the basis of research excellence and assessed through detailed peer review. The areas of research and the ideas to be investigated are defined by researchers, either by submitting a proposal directly or by informing a Council's strategic priorities. Research Councils develop their strategies and priorities through a strong consultative process, involving leading academic researchers and representatives from industry and public and third sectors recognised for their knowledge in the field.

11. Approximately half of all Research Council funding is distributed in "responsive mode" (unsolicited ideas in any area). The rest is distributed through a wide range of mechanisms appropriate to the Council and the research challenge under investigation such as thematic programmes, knowledge exchange activities and facilities. In addition four of the Research Councils (BBSRC, MRC, NERC, STFC) support research institutes⁶⁶ which they fully or partially fund.

12. Research Councils support substantial activity underpinning future growth in key sectors, such as those identified in the Industrial Strategy e.g. annual spend in health related research is over £1 billion. Many Research Councils have more than 50 per cent of their spend aligned to the Industrial Strategy sectors, e.g. construction, aerospace, automotive, renewable energy, agri-food and pharmaceuticals, often in partnership with other agencies such as the Technology Strategy Board (TSB).

13. Research Councils have a commitment to achieve impact from the excellent research they fund. To deliver impact, researchers need to engage and collaborate with the public, business, government and the third sector. The Research Councils support opportunities for business involvement at a number of different levels. At a small scale collaborative studentships offer low-cost, low-risk engagement, moving up the pipeline there are opportunities to collaborate on research grants and at a high level there are opportunities that include integrating the future research and development (R&D) of a company with the research base through strategic partnerships and major collaborative initiatives such as research centres. There is

⁶⁶ Institutes is being used as a generic term and covers all associated bodies of BBSRC, MRC, NERC and STFC.

more than one way to become involved depending on the capacity of the company and businesses are encouraged to move up the pipeline.

14. The proportion of Research Council funding going towards research conducted in collaboration with industry varies across Councils reflecting the scale and nature of their respective activities but they estimate as an overall figure it would be somewhere in the region of 20 per cent.
15. Support can broadly be categorised in the following ways:
 1. Brokerage – Research Councils have in-depth knowledge of the people and the research that is taking place within the academic community and can help business and others find potential partners – for example through the Gateway to Research.
 2. Information exchange – encouraging challenges to be shared and debated, and providing access to cutting edge research findings to further encourage their uptake e.g. through evidence seminars and conferences, networks such as the Knowledge Transfer Networks (KTNs), and access to large data sets.
 3. Collaborative Research – academic research undertaken in partnership with other universities or research organisations, with business, with government and/or with the third sector (e.g. charities). Collaborative research can take a number of forms, from a basic grant between two partners, through to a complex multi-partner research programme.
 4. Collaborative Training – enables researchers to develop the relevant skills to undertake excellent research, work effectively in business (and/or the government or other important sectors), and exploit the outcomes of their research. Training opportunities include vocational courses, collaborative studentship projects between academia and industry, and training in entrepreneurship.
 5. People Exchange – all Research Councils encourage increased levels of university-business interaction; all support the exchange of researchers between academia and industry, and stimulate partnerships between business and researchers. This includes support for fellowship schemes that enable researchers to work in a commercial environment, Knowledge Transfer Partnerships (KTPs), and placements.
 6. Commercialisation and Development – includes a number of activities to encourage researchers to take their ideas further down the route to exploitation, and to reward them for excellence in innovation. The Research Councils' Follow-on Fund (plus a range of other Council-specific schemes) supports 'proof-of-concept' type work.
 7. Research Infrastructure – providing research and development access to science facilities for both academic and commercial users as well as the physical co-location of industry, high-tech business and academic groups on

research and innovation campuses.

16. The Research Councils also seek to influence culture and behaviour through initiatives such as Pathways to Impact, open access policy, awards and incentives.

The Technology Strategy Board

17. The aim of the TSB is to accelerate economic growth by stimulating and supporting business-led innovation. This includes collaboration with universities: the programmes it supports often enable business-research base engagement and the businesses invested with often choose to collaborate with the research base. Approximately 30 per cent of its total grant funding goes to research base partners and 60 per cent of projects involve collaboration with the research base.

18. Over 150 different research base organisations from across the UK, including nearly all UK universities and a significant number of research institutes, are currently working with businesses on TSB projects.

19. The TSB categorise the different forms of support it offers to businesses as follows:

Investment for growth: Access TSB grant funding.
 Networking and partnership: Find partners and collaborators for innovation.
 Expertise and advice: Find knowledge and advice for your innovation journey.
 Specialist Facilities: Access facilities to develop and test new technologies.
 Government Contracts: Develop products/services for public sector needs.

20. The TSB states that engagement with the research base is an important element in almost all of their programmes and particularly the following:

Collaborative R&D Projects

Budget: £172.9 million in 2013/14

21. An activity that brings together businesses (from large corporate to micro companies) and academic partners to undertake R&D projects from which successful new products, processes and services can emerge. Projects range in value from £10,000 to over £100 million. Over 900 projects are currently being supported with a combined business and Government investment of over £1 billion (with just over half the funds committed by business).

22. A survey⁶⁷ on collaborative R&D identified 'the benefit of academic involvement is clearly demonstrated by the fact that the overall business impacts in projects with two or more academic partners are more than double those in projects with no academics'.

⁶⁷ Evaluation of the Collaborative Research and Development Programmes Final Report, PACEC, September 2011

Knowledge Transfer Networks

Budget: £15.2 million in 2013/14

23. These are over-arching national networks which aim to improve the UK's innovation performance by increasing the breadth and depth of the knowledge transfer of technology into UK-based businesses.
24. KTNs aim to make connections between the various players, helping industry to access knowledge and information central to innovation growth.
25. The TSB provides support for 15 KTNs, which have over 43,000 business members (also have 14,000 non-business members).

Knowledge Transfer Partnerships

Budget: £16.9 million in 2013/14

26. KTPs are intended to stimulate innovation through collaborative projects between business (including social enterprises) and the knowledge base by facilitating the transfer of knowledge and the spread of technical and business skills through projects undertaken by high calibre, recently qualified people under the joint supervision of personnel from business and the knowledge base.
27. There are currently over 600 live partnerships (as of June 2013) and approximately 75 per cent of the partnerships involve small and medium-sized enterprises (SMEs).

Catapult centres

Budget: £121.3 million in 2013/14

28. Catapult centres are physical centres where businesses, scientists and engineers work alongside each other on late stage R&D in order to turn high potential ideas into new products and services.
29. The TSB opened the first Catapult centre in October 2011. The High Value Manufacturing (HVM) Catapult is formed of a group of research and technology facilities from across the country, with seven centres of excellence. The remaining six Catapult centres in the first wave are now operational, in Cell Therapy, Offshore Renewable Energy, Satellite Applications and Connected Digital Economy, Future Cities and Transport Systems. A planned expansion of the network has been announced for 2015/16 with two new Catapults in the areas of Energy Systems and Diagnostics for Stratified Medicine. An extra £7 million is also being invested in the HVM Catapult.

Biomedical Catalyst

Budget: £30 million in 2013/14

30. The Biomedical Catalyst is a joint £180 million TSB and Medical Research Council programme which offers funding to innovative SMEs and academics looking to work either individually or in collaboration to develop solutions to healthcare challenges. The Biomedical Catalyst will accept innovative ideas from any sector or discipline

that demonstrates the potential to provide significant positive healthcare and economic impact.

31. Three categories of grant are available: Feasibility award, which enables the exploration and evaluation of the commercial potential of an early-stage scientific idea; Early-stage award, to evaluate the technical feasibility of an idea and establish proof of concept in a model system; and Late-stage award which takes a well developed concept and demonstrates its effectiveness in a relevant environment. Any UK SME or academic undertaking research and development, either individually or in collaboration, may apply; applications are accepted on a rolling basis for assessment by independent experts.

Innovation Vouchers

Budget: £2.5 million in 2013/14

32. The TSB has introduced a new national Innovation Voucher programme to support SMEs in working with external knowledge providers. The new programme was launched in September 2012 and will incentivise SMEs to engage with the knowledge base and other forms of innovation advice to help develop new ideas and potential new commercial products. The Vouchers will be particularly targeted at SMEs who are new to this type of collaborative activity or who lack the internal expertise or research capabilities to take forward new ideas. Current focus areas are agrifood, built environment, open data, cyber security and energy, water and waste.

Innovation and knowledge centres

Budget: £1.9 million in 2013/14

33. IKCs operate at an earlier stage than Catapult centres. They offer a shared space and entrepreneurial environment in which researchers, potential customers and professionals from academia and business can work side-by-side on commercial applications of emerging technologies. TSB partners with the Research Councils on IKCs.

Smart

Budget: £36.4 million in 2013/14

34. The Smart scheme offers funding to SMEs to engage in R&D projects from which successful new products, processes and services could emerge. Three types of grant are available: proof of market (up to £25,000 grant), proof of concept (up to £100,000 grant), and development of prototype (up to £250,000 grant). Pre start-ups, start-ups, and SMEs from all sectors may apply.

Launchpads

Budget: £800,000 in 2013/14

35. Launchpads are open to SMEs and provide funding for business innovation that aims to support the development and strengthening of clusters of high-tech companies in specific theme areas and geographical locations. They provide base funding through dedicated TSB competitions for approved research and

development projects and act as a catalyst to help the companies behind the projects to attract more investment.

36. In 2011 a launchpad competition was launched for the emerging 'Tech City' around Shoreditch in East London. The competition looked for exciting and innovative projects that may be too risky for companies to take forward alone, or that may take them into new areas. Eighteen projects were funded through the Tech City launchpad.

37. Other Launchpads announced are:

- Digital and Creative, Glasgow
- Space, Harwell
- Materials and Manufacturing, Daresbury and Runcorn.

Innovation Vouchers

Budget: £3.5 million in 2013/14

38. The TSB has introduced a new national Innovation Voucher programme to support SMEs in working with external knowledge providers. The new programme was launched in September 2012 and will incentivise SMEs to engage with the knowledge base and other forms of innovation advice to help develop new ideas and potential new commercial products. The Vouchers will be particularly targeted at SMEs who are new to this type of collaborative activity or who lack the internal expertise or research capabilities to take forward new ideas. Current focus areas are agrifood, built environment, open data, cyber security and energy, water and waste.

Small Business Research Initiative (SBRI)

Budget: £10 million in 2013/14

39. SBRI aims to provide business opportunities for innovative companies while solving the needs of government departments. The programme is designed to enable public bodies to fund the development of technology which will meet their future needs or policy objectives. It provides a structured approach and support for the procurement process when acquiring research and development work, particularly the vital engagement with industry.

40. The Government announced its intention in the 2013 Budget to expand the use of SBRI among key departments five-fold. The value of contracts made available through this route will increase from £40 million in 2012/13 to over £100 million in 2013/14, and over £200 million in 2014/15.

Eurostars

Budget: £3.3 million in 2013/14

41. Eurostars aims to help UK high-tech SMEs to develop partnerships with SMEs and knowledge and supply chain partners elsewhere in Europe, to develop their networks and to build up the knowledge to participate in large EU programmes.

Other schemes

R&D Tax Credits

42. Research and development (R&D) tax credits are a company tax relief which can either reduce a company's tax bill or, for some SMEs, provide a cash sum. R&D Tax Credits are the largest source of Government support for business R&D.
43. From 1 April 2012, the rate of relief under the SME scheme increased to 225 per cent of qualifying expenditure. The rate under the large company scheme is 130 per cent of qualifying R&D expenditure.
44. Government introduced a new "Above The Line" (ATL) Credit for large company R&D investment from April 2013. In Budget 2013 the Government announced that the headline rate of the ATL credit will be increased to 10 per cent from the 9.1 per cent rate proposed at Budget 2012.
45. The SME scheme is now worth up to about 30p for every £1 spent and the large company scheme is worth about 7p for every £1 spent. Claims for 2010/11 totalled £1.1 billion, supporting R&D investment by business totalling £10.9 billion, claimed by 10,290 businesses in 2010/11.

Patent Box

46. The 'patent box' was introduced from April 2013. This tax provision reduces the rate of corporation tax on the income derived from patents to 10 per cent, with the aim of incentivising firms to engage in research and development activity.

Growth Accelerator

47. Growth Accelerator is a Government supported service that provides coaching and advice to help SMEs to grow quickly and sustainably. It is aimed at owners and managers in all sectors with the potential to double the size of their business in three years.
48. The service provides access to a network of over 800 experts with experience of starting, managing and growing successful businesses. Government will invest £200 million in supporting up to 26,000 SMEs.

Smaller Schemes

49. Outwith BIS, there are many smaller schemes that support businesses to access:
- government grants
 - publicly-backed finance and loans
 - business support e.g. mentoring, consultancy
 - funding for SMEs and start-ups.
50. The Government's website has a tool which supports companies to find the different sources of support available to businesses by sector, in their location, for their size of business.

<https://www.gov.uk/business-finance-support-finder>

Annex 2. Terms of Reference

Independent Review by Sir Andrew Witty of Universities in their Local Communities: Enabling Economic Growth

Terms of Reference

The purpose of the review is **to focus on how universities can drive growth in their areas and for the benefit of the wider UK and to disseminate knowledge and best practice.**

The review should build on the Wilson Review of Business-University Collaboration, taking into account developments since the Wilson Review was published, including:-

- a) the development of the Government's industrial strategy;
- b) developments in the local economic landscape including the Government's response to the Heseltine Review;
- c) developments in the EU's approach to structural funds including "Smart Specialisation".

It should explore the range of ways that universities contribute to their local economies including as agents of research and innovation, as providers of skills, employers, purchasers of goods and services, and as facilitators bringing people together. It will explore the link between global comparative advantage, regional excellence and how to create an integrated strategy between the local and national players – all building on the already established Industrial Strategy.

It should take into account the ways in which university collaboration with both large businesses and Small and Medium-sized Enterprises (SMEs) can contribute to their local economies.

Questions the Review Might Wish to Explore:

The questions below are intended to provide a guide to the areas the Review might wish to explore.

1. Where universities provide the UK with global comparative advantage, how can we make sure that local economic development plans reflect these strengths?
2. What are the strengths of universities and how can we harness the diverse contributions that universities make?

3. Taking account of their diversity, how can universities best work with Local Enterprise Partnerships (LEPs) and other local actors to drive economic growth?
4. How can central Government best promote effective collaborations while respecting local leadership of the local economic growth agenda?

Regional scope

The main focus of the review and its recommendations should be on England; however there may be useful lessons to be drawn from Scotland, Wales and Northern Ireland and, indeed, wider afield. The review team is encouraged to engage with the governments of Scotland, Wales and Northern Ireland.

Reporting

The report findings will be presented to the Business Secretary and Economic Affairs Committee, in the summer, to ensure that the findings can inform LEP strategic plans and EU investment plans.

Background

The Wilson Review of Business-University Collaboration included a chapter on *Universities in their local communities: enabling economic growth*. A key finding was that LEPs have a key role to play in local economic growth and have the potential to be invaluable in helping universities improve their collaborative relationships with business, especially in supporting ambitious SMEs, a market that many universities find challenging. The report stated that the potential of LEPs needs to be realised if universities are to contribute to local economic development in an optimal manner.

Since the Wilson Review, the Government has further developed its approach to industrial strategy, emphasising the importance of partnership working between government and industry with an initial focus on 11 sectors and eight technologies in which Britain has the potential to be globally competitive.

On 18 March 2013, Government announced that LEPs are being tasked with taking on a much greater role in driving economic development. Specifically, they will develop multi-annual strategic plans for their area and will have access to greater resources and levers decentralised from Whitehall. A majority of the EU structural funds for England in 2014-20 will be nominally allocated to LEPs, who will develop EU investment plans as part of their overarching strategic plan. The plans will have to address the key EU funding priorities, a major one of which is innovation, through the lens of an EU-wide approach to 'smart specialisation'

The review is therefore a timely opportunity to build on previous work, in the light of the significant new role that Government envisages for LEPs from April 2015.

Annex 3. Sir Andrew Witty's Expert Advisory Group

Sir Andrew Witty was supported in his review by seven independent expert advisors. They were:

- Professor Sir John Bell, Regius Professor of Medicine at Oxford University
- Professor David Greenaway DL, Vice-Chancellor of the University of Nottingham and Member of the Nottingham Growth Board
- Professor Graham Henderson CBE DL, Vice-Chancellor and Chief Executive of Teesside University, Board Member of Tees Valley Local Enterprise Partnership
- Professor Dame Julia King, Vice-Chancellor of Aston University, Board Member of Greater Birmingham and Solihull Local Enterprise Partnership
- Professor Wendy Purcell, Vice-Chancellor and President of Plymouth University, Board Member of Heart of the South West Local Enterprise Partnership
- Professor Dame Nancy Rothwell, President and Vice-Chancellor of The University of Manchester, Board Member of Greater Manchester Local Enterprise Partnership
- Colin Skellett OBE, Chair of West of England Local Enterprise Partnership and Executive Chair of Wessex Water

Annex 4. Call for Evidence



Department
for Business
Innovation & Skills

Sir Andrew Witty's Independent Review of Universities and Growth

The Government has invited me to undertake an independent review to explore how universities can support growth by working with organisations such as Local Enterprise Partnerships (LEPs), as the local bodies responsible for setting strategies to drive economic growth across the country.

The purpose of the review is to focus on how universities can drive growth in their areas and for the benefit of the wider UK, and to disseminate knowledge and best practice. It is a good time to examine this question: the Government has recently brought forward its industrial strategy, identifying sectors and technologies likely to be central to our economic future, and I intend to focus in particular on what will enable these sectors and technologies to derive the fullest benefit from universities to drive economic growth.

Our universities have a worldwide reputation and make a valuable contribution to innovation and economic growth through a wide range of activities. They are one of the major sources of knowledge generation for the UK and are national and local assets supporting innovation and growth. They have a fundamental value in the creation and transmission of knowledge. Added to this they can act as centres of economic activity in their own right, often being among a region's biggest employers, and supplying the local and national economy with thousands of skilled workers each year.

I come to the Review with two hypotheses: first, that the strongest basis for regional economic growth is activity rooted in a sound understanding of a locality's comparative economic advantage; and second, that much of the UK's comparative economic advantage in the twenty-first century could be derived from our universities, and in particular from world class research in fields relevant to the Industrial Strategy sectors and technologies. I want to test these hypotheses during the Review.

I use these terms broadly. I include excellent publicly funded research taking place in institutions which are not universities, including for example on our Science and Innovation Campuses and other Research Institutes. I will take account of the wider range of innovation and business related activities that universities undertake to support economic growth. I also take it as read that local economic strength is frequently based in activities not confined to one place – ours is a relatively small country with interconnectivity across geographical areas, and collaboration across these areas is important.

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There has been a significant body of work undertaken in this area recently, notably the reviews by Lord Heseltine and Sir Tim Wilson. I will take the findings of these reviews and the Government's responses to them into account, but I do not intend to re-examine the questions already covered in them. I will be making recommendations on how we can maximise the broader contribution of our universities to innovation and growth in their own regions, and how incentives and support systems could be aligned with the Industrial Strategy to ensure the best outcome for the UK as a whole. I will also explore how EU structural and investment funds can spur the contribution to economic growth of universities working with businesses and how we can raise our game in securing the commercial benefits of breakthroughs in UK universities for the UK.

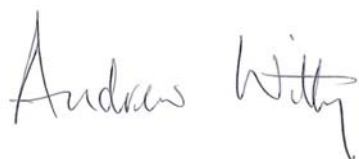
I would welcome evidence on these issues and on the role you think universities can play in supporting growth in their local areas and at a national level taking account of the Government's industrial strategy. The main focus of the review and its recommendations will be on England; however there may be useful lessons to be drawn from Scotland, Wales and Northern Ireland and, indeed, wider afield, and I would welcome any contributions from outside England.

I will publish my report later this summer.

I attach a list of questions on which I would welcome contributions. I would also be interested in views on my hypotheses and would welcome any other evidence you believe we should consider. I am grateful to Universities UK who have kindly agreed to assist me by coordinating the participation of universities in this consultation, and by collating and analysing responses from universities. Other organisations or individuals are invited to contribute and should send their responses direct to the address below.

The full terms of reference of the review are attached at Annex A for reference.

Please send your responses to universitiesandgrowth@bis.gsi.gov.uk by 31 May 2013.

A handwritten signature in black ink that reads "Andrew Witty". The signature is written in a cursive, slightly slanted style.

Questions

If you have quantitative data that backs up your views, and you would be willing to share it with the review team, we would be grateful to receive it.

We would be particularly interested in any strong case studies that illustrate examples of good practice or successful ventures in any of the areas set out below.

Universities and the industrial strategy

1. In what ways are universities contributing to the sectors and technologies in the Government's industrial strategy?
2. Are there ways in which they could contribute more?
3. What more could be done to maximise the associated benefits to local economies?

Universities, comparative advantage and local plans

4. How can we ensure that LEP strategic growth plans take account of the opportunity to derive global comparative advantage from world class research in some universities?
5. What connections need to be in place between LEPs, industry and universities to ensure regions can exploit the opportunities offered by comparative global advantage?
6. How can universities best work with LEPs and other local actors to drive economic growth, based on their own strengths or the industrial or commercial strengths of the region?
7. What are the types of connections and collaborations that have most impact for regional economic growth?
8. How can EU structural and investment funds spur the contribution to economic growth of universities working with businesses?

Collaboration and coordination

9. How can we ensure that there is collaboration and coordination in LEP strategic growth plans where that is mutually beneficial?
10. How can central Government best promote effective collaborations while building on local leadership of the local economic growth agenda? What incentives could be added to the current range of programmes?

Reaping the benefits

11. How far is it true that the commercial benefits derived from breakthroughs in UK universities often go outside the UK?
12. If so, what measures, incentives or support systems would secure more of the commercial benefits for the UK?

For information

The 11 Industrial Strategy Sectors and their aims are:

1. Aerospace: to maintain existing UK market share and secure UK employment;
2. Civil Nuclear: to increase inward investment in the energy supply chain;
3. Oil and Gas: to increase inward investment in the energy supply chain;
4. Offshore Wind: to increase inward investment in the energy supply chain;
5. Agri-tech: developing and exporting innovative technologies e.g. in food security;
6. Education: to grow UK education exports;
7. Information economy: to optimise ICT use by business;
8. Automotive: to repatriate supply chain and exploit low carbon technologies;
9. Construction: to improve competitiveness and productivity to support increasing exports;
10. Professional business services: targeting export opportunities in developing countries; and
11. Life Sciences: Strategy already published in December 2011; one-year-on report in December 2012

The eight great technologies are:

1. Big data and energy-efficient computing
2. Synthetic Biology
3. Regenerative Medicine
4. Agri-Science
5. Energy Storage
6. Advanced Materials and Nano-technology
7. Robotics and Autonomous Systems
8. Satellites and commercial applications of Space technology.

Annex 5. List of Respondents

The following individuals and organisations responded to the *Call for Evidence*, and/or offered views on the *Preliminary Findings* and heat maps. Universities UK assisted in cataloguing, analysing and summarising the responses from their members. Responses may be viewed at <https://www.gov.uk/government/consultations/universities-and-growth-the-witty-review-call-for-evidence>.

Academy of Social Sciences

Aerospace Defence Security (ADS)

Aerospace, Aviation and Defence Knowledge Transfer Network

Association for University Research and Industry Links

Association of Independent Research and Technology Organisations

Association of Teachers and Lecturers

BioIndustry Association

Biorenewables Development Centre

Birmingham Science City

Black Country LEP

Brighton Institute of Modern Music/BIMM Group

Buckinghamshire Thames Valley LEP

Business West

Caterpillar UK

CBI

Centre for Process Innovation

Coast to Capital LEP

Construction Industry Council

Construction Industry Training Board

Corridor Manchester Partnership

Creative Engineering for Industry

Creative England

Creative Skillset

Design Council

Dr Fiona Whitehurst - Senior Lecturer, Newcastle University Business School

Dr Jonathan Alltimes - Lecturer in Technology and Information Management

Economic Modelling

Energy & Utility Skills Ltd/National Skills Academy for Power

Engineering Employers' Federation

Enterprise Educators UK

Enterprise M3

e-skills UK

Ethical Medicines Industry Group

Greater Birmingham and Solihull LEP

Greenwich School of Management

GuildHE

Imperial Innovations Ltd

Interface

Isis Innovation Ltd

James Derounian

JCB

John C Pett

Julia Lane

Knowledge Economy Innovations

Landex

Liverpool City Region Innovation Board

Local Government Association

Marches LEP

Manchester College

Manufacturing Technology Centre

Million+

N8 - Partnership of the 8 leading research universities in the North of England

National Centre for Entrepreneurship in Education

National Centre for Universities and Business

National Composites Centre

National Nuclear Laboratory

National Physical Laboratory

National Skills Academy Creative and Cultural (Creative and Cultural Skills)

National Skills Academy Nuclear

Neale Thomas

New Economy Manchester

Northampton Borough Council

North East Process Industry Cluster

Oxfordshire LEP

People 1st

Plymouth Manufacturers' Group

PraxisUnico

Professional and Business Services Council

Professor Andy Penaluna

Research Councils UK

Russell Group

School for Startups

SCY Enterprise Ltd

Secos Partners

SETsquared

South East Midlands LEP

Staffordshire County Council

Stoke on Trent and Staffordshire LEP

Swindon and Wiltshire LEP

Talent Retention Solution for Advanced Manufacturing and Engineering Careers

Technology Strategy Board

Tees Valley Unlimited LEP

Ten Cate - Advanced manufacturing business

Thames Valley Berkshire LEP

The Association of Teachers and Lecturers

The Local Government Association

UK Photonics Leadership Group

UK Science Park Association

University Alliance

UUK

UUK Specialist Institutions Forum

Wellcome Trust

Universities/Higher Education Institutions

University of Aberdeen

Academy of Social Sciences

Anglia Ruskin University

Aston University

University of Bath

Bath Spa University

University of Bedfordshire

Birkbeck, University of London

Birmingham University

Birmingham City University

Bournemouth University

University of Bradford

University of Bristol

Brunel University

University of Cambridge

University Campus Suffolk

Canterbury Christ Church

University of Central Lancashire

University of Chester

City University

Combined Universities in Cornwall

Coventry University

Cranfield University
University of Cumbria
De Montfort University
University of Derby
University of Dundee
Durham University
University of East Anglia
University of East London
Edinburgh Napier University
University of Essex
University of Exeter
Falmouth University
University of Glasgow
University of Greenwich
Greenwich School of Management
Harper Adams University
University of Hertfordshire
University of Huddersfield
University of Hull
Imperial College London
Institute of Education
Keele University
University of Kent
King's College London
Lancaster University

University of Leeds

University of Leicester

Liverpool John Moores University

University of Loughborough

Manchester Metropolitan University

Newcastle University

University of Northampton

Northumbria University

University of Nottingham

Nottingham Trent University

Open University

University of Oxford

Plymouth University

University of Portsmouth

Queen's University Belfast

University of Reading

Royal Holloway

Royal Veterinary College

University of Sheffield

Sheffield Hallam University

University of Southampton

Southampton Solent University

University of South Wales

Staffordshire University

University of Stirling

University of Strathclyde

University of Sunderland

University of Surrey

University of Sussex

Teesside University

University of the Arts London

University of Ulster

University College London

University of Wales Trinity St David

University of Warwick

University of the West of England

University of Wolverhampton

University of Worcester

University of York

Yorkshire Universities Group

Annex 6. Meetings with Stakeholders

Sir Andrew Witty and the Review team held a number of meetings with groups of stakeholders during the Review. These are listed below.

April 2013: North East universities and LEPs at Newcastle University

April: Midlands universities and LEPs at Aston University

May: London Legacy Development Corporation (LLDC), London

June: Russell Group, London

June: London and South East universities and LEPs, London

June: Universities UK, London

June: North West, Yorkshire and Humber LEPs and universities, University of Manchester

June: University Alliance, University of Portsmouth

July: Confederation of British Industry – Inter-Company Academic Relations Group, University of Nottingham

July: Bristol/South West universities and LEPs, University of Bristol

July: Association of Business Schools Innovation Task Force, London

July: East London universities, London LEP, Greater London Authority, LLDC, London

Annex 7. Preliminary Findings

The Review's *Preliminary Findings* are available at:

<https://www.gov.uk/government/consultations/universities-and-growth-the-witty-review-call-for-evidence>

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BIS/13/1241