Department for Business Innovation & Skills

MAPPING LOCAL COMPARATIVE ADVANTAGES IN INNOVATON

Framework and indicators

JULY 2015

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Executive Summary

Introduction

The importance of 'place' to science, innovation and economic growth is increasingly recognised but under analysed and not yet fully understood. This report seeks to provide a consistent body of evidence of comparative innovation strengths in the 39 LEP areas to help LEPs and their partners to marshall their innovation assets to best effect using European Structural Funds and other funding streams. It is hoped that the data it contains will also enable individual LEPs to identify where there is scope for joint working with other LEPs and also the Department for Business Innovation and Skills, other government departments and national agencies. It should also help the LEPs and their partners to play to their respective innovation strengths, situate them in a wider regional and national context and maximise comparative advantage. That should in turn lead to less duplication and unproductive competition between institutions and regions. The study entailed:

- a literature review;
- development of a framework and set of indicators;
- consultation with LEPs and relevant bodies about framework design and choice of indicators;
- populating the framework with publicly available quantitative and qualitative data; and
- supplying a brief accompanying commentary.

The importance of innovation at the local and regional level

This report uses the standard BIS definition of innovation: 'activity that is new in its context, such as implementation of a new or significantly improved product, service or process, a new marketing method or new organisational methods.' There is overwhelming evidence to suggest that innovation is crucial to long term economic growth. Likewise, regions' prosperity significantly depends upon their institutions' capacity to support innovative firms, institutions and people. There is growing consensus that a region's degree of innovation and competitiveness is significantly influenced by a range of factors including firm type, sectoral mix and clustering; the presence of universities, research and business support facilities; skill levels; funding; quality of infrastructure; degree of entrepreneurship; good governance and leadership; social capital. Interestingly however, regions with similar innovation capacity can have very different growth patterns.

Innovation and knowledge tend to be concentrated in certain places because of agglomeration effects which principally result from returns to scale and different kinds of 'spillover' where technology support to primary beneficiaries 'spills over' to other organisations and firms. Spillovers tend to be greatest where there are multi-purpose technologies, nascent and high value added industries, universities and research institutes, open innovation systems, close relationships and proximity between actors, good knowledge transmission/exchange mechanisms and firms possess high absorptive capacity. Despite such concentrations of knowledge assets and innovation, the benefits of innovation can be widespread due to diffusion

processes and the spatial extent of spillovers. In recent years there has been growing interest in analysing and understanding local and regional innovation systems which constitute networks of actors such as firms, universities and government research bodies supporting learning and innovation and the way in which they are influenced by policy, governance, institutionalised learning and culture.

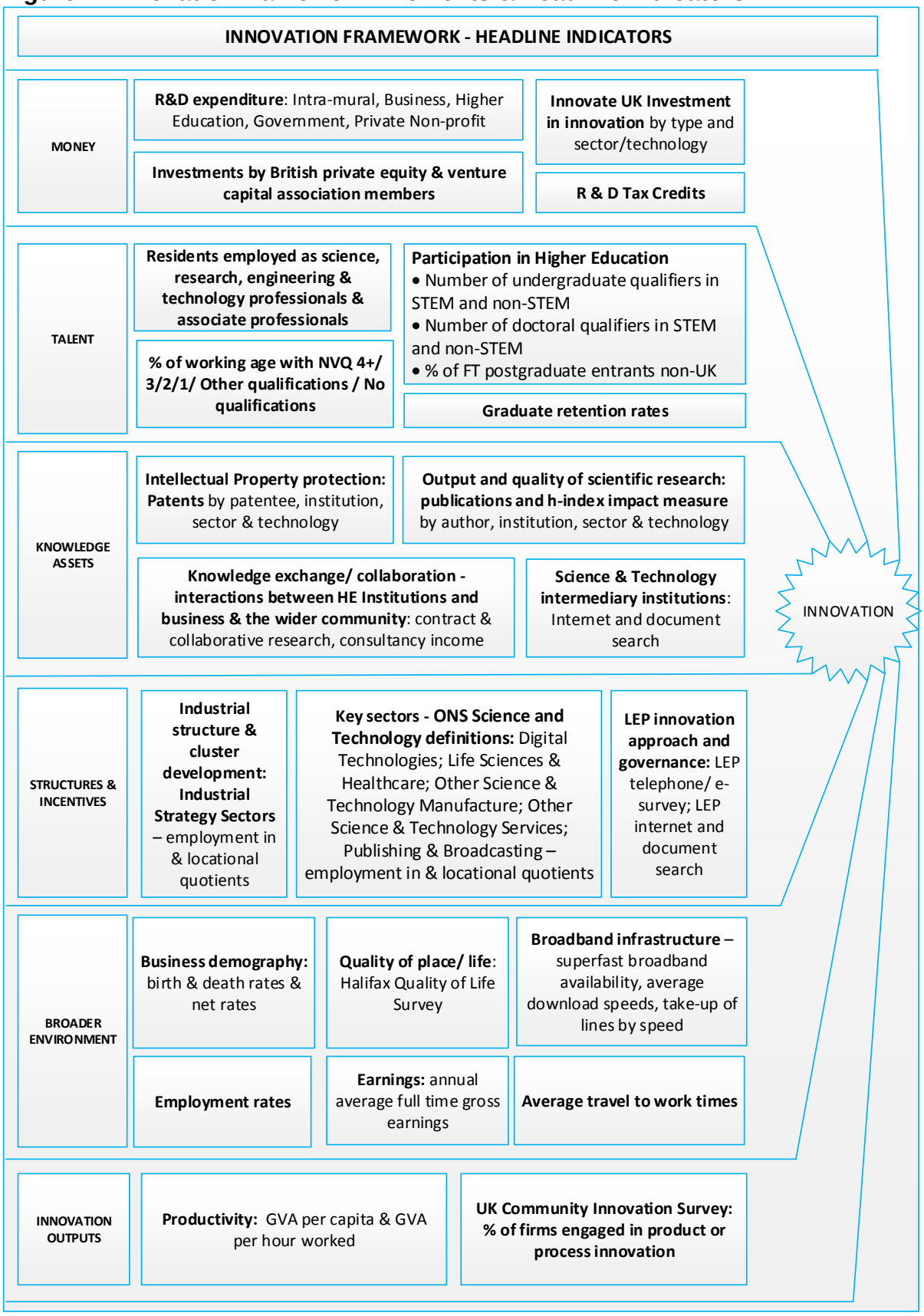
Framework and indicators for gauging local innovation strengths

Having reviewed a number of conceptual frameworks of urban and regional innovation systems, we decided to adopt as our template the six-part framework contained in the Allas report. We preferred it because it was informed by an extensive research programme on innovation, founded upon national policy objectives, and also because of its comprehensiveness, adaptability and way in which it enables benchmarking of local and regional strengths against national and international norms. We initially collected over 50 indicators for the six innovation elements which are available for geographies compatible with LEP boundaries and subsequently narrowed these down to 15 headline indicators on the grounds of manageability, replicability and the fact that the latter capture much of the variance in the remaining, 'secondary' indicators.

Our framework and set of indicators also took into account the views of the two thirds of LEPs who responded to our consultation exercise. The vast majority supported our methodological approach and felt that an improved intelligence base would inform their dialogue with one another and national bodies such as BIS. However, some were concerned about how the metrics would be used and warned against simplistic comparisons of LEPs given different local contexts, boundary issues and the fact that some forms of innovation (e.g. science and technology-related) can be more easily measured and captured than others (e.g. process innovation, low technology, relationships between innovation elements). A number of LEPs suggested additional indicators which we incorporated in the final version of our framework such as venture capital investment, take up of research and development tax credits, graduate retention, business start-ups and deaths, broadband access, speed and take-up.

The constituent elements and indicators of the innovation framework are shown in Figure 1. In each case we have explained why we selected them but also set out their limitations as well as their strengths. We have subsequently collected data for each of the 23 indicators and then presented these either in map form or using scatter plots and histograms along with a brief commentary. Most data used is available on a LEP basis but in a few instances we had to group LEPs together as the data was only available on a less fine grained basis. Using Principal Component Analysis we then explored whether indicators could be combined so as to present a more summative picture either because they were closely related or particularly important. While this did reveal that some headline indicators such as higher level skills, Innovate UK investment and patents were especially important, there was insufficient statistical evidence to suggest that we should combine or weight certain indicators. We therefore resorted to a more basic approach of comparing all 39 LEPs in terms of their headline indicator rankings.

Figure 1: Innovation framework: Elements & headline indicators



The headline indicators – overall picture/summative findings

This report has revealed a very varied picture of local innovation strengths. All LEPs have comparative strengths on some elements and indicators. Some are more marked than others. Some of the enabling factors are more spatially concentrated, others more dispersed. For example, Business Research and Development Expenditure is relatively concentrated while Higher Education Research and Development Expenditure is more evenly spread across the country. The same distinction can be drawn between public and private investment generally. Some LEPs have major clusters of innovative firms in related economic sectors while others have niche advantages in highly specialised sectors of the economy. Some sectors such as construction and health are distributed relatively evenly across the country.

Echoing wider realities of economic geography, London and the South East dominate in terms of many of the key metrics such as business research and development expenditure, equity and venture capital, many categories of Innovate UK investment, proportion of people with higher level qualifications and higher order skills in STEM professions, range of innovative sectors and knowledge assets and innovation outputs such as GVA/hour worked and employment rates. On the other hand, midlands and northern innovation strengths in terms of high value manufacturing are clearly evident, as they attract significant Innovate UK investment, such as for the Catapults.

However, it is clear that some LEPs have more strings to their bow than others as they have strengths across the board. The evidence strongly suggests that some have a more balanced, sustainable innovation system than others. Although London city region LEP areas and third tier city regions in the South East together with mostly neighbouring third tier city region LEP areas in East England and East Midlands score relatively well on many indicators, there are very important outliers in the south west, north west and west midlands. If one analyses high scoring LEPs by type of LEP area, third tier city region LEP areas from a number of regions account for over half of the top third LEP areas, London and London city region LEP areas account for almost a third of them and a couple of second tier city regions taking the remaining places. The more qualitative soft mapping of LEP innovation plans, knowledge assets and LEP innovation groups broadly confirms this picture but some northern LEP areas also excel in terms of governance and networking.

Chapter 5 goes into more detail about the overall picture and also discusses which LEPs possess comparative strengths in terms of the individual headline indicators. Indicators belonging to the money element are discussed in paragraphs 5.8 – 5.11; those gauging talent in 5.12 – 5.16; knowledge assets indicators in 5.17 - 5.19; structures and incentives indicators in 5.20 – 5.24; broader environment indicators in 5.25 – 5.30 and finally, innovation outputs indicators are covered in paragraphs 5.31 – 5.34.

We would counsel that the assembled body of evidence is used with great care. The set of headline indicators presented only provides a partial view of local comparative strengths owing to:

- the shortage of data at LEP level;
- caveats and qualifications about available data;
- the absence of measures for some key innovation factors;
- rapidly changing local contexts which is inevitable given the nature of innovation.

LEPs and partners should therefore in our view be afforded the opportunity to supplement the data with local intelligence.

Avenues for further research

With more time and resource, the analysis in this report could be extended in a number of ways: Inclusion of historic data would provide a greater insight into trajectories and direction of travel and reduce problems associated with year on year data variation. Collection of qualitative data about, for example, membership of key innovation hubs/networks, collaborations, and who sits on key innovation groupings would reveal more about institutional relationships. Data providers could be asked to investigate the feasibility of making regional data available at LEP level. There is scope to disaggregate some data either spatially or by category which would reveal niche strengths that are concealed by broad-brush metrics (e.g. industrial sector; research publication sub-domains).

The data in this report could be presented and analysed very differently depending on the purpose of the exercise. LEPs might wish to benchmark themselves against suitable peers rather than all LEPs or verify and market test particular aspects of their Smart Specialisation Strategy and Innovation plans. The data analysis could also be adapted to inform both local and national investment decisions. LEPs may wish to add other indicators into the mix given their particular make-up and strengths. Spatial referencing and tagging of the data could enable it to be presented in interesting ways at the tap of a button using different visualisation techniques. The data repository could be supplemented with LEPs' own innovation data provided quality control mechanisms are put in place.

We also discovered gaps in understanding which in our view call for further primary research. Some important aspects of the innovation environment such as 'openness,' 'buzz', appeal to young talented workers and international as well as domestic students have proved difficult to define and measure and warrant further investigation. Demand-side measures of innovation are less well developed than supply-side ones. The role of leadership and support for entrepreneurs, different forms of social media and social and public sector innovation at a LEP level also remain under-researched areas.

1. Background

1.1 Introduction

1.1 Science and innovation make a crucial contribution to national productivity gains and economic growth. This has been recognised for some time by national government and other key bodies, hence the growing scrutiny, policy support and investment in innovation-intensive parts of the economy in recent years. The current Government set out its general approach and strategy for promoting innovation some time ago (BIS, 2011) and has since made significant moves to improve the UK innovation system. Tax measures have been introduced to boost R&D; a new network of Catapult Centres is being created to bridge the gap between academia and business to support key sectors and the commercialisation of new technologies. A suite of external reviews (e.g. Wilson (2012) and then Witty (2013) on Universities and economic growth; Hargreaves (2011) on Intellectual Property) have been commissioned and their findings acted upon. Steps have also been taken to improve access to finance, raise skills and promote innovation through public procurement. International benchmarking has led to a better understanding of how the UK performs relative to its peers (Allas, 2014). The Government has just published an action plan setting out how it intends to ensure that science and innovation contribute to economic growth and its priorities in that regard (HMT/BIS, 2014).

1.2 However, by common consent the 'place dimension' to innovation and policy making remains less well understood and policy at that spatial level is less clearly articulated and orchestrated (HMT/BIS, 2014). Many policies and grant regimes have been applied uniformly nationally and are therefore 'spatially blind.' The science, research and innovation policies of local economic development bodies such as Local Enterprise Partnerships (LEP) are rapidly developing but vary in their sophistication. There are many ingredients to the innovation mix and these often vary depending on location. Such patterns can persist as some inputs/assets are more fixed than others, at least in the short term. Some aspects of knowledge production and exploitation are becoming more concentrated. Innovation hotspots invariably contain clusters of related or complementary industries, where the relevant businesses, universities and public bodies collaborate extensively and benefit from a good support infrastructure.

1.3 This report focuses on innovation at the local level, specifically in the 39 LEP areas. It is increasingly acknowledged that 'place' plays an important role in innovation and this is stressed in the Government's recent science and innovation strategy (HMT/BIS, 2014). All innovations happen somewhere, and benefits can result from businesses, infrastructure, and idea-generators clustering together. Innovation at the local level plays a key role in local and regional economic growth. LEPs have been charged by Government to bring together the relevant public, private, voluntary and community bodies in order

to promote economic growth. Innovation is central to many of their strategic growth plans. One of LEP's roles is to direct the use of European Structural and Investment Funds for the period 2013-19, a substantial portion of which - some £600m - relates to research and innovation activities. The European Commission has urged each LEP to adopt a 'smart specialisation' approach – essentially to major on what they are best at in innovation terms and to develop proposals which promote business investment in innovation by strengthening the local innovation ecosystem and local capabilities, supporting supply chains, promoting social innovation and branding. Effective, co-ordinated use of European structural and other funding and public funding requires a good collective understanding by LEPs and their partners of where their comparative strengths lie. This in turn requires a consistent and comprehensive evidence base for each LEP area to enable individual LEPs and their partners to identify both their areas of comparative advantage and also where their peers have complementary strengths and collaboration should be pursued. In the absence of such evidence, there is a risk that LEP plans will duplicate one another and fail to spot opportunities to collaborate with each other as Witty noted in the preliminary stage of his review (Witty, 2013). In his final report Witty recommended that Government should establish an authoritative advisory capacity to advise Government, LEPs and other decision takers on how strongly LEP proposals are based on a sound assessment of comparative advantage and to identify and promote related good practice (Witty, 2014). In response, the Government asked the National Centre for Universities & Business (NCUB) to create an Advisory Hub on Smart Specialisation. The hub will provide both evidence and advice to local policy makers about what is happening around the country and what works. It will also encourage business engagement with local innovation assets and activities and foster improved decision-making.

1.4 Better identification of local innovation strengths also resonates with localism and devolution debates and the common desire shared by LEPs, local authorities and their partners to marshal, capitalise upon and benefit from their local assets as much as possible. Innovation already features in LEPs' Growth Deals and has relevance too for City Deals and emerging City regional deals. Since growth at every level significantly depends on innovating firms, marshalling local innovation potential will be crucial to tackling some of the UK's most serious weaknesses such as sectoral and spatial re-balancing, household debt and public spending pressures (BIS, 2011).

1.5 Many LEPs have made a good start in assembling available evidence and thereby identifying their comparative strengths in the course of preparing Strategic Economic Plans (SEPs) and European Union Strategic Investment Fund (EUSIF) plans. The Witty Review of Universities and Growth also identified and mapped local knowledge assets such as higher education institutions (HEIs) and Catapult centres and sectoral strengths.

1.6 That said the evidence base at local level is at present uneven for a number of reasons. Innovation data are less readily available at a local than regional or national level. LEPs have many responsibilities and limited resources to commission or undertake primary research. Also, LEPs have adopted different approaches to data-gathering which means that the evidence is not readily usable beyond their individual boundaries. There is a lack of a common framework and set of indicators for gauging local innovation strengths that could be applied across the country and used for multiple objectives by multiple users. This research has been commissioned to address this gap.

1.2 The scope and purpose of the research

1.7 The two key requirements for this research are, firstly, to build a framework for evidence of local comparative advantages in innovation and secondly, populate it with the available evidence drawing from existing sources (i.e. without new raw data-gathering). The framework has been designed with two customers in mind: LEPs and BIS policy makers. It should assist local decision makers in LEPs by supplying more evidence about local innovation assets and activities and the connections and relationships between them and also improve their knowledge and understanding of complementary innovation strengths elsewhere in the country, promoting collaboration and knowledge sharing across LEP boundaries. By building up consistent evidence of local comparative strengths, this research should help BIS policy makers to support local growth and innovation and also gain a better understanding of the interplay between national and local innovation and the way in which large scientific infrastructures and policies connect with activity across the country and what different local areas do well.

1.8 This report seeks to achieve the following aims, objectives and outputs (which were specified in the research brief):

Aim

Support both local and national innovation policy by building an evidence base for local comparative advantages in innovation.

Project Objectives

1. Devise a framework for consistent and comparative evidencing of local Innovation strengths at the LEP level, covering the following considerations and tasks:

- Develop a taxonomy of the key components of local innovation – focussing on assets and the connections between them.
- Review existing ways of evidencing these by scrutinising indicators and other sources.
- Develop ways of evidencing each component in the taxonomy and

deciding on the mix of quantitative and qualitative data evidence drawn from indicators and other sources which can be readily updated.
- Ensure the framework is flexible enough to accommodate all sectors/areas, not just the Great Technologies and key industrial strategy sectors which are national priorities.
- Offer guidance on interpreting evidence in the framework.
- Identify areas within the framework where there are evidence gaps or a lack of data.

2. Build the evidence base by populating the framework with evidence of local innovation strengths in principally the Industrial Strategy sectors and the Eight Great Technologies as follows:

- Compile both available evidence and the data required for the framework into a repository.
- As far as is possible using existing quantitative/qualitative data, gather the indicator data for each LEP thereby providing them with a view of their contribution to developing national capability in these areas of strategic importance.

Project Outputs

These were twofold:

1. A report detailing (i) the evidence framework and how it can be interpreted/used, and (ii) summaries of each LEP's performance on each indicator/source across the Industrial Strategy sectors and Eight Great technologies.
2. A compilation of the data used in each indicator/source to enable further analysis by BIS and to feed into the NCUB Advisory Hub observatory.

Methodological approach

1.9 The research methodology is structured around addressing the two core requirements of the research specification: constructing the framework then collecting and analysing the evidence.

Devising an analytical framework for evidencing local strengths

1.10 Since a substantial body of research on defining and measuring innovation has already been conducted at national and international level and to a lesser extent at local and regional level, the first step was to conduct a literature review covering the following themes:

1. Different ways of defining innovation and innovation policy.
2. Why innovation at the local and regional level is important.

3. The factors driving local and regional innovation.
4. Different approaches to conceptualising and measuring local and regional innovation and dealing with the main methodological challenges such as isolating the contribution of innovation to economic performance, apportionment of assets, spill over effects and data limitations.

Constructing a conceptual framework and taxonomy

1.11 Drawing upon the final component of the literature review, the next step was to construct a conceptual framework covering the main elements of local innovation systems, different innovation routes and stages, firm-based perspectives and more systemic approaches, supply and demand aspects. We also looked into practical considerations such as data availability, comprehensiveness, replicability, reliability, accuracy and scope for using proxies (e.g. using alternative sub-regional and regional geographies). Our framework initially comprised a number of innovation elements accompanied by a set of 50 indicators. On the grounds of manageability and at the suggestion of the Project Steering Group, this set was later divided into 15 'headline' indicators and 35 'secondary' indicators. We selected the former using a combination of criteria:

- coverage of the main framework elements and preferably informing more than one;
- ensuring data coverage across industrial sectors, key industrial strategy sectors and the Eight Great Technologies;
- measuring both innovation inputs and outputs;
- revealing finer grain strengths and niches;
- capturing much of the variance of the secondary indicators;
- replicability - capable of being updated reasonably frequently.

1.12 Given the need to ensure that the framework and indicators are both usable and applicable to the principal users' needs, we circulated a draft framework for comment to both the Project Steering Group and also each of the 39 LEPs. 26 LEPs responded to the consultation exercise. Most of them took part in telephone interviews and a minority supplied written responses. In the light of the comments received, we added a few indicators and made adjustments to a handful of others.

Building the evidence base

1.13 The second stage of the research essentially involved populating the conceptual framework using readily available rather than new raw data, presenting it in both tabular and visual form and then analysing it to derive key trends and headline findings. This entailed discovering the most efficient means of collecting the relevant data and then systematically recording the data source, its frequency of publication and time lag before release, and its replicability over time. The data commentary also presents caveats and

qualifications that need to be born in mind when using each dataset along with advice and guidance about how each might be used to best effect, in some cases in conjunction with others. Qualitative information is similarly presented along with details about how it might be used to complement, qualify and add colour to the quantitative data. The data are formatted and presented so as to enable LEPs and BIS to grasp quickly their comparative strengths relative to other LEPs and national norms. Accompanying the data and charts is a brief commentary highlighting where individual LEPs have a comparative advantage and noting any obvious trends and attributes of the LEPs concerned. The raw data listings are presented in the report's appendices both for reference purposes and also the repository. They will also provide a benchmark for future data collection and monitoring.

Report outline

1.14 Chapter 2 discusses different definitions of innovation, why innovation at the local and regional level matters, what drives it and the attempts to conceptualise and measure it at that spatial level. Chapter 3 describes the proposed conceptual framework and indicators, LEPs' views on them and the resulting modifications made and ends by discussing the caveats which need to be born in mind when using the framework and indicators. Chapter 4 presents tables and charts for each indicator together with an accompanying commentary drawing out the headline messages about different LEPs' comparative strengths. Chapter 5 draws together and summarises the main research findings and patterns of comparative advantage. Chapter 6 recommends some potentially fruitful lines of further research.

2. Innovation at the local and regional level

2.1 Introduction

2.1 This chapter sets the scene for the report by briefly discussing what innovation is and why its incidence at the local and regional level matters. It summarises a literature review which discusses more fully definitions of innovation, why it is important and what drives and inhibits it (see Appendix A).

2.2 This report examines the extent of innovation - 'activity that is new in its context, such as implementation of a new or significantly improved product, service or process, a new marketing method or new organisational methods' - at the local and regional level (BIS, 2014b). Innovation is multi-faceted and multi-disciplinary, multi-directional and non-linear, the product of a combination of various assets and also networks and interactions between many players – businesses, universities, research bodies, funders, business support organisations and innovation infrastructure bodies (BIS, 2014). There is overwhelming evidence to suggest that innovation is crucial to long term economic growth – NESTA, for example, has estimated that 63% of productivity growth in the UK in the period 2000-2008 stemmed either directly or indirectly from innovation (NESTA, 2014). There is increasing interest in how best to promote innovation at all spatial levels for macro-economic reasons and also to address different forms of market failure such as investment risk and value capture and how best to maximise diffusion and firms' capacity to absorb novel products and processes.

2.3 Research has shown that a particular area's capacity for innovation depends upon a mix of factors such as its openness and ability to utilise international innovations, local assets such as knowledge institutions, networks and institutional relationships, sectoral mix, presence of clusters, and economic history.

2.2 Why is innovation at the local/regional level important?

2.4 There is growing consensus that innovation and competitiveness are significantly influenced by local and regional conditions and factors (OECD, 2007; Doloreux & Panto, 2004). Regions' prosperity significantly depends upon their capacity to support innovative firms, institutions and people (Council on Competitiveness, 2005). However regions with similar capacity can have very different growth patterns (Asheim and Gertler, 2006). Regions and localities are the locus where companies, their workers, universities and government institutions relate to one another most directly. Proximity

encourages interaction and it is at the regional and local level where firms can gain access relatively easily to specialised infrastructure, educational establishments and skilled people. Innovation activities, factors and drivers are also unevenly distributed and processes of knowledge production, exploitation and accumulation are becoming more concentrated, heightening the significance of location.

2.5 The knowledge economy is concentrated in cities and major urban centres where knowledge businesses and institutions, support services, highly skilled workers are present in abundance and both the demand for and supply of sophisticated goods and services and scope for knowledge and technology spillovers and face-to-face contact is greater. Such concentrations of innovation and knowledge in certain places partly arise because of agglomeration economies – the most relevant in this context are knowledge spillovers, especially tacit knowledge which is context-specific and relies upon proximity and the minimisation of transaction costs (Asheim & Gertler, 2006; Krugman & Venables, 1996).

2.6 Recent research has sought to distinguish and understand better the different types of spillover (the indirect benefits earned by businesses as a result of technology support supplied to the primary beneficiary) and what kinds of support programme and innovation system maximise them (Medhurst et al, 2014). Spillovers can be of three types:

1. market spillovers which are the societal benefits arising from commercialisation of innovation by programme recipients in excess of price paid;
2. knowledge spillovers which refer to the use of knowledge by non-programme beneficiaries;
3. network spillovers which arise from the take-up of innovation by additional users which increases the value of innovation to existing users.

The literature suggests that open innovation systems are more conducive to producing spillovers than closed ones and that many of their most crucial characteristics in that respect vary spatially such as the presence of multi-purpose technologies, nascent and high value added industries, universities and research institutes, close relationships and proximity between actors, good knowledge transmission/exchange mechanisms and high absorptive capacity (Medhurst et al, 2014).

2.7 Evidence of the extent of local knowledge spillovers is mixed and significantly affected by sectoral and institutional characteristics. Firms located in high technology sectors such as computing, biotechnology, aerospace, automobiles, ICT and also finance are more likely to innovate than firms outside the regions where they are concentrated (Bascavusoglu-Moreau & Li, 2013). In some such clusters, there are strong interactions between firms and suppliers, research laboratories and universities, support organisations. Such

local networks are important to the health of firms in the clusters and their capacity to innovate when complemented with national and global networks (Christopherson, Kitson & Michie, 2008). Clusters can act as a hub for attracting global talent and some also promote knowledge diffusion within them through labour mobility and the tacit knowledge that qualified people possess. Where universities feature, their prime role is to act as a conduit for bringing in high quality undergraduate capital into the region (Faggian & McCann, 2006) though university-business interactions are important in some cases.

2.8 Network spillovers occur when innovative goods and services create demand for complementary goods in others sectors or are adapted to other markets. They are also termed regional spillovers as they relate to the locality and proximity of actors in an innovation system. Such spillovers sometimes materialise in creative clusters where creative, high–tech manufacturing and knowledge intensive business industries co-locate and interact through value chain linkages, shared infrastructure and labour mobility (Chapain et al, 2010).

2.9 Despite this concentration of knowledge assets and innovation, the benefits of innovation are widespread due to diffusion processes and different types of spillovers which can occur within a three hour isochrone of the source (Rodriguez-Pose & Crescenzi, 2006). Innovation frequently benefits adopters more than the innovator (NESTA, 2012). Also a combination of disagglomeration economies, decentralisation of some functions and rapidly improving widely available ICT technologies and telecommunications are leading to a growth in private knowledge service employment in smaller centres and rural areas. This suggests that there is plenty of scope for innovation in many localities as some kinds of knowledge intensive services are less subject to agglomeration economies than others (Morris, 2010). Sectoral representation and mix is therefore a key locational factor.

2.10 Local and regional innovation performance varies because the following contributory factors also vary appreciably in quality and quantity (EC, 2014):

- sectoral mix and extent of clustering;
- size structure and presence of large dynamic firms;
- knowledge base: the nature and extent of their local public research institutions, universities, support facilities;
- skill levels;
- availability of public and private funding, venture capital;
- degree of entrepreneurship, business-supportive environment;
- quality of governance and leadership;
- social capital;
- quality of infrastructure.

2.11 Paralleling wider trends, there has been growing interest in regional systems of innovation owing to regional clusters of industrial activity, increasing EU and other policies concerning regional development and the societal challenges regions face (McCann & Ortega-Argiles, 2013). There is no settled definition of such systems but most would agree they constitute actors such as firms, universities and government research bodies which support learning and innovation and the linkages between them which are influenced by policy, governance, institutionalised learning and culture (EC, 2014). The boundaries of innovation system are defined in three main ways: spatially, sectorally and in terms of system activities and functions (Edquist, 2005). However, these systems are not closed and have important relationships with their regional counterparts and also national and supra-national systems of innovation (Asheim & Gertler, 2005). Attempts to define and measure regional systems of innovation have frequently been criticised for their lack of precision and rigour, selection of different factors, overemphasis of the degree to which regional systems are independent of supra-regional systems and inordinate focus on successful cases (EC, 2014). Others have argued that the systems of innovation approach focuses too much on institutions and structures and underplays the role of the individual entrepreneur. They therefore urge that greater emphasis be placed upon the degree to which systems facilitate or constrain entrepreneurship through resource access and mobilisation and associated knowledge accumulation and to that end have developed an entrepreneurial system index (Autio et al, 2012; Acs et al, 2013).

2.12 Summing up, innovation systems and arrangements at the local and regional (in this case Local Enterprise Partnership) level matter. It makes eminent sense for institutions in regional innovation systems to play to their strengths not only to maximise their comparative advantage but also to place those in a regional and national context to identify areas of potential collaboration between institutions and regions and avoid chasing the latest fashions, associated mimicry and also destructive and wasteful competition. NESTA, BIS and others have highlighted national innovation strengths and weaknesses (e.g. world leading businesses and universities and a good business environment versus falling investment in innovation post 2008, comparatively low R&D spend and lack of relevant skills). This research should help reveal more about the local and regional picture.

3. Framework and indicators for gauging local innovation strengths

3.1 The framework

3.1 This chapter discusses our framework for analysing local innovation strengths and our rationale for selecting the indicators for each element. Further details of how we arrived at this framework and set of indicators are discussed in Appendices B and C1. Appendix B reviews previous attempts to measure and conceptualise local and regional innovation. Appendix C1 describes the process of LEP consultation that we undertook to refine our initial proposals into the final framework and set of indicators.

3.2 Having assessed the suitability and robustness of existing conceptual frameworks on urban and regional innovation systems, we concluded that the six-part framework in the Allas report (Table 3.1) provides the best template for this research for the following reasons.

- It was rooted in an extensive research programme on innovation including a major review of academic and other literature and therefore a good understanding of what makes for an effective science and innovation system.
- It is the most comprehensive and up to date and captures most of the other frameworks' content and what they are seeking to measure.
- It was developed to benchmark the national innovation system against its international peers which makes it possible to compare local and regional strengths with national and international norms.
- Since LEPs are seeking to fulfil national policy objectives as well as their own, it seems logical to draw substantially from it.
- It can readily be adapted to gauging local/regional innovation strengths.

Table 3.1: Allas' Six-part framework for benchmarking the UK science and innovation system

1. Money: A key input into all parts of the system, used to invest in infrastructure, new knowledge, absorptive capacity and innovation.

2. Talent: The human capital required to demand, develop, share and exploit new and existing knowledge.

3. Knowledge assets: Intermediary outputs of the system that provide an indicator of its quality and potential and that are relatively easy to measure.

4. Structures and incentives: The institutions and interconnections that determine how effectively the actors in the system work together to generate outcomes.

5. Broader environment: The economic and societal context with which the science and innovation system interacts.

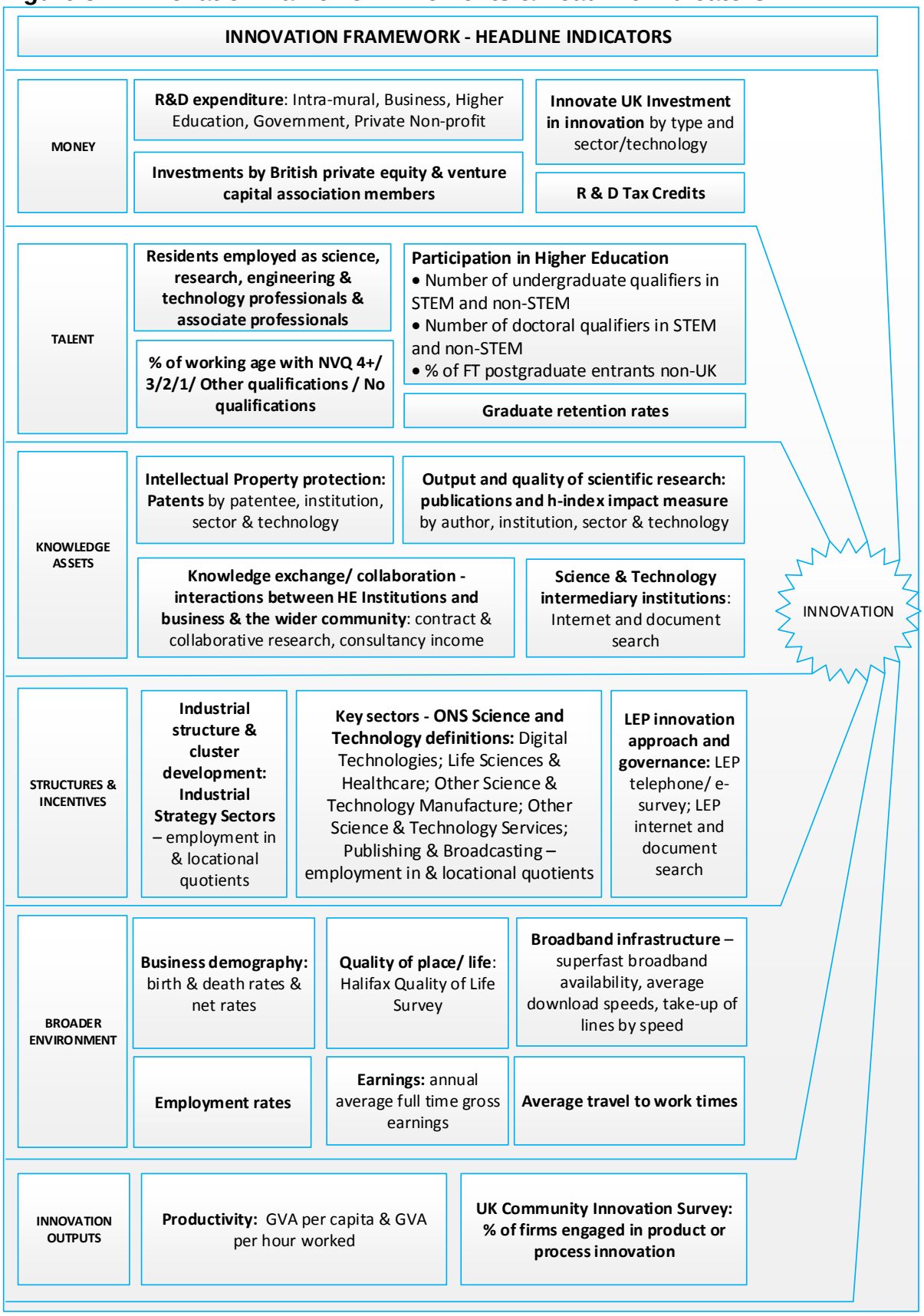
6. Innovation outputs: Measurable outputs that can be used as proxies for the ultimate outcomes sought, i.e. economic and societal benefits.

Source: BIS, 2014a

3.2 Rationale for choice of indicators

3.3 Figure 3.1 shows the 23 headline indicators we have selected for each of the elements of the innovation framework. We now go on to discuss our reasons for selecting them and also the main caveats and qualifications which need to be born in mind when using them.

Figure 3.1: Innovation framework: Elements & headline indicators



Money: Research and development expenditure

3.4 There is significant empirical evidence showing a positive correlation between this proxy for both innovation investment and firm-specific technological progress and labour productivity and economic growth. While studies indicate that spillovers from, and returns on, Research and Development vary by category, there is consensus that they are positive and substantial with rates of return of between 20 and 50% (BIS, 2011; Medhurst et al, 2014). However, its limitations as a measure also need to be born in mind. It is a measure of innovation input rather than output and the UK innovation survey shows that more than half of innovative companies do not perform any R&D. Also, the statistics refer to where the R&D expenditure was incurred which is not necessarily where the R&D is performed as a firm may not handle its financial affairs in the same place as its R&D facilities.

Money: Innovate UK investment

3.5 Innovate UK is a business-led Government partner organisation whose role is to stimulate and accelerate innovation in technologies with the greatest potential for boosting growth and productivity. It is the Government's prime channel for incentivising business-led innovation and allocates all investment of this nature. Funding streams can now be analysed on a LEP basis and this indicator gives a strong indication of local excellence, comparative strength and potential in key technologies and related sectors since grant are awarded on the basis of the quality of applications. This measure indicates the extent of collaboration between business and academia and commercialisation. The database breaks grants down into 17 broad categories and gives figures for both number of participants and size of grant. While the latter is one element of public sector financial support ('money' in the framework') the former is a useful indicator of activity in 'structures and incentives' and 'broader environment'. A number of the grants - including 'fast track' and 'feasibility studies', 'European' and 'collaborative R&D' - are also broken down by Innovate UK's priority investment areas, most of which 'read across' to the 11 industrial strategy sectors and 8 'great technologies.' This linkage will thus allow finer analysis by sector and technology.

3.6 The funding data have been analysed for the first time at LEP level but Innovate UK is careful to emphasise that its grants and those of its predecessor, the Technology Strategy Board, for 'challenge-led' and 'collaborative R&D programmes' grants are awarded on the basis of the quality of applications and not as a result of any geographic allocation. Determined by the needs and opportunities prevailing at the time of the award, the grants are seen by Innovate UK as indicators of quality and potential.

3.7 There are some caveats with using this data. Innovate UK also makes the important point that major investments such as the Catapult Centres are recorded at the location of the recipient of the award but it is important to bear in mind that the Centres are national programmes intended to benefit the UK

and not just the area in which they are located. Their services extend beyond the locality and some have satellites based elsewhere which needs to be recognised in any analysis.

3.8 The usual caveats with company-based data also apply to Innovate UK's database. The location of the grant is based on the address of the company registered for the project and this address may be a registered or head office rather than where the innovation project activity itself is located. And companies may move, change name and their "SME status" may change through growth or acquisition.

Money: Venture capital funding

3.9 Venture capital funding gives a broad indication of which innovators and their business concepts are perceived as having commercial potential. Access to capital is regularly cited as one of the main obstacles to innovation in the Community Innovation Survey.

3.10 The best source of data is the British Private Equity and Venture Capital Association (BVCA) Report on Investment Activity which is compiled annually. This report identifies the location of individual company investments by standard Government Office Region (GORs) rather than LEPs and will therefore conceal sub-regional differences. We know anecdotally, for example, that one of the strengths of the Greater Cambridge and Greater Peterborough innovation system is the access to venture capital provided by the so-called 'Cambridge Angels'. This level of investment will be hidden in the regional average.

Money: Take up of research and development tax credits

3.11 The Government's Research and Development Tax Credit scheme enables both SMEs and large companies to claim tax relief on eligible research and development activities (which are broadly defined as constituting some kind of technological advance).

3.12 HMRC collect data on claims for R&D tax credits but it does have a number of limitations. Claims are based on registered office location which may not be where the actual R&D activity is carried out. Also, claims can be made up to 2 years after the end of an accounting period which may lead to subsequent data revision. A small number of large company claims are not included because of their non-standard format. Not all expenditure on R&D in the UK is used to claim the tax credit, so these statistics do not give a comprehensive account of all R&D activity in the UK. Also the data are not disaggregated below regional level.

Talent: Residents employed as science, research, engineering and technology professionals, associate professionals

3.13 Human capital is a crucial aspect of innovation since many intangible assets such as patents, design, software, research and development are the result of human expertise (BIS, 2011). Studies have shown that higher level skills drive up demand for innovation and also increase the absorptive capacity of firms. Human capital is needed to drive the demand for, develop, share and exploit knowledge (BIS, 2014a). Technology innovation requires the supply of well-trained scientists and engineers especially in high value added manufacturing (BIS, 2011). This indicator reveals the size of the local talent-pool in this key respect.

3.14 This indicator does, however, needs to be used in conjunction with other measures of talent. The extent of innovation hinges upon organisational, managerial and marketing as well as technical skills and the skills mix required depends on industrial sector, innovation stage and type and business model and also extent of foundational skills in the general workforce (BIS, 2011). It is difficult to distinguish which skills drive innovation and which are required as a result of it.

Talent: Percentage of working age with NVQ 4+/3/2/1/Other qualifications/No qualifications

3.15 This indicator is designed to capture the broad range of skills levels in LEP areas in recognition of the fact that successful innovation processes not only require human capital at the high end of educational attainment but also a well-educated population more generally (BIS, 2014a). It therefore complements the other talent indicator. The indicators thus measure both 'push' and 'drag' factors in relation to innovation at local, LEP, level.

3.16 Some of the qualifications about the first talent measure also apply to this one, principally the difficulty in pinpointing exactly which skills a local economy needs in innovation terms.

Talent: Number of undergraduates/ postgraduates/ research-based doctorates

3.17 We have collected HESA data on undergraduates and postgraduate students to highlight the talent-pool of those who are training in higher level qualifications. This is a proxy measure for highly qualified human capital.

Talent: Graduate retention

3.18 We have incorporated graduate retention as an indicator because the degree to which companies employ graduates is an important driver of innovation demand. This indicator also points to the desirability of an area and the local

economy's ability to retain this talent which is a rough proxy for level of, and demand for, innovation in local firms.

3.19 These data have two main downsides. They are only available on a regional basis which obscures intra-regional flows of graduates which may be very significant if a region contains a number of major towns and cities. Secondly, graduate destinations are recorded 6 months following graduation which provides only a snapshot and partial picture of graduate mobility.

Knowledge Assets: Patents – by patentee, institution, sector and technology

3.20 A range of academic research has found that use of patents is associated with better use of knowledge by firms, more knowledge transfer between firms and universities and improved knowledge creation, enhanced prospect of company survival and growth in the case of small firms. These effects have been particularly evident in patent intensive sectors such as aeronautics, pharmaceuticals and biochemistry (BIS, 2011). Using data from the US Patent Office and Espacenet, we are able to ascribe a patent to an inventor, an inventor to an application and both to a LEP.

3.21 However, patents only offer a partial insight into the way in which firms protect their technical innovations. Only 15% of large firms use patents and 7.5% of SMEs do so. Most firms instead rely on secrecy, speed to market and complex designs as means of protection. Also, patents statistics have significant limitations. They are usually registered at head office rather than necessarily the place where the invention was made. They vary greatly in value since studies have shown that the most valuable 0.8% of European patents account for half the value of all patents (BIS, 2011).

Knowledge Assets: Output and quality of scientific research: publications and h-index impact measure

3.22 For many decades, research has been seen as a primary driver of innovation. Publication of research in prestigious journals has been one of the principal means of disseminating the results of ground-breaking research globally. Peer review provides a good acid test of academic rigour, quality and significance. Together with patents which provide a greater insight into the potential commercial value of research, this indicator gives a good insight into the scale and significance of intellectual capital and knowledge in different universities and other research bodies. Using Scopus, University Institutional Repositories and PubMed combined we have extracted information for each journal article on authorship, institutional addresses and subject matter and mapped these to LEP areas. For research quality, we have opted to use an 'h-index' (Hirsch, 2005) which rates and scores published articles according to the ranking of the journals in which they appear, hence giving a broad indication of their citation potential.

3.23 However, it must be remembered that research publications' value in innovation terms varies a lot depending on theme and subject matter. Papers in STEM subjects are usually more significant in this respect though not always due to the unpredictable, cross-cutting nature of innovation. Concerns have been voiced that repeated research assessment exercises have led to an increase in the volume of publications but not a commensurate increase in originality or quality.

Knowledge Assets: Knowledge exchange/ collaboration - interactions between Higher Education Institutions and business and the wider community

3.24 In Chapter 2 we noted that open innovation at every geographical level is crucial to the production of new knowledge and innovation. One key aspect of knowledge exchange at the local level is University-business-community links. The Higher Education Business and Community Interaction Survey (HE-BCI) provides good information on the scale and direction of interactions between Higher Education Institutions and business and the wider community, focusing on interactions with external partners, such as contract and collaborative research, consultancy, continuing professional development, facilities and equipment related services and intellectual property.

3.25 As a self-reporting exercise, the HEB-CI survey is dependent on the accuracy and consistency of data recording by survey respondents. Also it should be noted that some income streams such as intellectual property, collaborative research, and regeneration income can be either highly volatile or subject to the availability of public funds over time (Day and Fernandez, 2015).

Structures and incentives: Industrial structure and cluster development: Industrial Strategy Sectors & Great Technologies

3.26 Given that the literature review showed that some sectors are more innovative than others and that innovation takes different forms in different sectors and that certain types of clusters benefit from knowledge spillovers, it is vitally important to investigate the sectoral strengths of different LEPs using location quotients. To cast light on industrial structure, the presence of key innovative sectors and cluster development we draw upon the analysis of location quotients for the industrial strategy sectors undertaken by the Enterprise Research Centre (Anyadike-Danes et al, 2013). The LQs compare for each LEP area the share of employment in each of the Industrial Strategy Sectors with the corresponding national shares. LQs greater than one in a sector in an individual LEP area indicate a local share of employment higher than the national average proportion of employment in that sector. Location quotients could not be calculated for the Offshore wind sector because of the disclosive nature of the data so ERC mapped instead the location of activities in the sector using company data. ERC is careful to stress that the calculation of LQs is just a first basic step in the process of cluster identification and that the LQ analysis does not capture, for example, the nature and scale of local

supply chains and inter-firm linkages nor does it differentiate between firm types (in terms of scale and ownership and control). The LQ analysis does provide, however, an initial indication of where comparative advantage might lie.

3.27 The main shortcoming with the Business Register and Employment Survey source data concerns the SIC codes used to classify industrial groupings. Some codings are historic and do not reflect the current nature and activities of the businesses concerned.

Structures and incentives: 'Science and Technology' sectors: ONS classification

3.28 In recognition of the lack of a standard classification of 'science and technology' businesses, ONS has recently recommended the adoption of a classification that it has developed for use by the Greater London Authority (Harris, 2015). Its advantage is its use of the UK Standard Industrial Classification that makes it easy to construct. Its main disadvantage is its one-dimensional use of disaggregated economic activity and its inability to include occupational characteristics or the educational qualifications of the workforces in the identified sectors. The classification has five broad sub-categories, which can themselves be further disaggregated into 21 constituent sub-groups.

3.29 The classification covers most of the Industrial Strategy sectors, the exceptions being agri-tech, nuclear and construction. Unlike other 'Science and Technology sector' classifications, which tend to prioritise science and hi-tech-based manufacturing activities, it also usefully includes 'science and technology-based' services including higher education, research and development, architecture, engineering and professional and business services.

Structures and incentives: Collaboration - LEP structures and networks

3.30 As LEPs have responsibilities for promoting economic growth and also drawing up strategies for use of European Structural Funding which contain an innovation element the nature of related structures and networks provide an indication of the sophistication of local innovation systems, principally the extent of networking and collaboration between government bodies, knowledge institutions and the private sector. This ideally requires an extensive institutional mapping exercise covering each of the 39 LEPs which is beyond the scope of this research but for the purposes of this exercise it is possible to construct some crude proxies. These principally include whether LEPs and partners have prepared properly evidenced innovation strategies, have dedicated groups with responsibility for promoting innovation and the degree to which innovation features in their Strategic Economic Plans and European Structural Funding Strategies.

3.31 The major limitation of such 'soft mapping' of LEP structures and networks is its subjectivity. LEP innovation strategies vary in their degree of detail, use of evidence and sophistication and the extent to which they have engaged all key stakeholders. The nature and size of membership of key LEP groupings and related innovation assets does not necessarily mean they have clout and are effective.

Broader environment: Employment rates

3.32 Employment rates are both an indicator of the broader environment and also innovation output. They are not only a pointer to a LEP areas' economic wellbeing and therefore ability to attract labour but also an outcome measure since innovation leads to economic growth and jobs growth, at least in the aggregate and over a period of time.

3.33 This indicator needs to be applied with care. While innovation usually increases productivity it may lead to the loss of jobs in some sectors such as manufacturing and primary industries. It also needs to be analysed in conjunction with other measures such as labour force skills and qualifications and productivity metrics to get at the nature and quality of employment in different LEP areas.

Broader environment: Quality of place/life

3.34 LEP areas' ability to attract and retain highly qualified talent depends primarily upon the nature of their economy and the presence of profitable companies. However, talented people choose to live in places with a good quality of life which in turn reinforces their economic buoyancy and influences the quality of their social and leisure facilities. Most quality of life surveys use a basket of indicators and we have opted to use the Halifax Quality of Life Survey because it is comprehensive, publicly available, is widely used and quoted and presents data on a sufficiently fine-grained basis.

3.35 All quality of life surveys suffer from limitations. There are issues about choice and weighting of individual indicators, difficulty in capturing subjective aspects of quality of life such as 'buzz' and the fact that some entrepreneurs and innovators may be drawn to locations with low overheads which might not rank highly in quality of life terms. The Halifax survey draws in part on Census data which is not frequently updated and therefore may not present an up-to-date picture in those respects. It also includes measures which feature under other framework elements therefore resulting in some double counting.

Broader environment: Transport accessibility - average travel to work times

3.36 The ability of suitably qualified labour to access innovation hubs has a bearing on their appeal, attractiveness and sustainability especially if other factors such as the high cost of housing in neighbouring areas forces employees to

live further afield. This is an acute issue in urban areas which are strong in innovation terms and growing rapidly but are surrounded by the greenbelt such as Cambridge and Oxford. We propose to capture LEP areas' relative accessibility by measuring average travel to work times for each LEP area. We draw upon and re-apportion the latest ONS data which is available for local authority areas.

3.37 Accessibility is difficult to capture in a single measure since commuters use different modes of travel. Global interconnectedness is often vital in terms of knowledge exchange which can make proximity of, and travel times to, international airports a relevant factor too.

Broader environment: Average (mean) earnings

3.38 Average earnings provide a reasonably good proxy for consumer demand for innovation and it is also an output indicator as it relates closely to productivity and economic strength.

3.39 Statisticians advise that median earnings is the best metric to adopt because the distribution of earnings is highly skewed. However, we have had to opt for average earnings because of the need to aggregate local authority-level data on earnings to LEP area level.

Broader environment: Business start-ups, deaths and net change

3.40 We have included business openings and closures data as they provide a good proxy for entrepreneurialism, evidence of innovation and processes of creative destruction.

3.41 ONS uses the Inter-Departmental Business Register to measure births, deaths and net change. To feature in the IDBR database enterprises must be VAT registered, operating a Pay as You Earn (PAYE) scheme or incorporated businesses registered at Companies House. 2.6 million of the UK's 4.8 million private sector businesses were not registered for either VAT or PAYE in 2012. Therefore such data only provide a partial picture of entrepreneurial activity.

Broader environment: Broadband availability, speed and take up

3.42 We concur with those LEPs in more rural areas who argue that broadband access and speed have a potentially significant bearing on the ability of their firms to innovate either through absorption or opening up markets for new products and processes. OFCOM collect comprehensive data on broadband availability, speed and take up.

Innovation outputs: Productivity: GVA per hour worked; & GVA per capita

3.43 As already discussed, both economic theorists and practitioners concur that innovation, productivity and growth are linked hence productivity indicators are an obvious innovation output measure. We propose to collect two measures of productivity. GVA per capita is an indicator of wealth production, controlling in crude terms for size of population. GVA per hour worked is a more precise measure of productivity because it gauges the labour input required to add value to materials and other inputs to producing goods and services. GVA per capita by contrast is not a good measure of productivity or income because it uses a workplace-based numerator and a residence-based denominator and does not take into account of commuting, variations in the number of young people and pensioners and different labour market structures.

Innovation outputs: UK Community Innovation Survey: innovative businesses, turnover, expenditure, exporting, collaboration with universities and other research and development establishments, higher qualifications

3.44 One of the most crucial metrics is gauging to what extent UK businesses are innovating and what form this is taking and its contribution to their turnover. The UKCIS provides the most comprehensive evidence base on this score and its repetition every two years enables key trends to be discerned. Another virtue of UKCIS is that identical surveys are simultaneously carried out in other EU member states permitting national and international benchmarking and comparisons to be made. Due to the work of the Enterprise Research Centre at the Universities of Warwick and Aston, UKCIS data are now available for LEP geographies.

3.45 The main problem with using UKCIS statistics at a highly disaggregated LEP level is that sample sizes may be too small for some datasets to be statistically meaningful as UKCIS was designed as a national survey.

3.46 Table 3.2 presents the complete set of headline indicators together with details of data sources, spatial scale and update frequency.

Table 3.2: Headline indicators – the selection

	Indicator	Source; date; spatial scale; update frequency
Money		
1a	Business enterprise R&D expenditure (BERD)	ONS; 2013; LEP; FOI request
1b	R&D expenditure: Total intra-mural (GERD), Business (BERD), Higher Education (HERD), Government	Eurostat; 2011; NUTS 2 regions; annual

	(GovERD), & Private Non-profit (PNPRD)	
2	Innovate UK (Technology Strategy Board) Investment in innovation by type and sector/technology	Innovate UK (Technology Strategy Board) 2010-15; LEPs; first time data analysed by LEP
3	Investments by British Private Equity and Venture Capital Association Members	BVCA British Private Equity and Venture Capital report on Investment Activity 2013; 2011-13
4	R & D Tax Credits	HMRC; 2012-13; GOR; annual
Talent		
5	Residents employed as science, research, engineering & technology professionals & associate professionals	Annual Population Survey; 2013-14; LEP; Quarterly
6	% of working age with NVQ 4+ and NVQ 3; no qualifications	Annual Population Survey 2013-14; LEP; Quarterly
7	Number of undergraduates: STEM & non-STEM FT postgraduates students: % and number non-UK Number of doctorates: STEM & non-STEM	HESA; 2013-14; institutions mapped to LEPs; annual
8	Graduate retention rates	HESA 'Destination of Leavers from Higher Education' survey; 2012-13; LA & GOR; annual
Knowledge Assets		
9	Intellectual Property protection: Patents by patentee, institution, sector & technology	USPTO and Espacenet; tested up to 31 Oct 2014 to be extended; coverage of US, EU and international patents filed in US or EU territories; inventors addressed to UK postcode level then rolled up to LEP areas
10	Output and quality of scientific research: publications and h-index impact measure by author, institution, sector & technology	Scopus, institutional repositories and PubMed; 1 Jan 2013 to 31 Oct 2014; UK wide coverage.
11	Knowledge exchange/ collaboration - interactions between HE Institutions and business & the wider community: collaborative research, consultancy, and contract research income	Hefce Higher Education Business and Community Interaction Survey (HE-BCI) data; 2012/13; institutions mapped to LEPs; update for 2013/14

12	Science and technology intermediary institutions	Internet and document search
Structures & Incentives		
13	Industrial structure & cluster development: Industrial Strategy Sectors –locational quotients	Enterprise Research Centre analysis of the Business Structure Database; 2012; LEPs
14	Key sectors: ONS Science and Technology definitions: Digital Technologies; Life Sciences and Healthcare; Other Science and Technology Manufacture; Other Science and Technology Services; Publishing and Broadcasting – employment in / locational quotients	Business Register and Employment Survey; 2013; LEPs; annual
15	LEP innovation approach and governance:	LEP telephone/ e-survey; LEP internet and document search; current
Broader Environment		
16	Employment rates	Annual Population Survey; 2013-4; LEPs; quarterly
17	Quality of place/ life	Halifax Quality of Life Survey (Lloyds Banking Group); 2013; local authorities aggregated to LEP; annual
18	Average travel to work times	Annual Population Survey; 2012; LAs aggregated to LEPs; 3 yearly
19	Broadband infrastructure: Superfast broadband availability Average download speeds Take-up of lines by speed	Ofcom; 2014; Local Authority and County data aggregated/ apportioned to LEPs
20	Business demography – birth rates, death rates and net rates	ONS Business Demography; 2012; Local Authorities
21	Annual Average Gross Full Time Earnings, workplace based	Annual Survey of Hours and Earnings; 2013; Local Authorities; annual
Innovation Outputs		
22a	Productivity – GVA per capita	ONS; 2013; LEP; annual
22b	GVA per hour worked	ONS; 2012; NUTS 3; annual
23	UK Community Innovation Survey: % of firms engaged in Product or Process Innovation	UK Community Innovation Survey – Enterprise Research Centre analysis of the UK Innovation Survey 7; 2008-10; LEPs; 2-yearly survey

3.3 LEP area typology

Final caveats regarding the framework – LEP areas face different circumstances and challenges

3.47 There is a need to recognise that LEP areas face very different circumstances and challenges both generally in terms of economic development and specifically regarding innovation. This will fundamentally affect the nature of their innovation inputs and outcomes and comparative strengths. It is also important to place LEP areas in their regional context since many are part of larger travel to work areas or conurbations. Some will gain more or less from knowledge spillovers than others given the nature of their neighbouring LEP areas and broader surroundings. We have therefore produced a broad typology which classifies LEP areas according to their position in the urban hierarchy and degree of urbanisation. The methodology and definitions for the classification are set out in Appendix C2. The classification contains six categories:

1. Capital city LEP area, London (Capital)
2. LEP areas in the London city-region (Lon C-R)
3. LEP areas covering second tier city-regions (2nd Tier)
4. LEP areas covering third tier city-regions (3rd Tier)
5. LEP areas that are urban with a significant rural dimension (Urban-rural)
6. LEP areas that are largely or mainly rural (Rural)

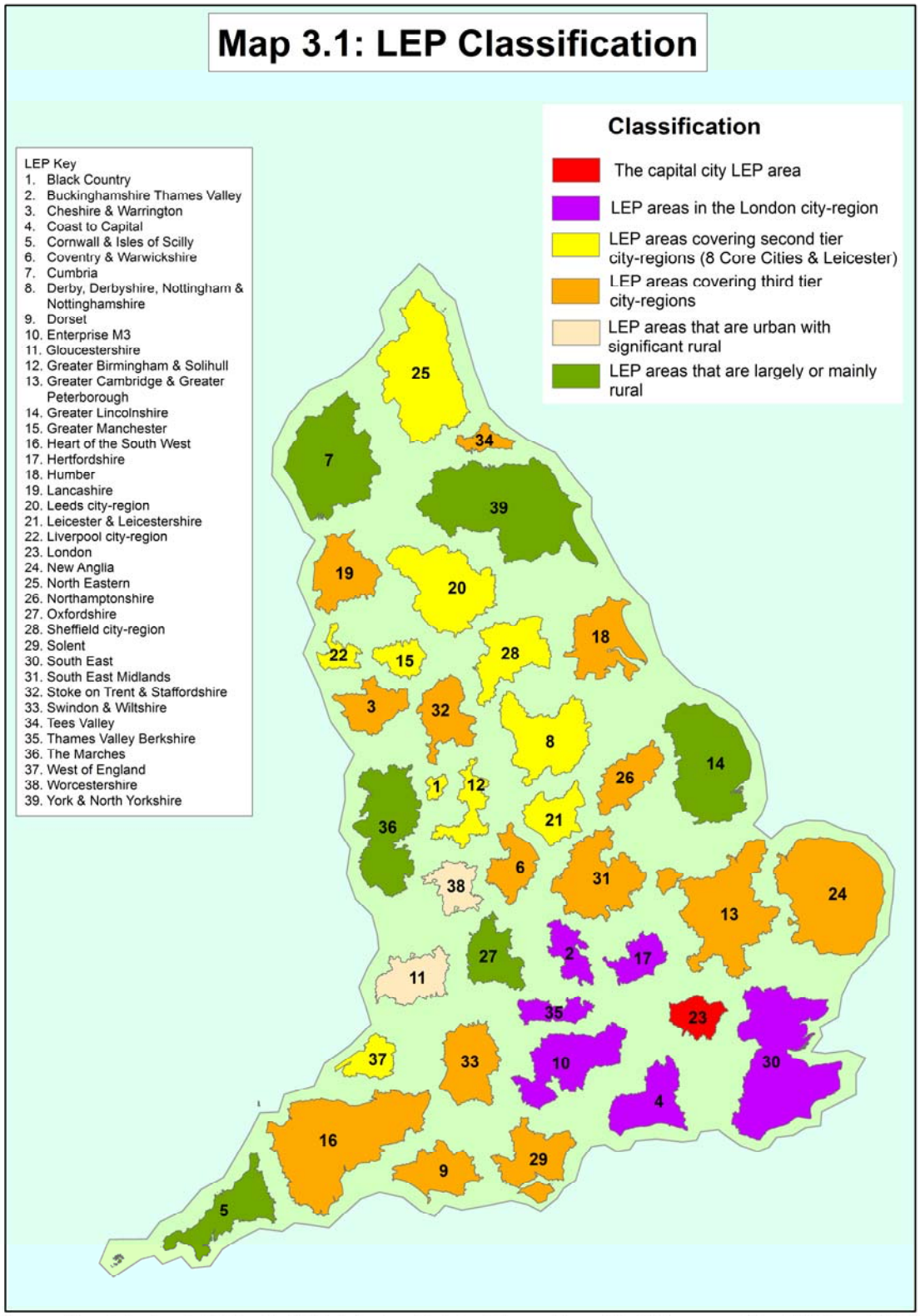
3.48 Table 3.3 and Map 3.1 present the LEP area classification.

Table 3.3: LEP Area Classification

Classification	LEP area
Capital	London
Lon C-R	Hertfordshire
Lon C-R	South East
Lon C-R	Coast to Capital
Lon C-R	Thames Valley Berkshire
Lon C-R	Buckinghamshire Thames Valley
Lon C-R	Enterprise M3
2nd Tier	Black Country
2nd Tier	Greater Manchester
2nd Tier	Liverpool City Region
2nd Tier	Leicester and Leicestershire
2nd Tier	West of England
2nd Tier	Greater Birmingham and Solihull
2nd Tier	North Eastern
2nd Tier	Sheffield City Region
2nd Tier	Derby, Derbyshire, Nottingham and Nottinghamshire,
2nd Tier	Leeds City Region

3rd Tier	Tees Valley
3rd Tier	Dorset
3rd Tier	Lancashire
3rd Tier	Humber
3rd Tier	Coventry and Warwickshire
3rd Tier	Cheshire and Warrington
3rd Tier	Solent
3rd Tier	Stoke-on-Trent and Staffordshire
3rd Tier	New Anglia
3rd Tier	South East Midlands
3rd Tier	Heart of the South West
3rd Tier	Greater Cambridge & Greater Peterborough
3rd Tier	Swindon and Wiltshire
3rd Tier	Northamptonshire
Urban/rural	Worcestershire
Urban/rural	Gloucestershire
Rural	Oxfordshire
Rural	Greater Lincolnshire
Rural	The Marches
Rural	York and North Yorkshire
Rural	Cornwall and the Isles of Scilly
Rural	Cumbria

Source: ONS Mid-Year Population Estimates

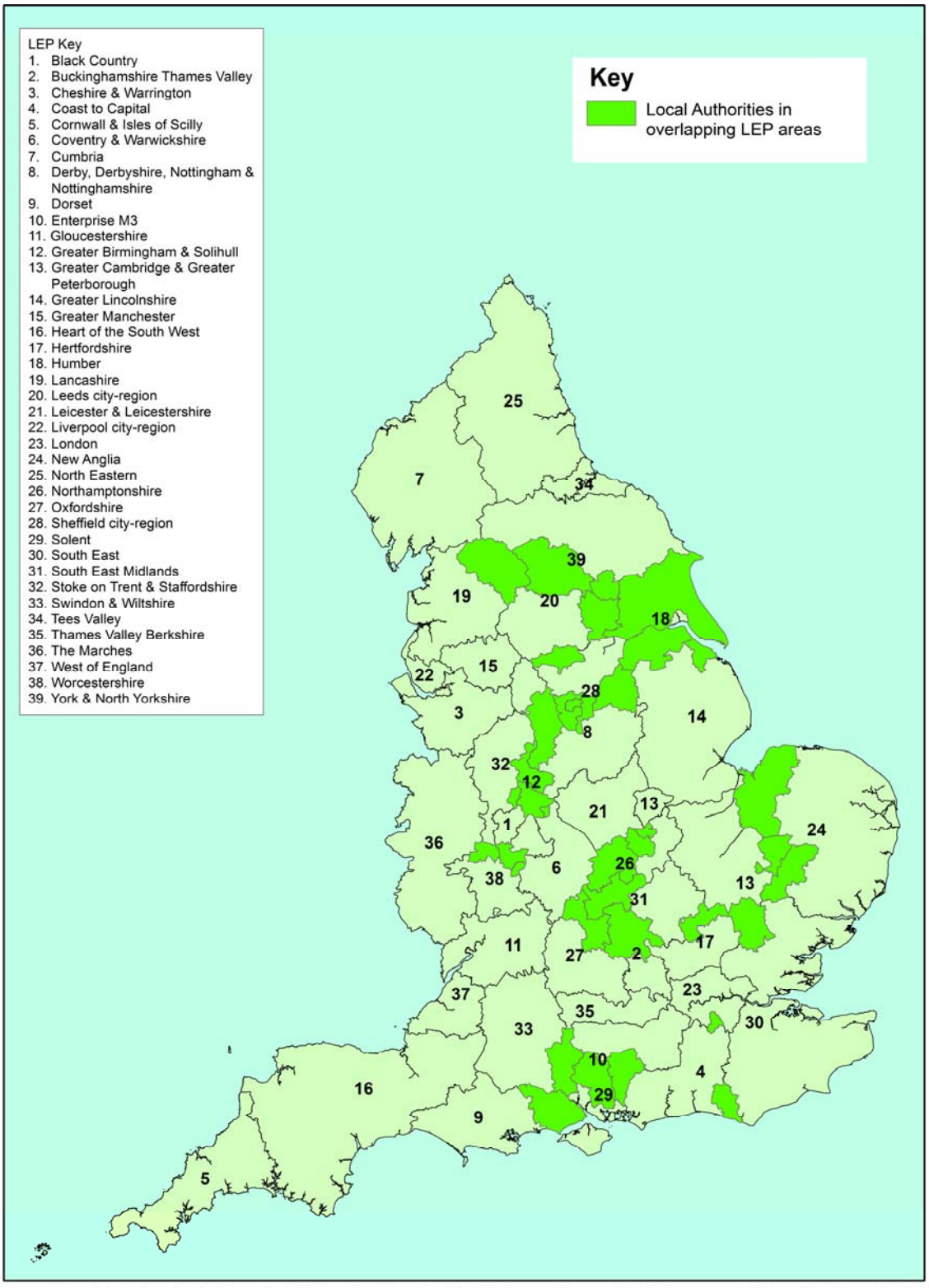


Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015.

3.4 LEP geographies and data collection

3.47 Before presenting the data for the headline indicators for LEP areas, it is important to highlight a key issue relating to the locally-defined LEP area geographies. In numerous instances LEP area boundaries overlap. This is the case for 21 of the 39 LEP areas. 38 Local Authorities fall into two different LEP areas (see Map 3.2). This degree of overlapping boundaries has provoked some debate over the coherence of LEP geographies in terms of governance and particularly economic functionality. In the spirit of localism, the geographies have remained unchanged. They raise issues for our analysis, however. We have to treat each LEP area independently, as emphasised by our 'exploded' maps of the LEP areas in the analysis that follows, but inevitably there is a degree of 'double counting' where LEP areas overlap. Thus for example, data on the University of York's HEI funding are counted both in the York, North Yorkshire and East Riding LEP area total and also in the Leeds city-region LEP area total due to the 'City of York' Local Authority falling within both LEP areas. Data for the LEP areas in total, therefore, exceed the national total. We provide totals for England to provide a national comparison for individual LEP areas but the 'double counting' factor needs to be kept in mind.

Map 3.2: LEP Areas and Overlapping Boundaries



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015.

4. The Headline Indicators

4.1 Money

4.1 We have focused on 4 indicators for the 'money' element of the innovation framework:

- R&D expenditure by four categories (business enterprise, higher education, government and private non-profit);
- Innovate UK's investments in innovation activities by grant;
- private equity and venture capital (regional) investments; and
- R&D (regional) tax credits.

Research and Development Expenditure

4.2 R&D data are reported by four categories, in descending order of size: business enterprise, higher education, government and private non-profit. At sub-national level, the data are also normally reported for NUTS2 regions (30 in England). Thanks to a recent Freedom of Information request, we are able to report here data made available by ONS for business enterprise R&D at LEP area level for the year 2013. Whether this level of analysis will be conducted routinely in future by ONS remains to be seen. For the other three categories and an overall total figure, we have had to use the latest NUTS2 level data for 2012.

Business Enterprise R&D Expenditure

4.3 Business Enterprises spend the most on R&D, together accounting for two thirds of total R&D expenditure in England in 2012. Map 4.1 shows its distribution, as already noted, by LEP area in 2013. A distinct pattern can be seen with the group of LEP areas with the highest totals – above £1 billion – split between a band of LEP areas stretching from Enterprise M3, Thames Valley Berkshire, Hertfordshire and London in the south east to Greater Cambridge and Greater Peterborough in eastern England and two outliers, Coventry and Warwickshire in the midlands and Cheshire and Warrington in the north west. It should be noted, however, that the Cheshire and Warrington spend was dominated by that of a major pharmaceuticals company which has announced its intention to shift its operations to Cambridge, threatening the area's future ranking accordingly.

4.4 Figure 4.1 charts the distribution of LEP areas in relation to business enterprise expenditure on R&D (BERD) showing those with spend greater than and those with spend less than their respective shares of FTE employment (respectively, above and below the line). 16 LEP areas had shares of business enterprise R&D spend above their shares of FTE employment, 23 below.

4.5 All of the group of 'big spenders' stand out in terms of above 'expected' performance in relation to employment share, with the notable exception of the

capital, London. With a 21% share of FTE and an 8% share of BERD, it is located well below the performance line. Other LEP areas with notable above 'expected' performance on BERD include a group of second- and third-tier city-region LEP areas and rural Oxfordshire:

- Derby, Derbyshire, Nottingham and Nottinghamshire (second-tier);
- Solent (third-tier);
- New Anglia (third-tier);
- Swindon and Wiltshire (third-tier); and
- Oxfordshire (rural)

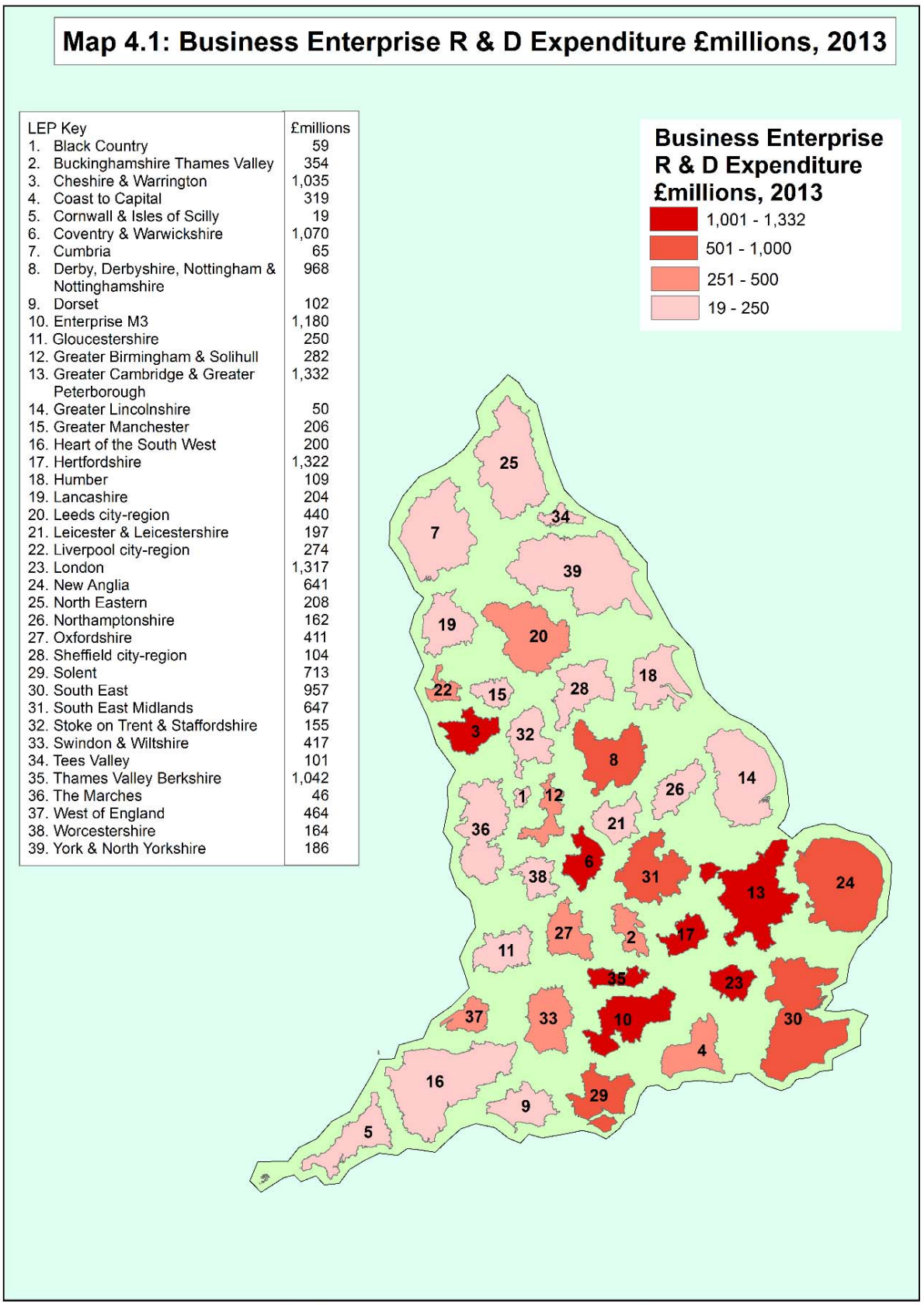
4.6 In addition to London, LEP areas with shares of BERD below what their workforce size might suggest include, notably, three northern core/ second-tier city-region LEP areas: Greater Manchester and the Leeds and Sheffield City Regions.

4.7 Map 4.2 shows BERD expenditure at LEP area level by FTE employment to allow for workforce size. Coventry and Warwickshire, in the West Midlands, has the highest figure, followed by Hertfordshire and Thames Valley Berkshire in the South East and Cheshire and Warrington in the North West (with figures between £2,000 and £3,000). The next group (with figures between £1,000 and £2,000) extends the south eastern band to include Buckinghamshire Thames Valley, Enterprise M3, Swindon and Wiltshire, Oxfordshire and Solent and adds Gloucestershire and West of England in the South West, New Anglia in eastern England and Derby, Derbyshire, Nottingham and Nottinghamshire in the midlands.

4.8 We now turn to the other R&D expenditure categories using, as already explained, the latest NUTS2-level data for 2012. These figures provide the background for the maps which follow and on which we have overlaid LEP boundaries to give some indication of the distribution of R&D spend across LEP areas. It is a complicated geography. Most NUTS2 regions are variously composed of a number of LEP areas, ranging from 1 to 4.

Map 4.1: Business Enterprise R & D Expenditure £millions, 2013

LEP Key	£millions
1. Black Country	59
2. Buckinghamshire Thames Valley	354
3. Cheshire & Warrington	1,035
4. Coast to Capital	319
5. Cornwall & Isles of Scilly	19
6. Coventry & Warwickshire	1,070
7. Cumbria	65
8. Derby, Derbyshire, Nottingham & Nottinghamshire	968
9. Dorset	102
10. Enterprise M3	1,180
11. Gloucestershire	250
12. Greater Birmingham & Solihull	282
13. Greater Cambridge & Greater Peterborough	1,332
14. Greater Lincolnshire	50
15. Greater Manchester	206
16. Heart of the South West	200
17. Hertfordshire	1,322
18. Humber	109
19. Lancashire	204
20. Leeds city-region	440
21. Leicester & Leicestershire	197
22. Liverpool city-region	274
23. London	1,317
24. New Anglia	641
25. North Eastern	208
26. Northamptonshire	162
27. Oxfordshire	411
28. Sheffield city-region	104
29. Solent	713
30. South East	957
31. South East Midlands	647
32. Stoke on Trent & Staffordshire	155
33. Swindon & Wiltshire	417
34. Tees Valley	101
35. Thames Valley Berkshire	1,042
36. The Marches	46
37. West of England	464
38. Worcestershire	164
39. York & North Yorkshire	186



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015; Data from the Office for National Statistics. Map layout by EIUA.

Figure 4.1: LEP area shares of England's Business Expenditure on Research & Development (BERD) compared with shares of England FTE employment, 2013

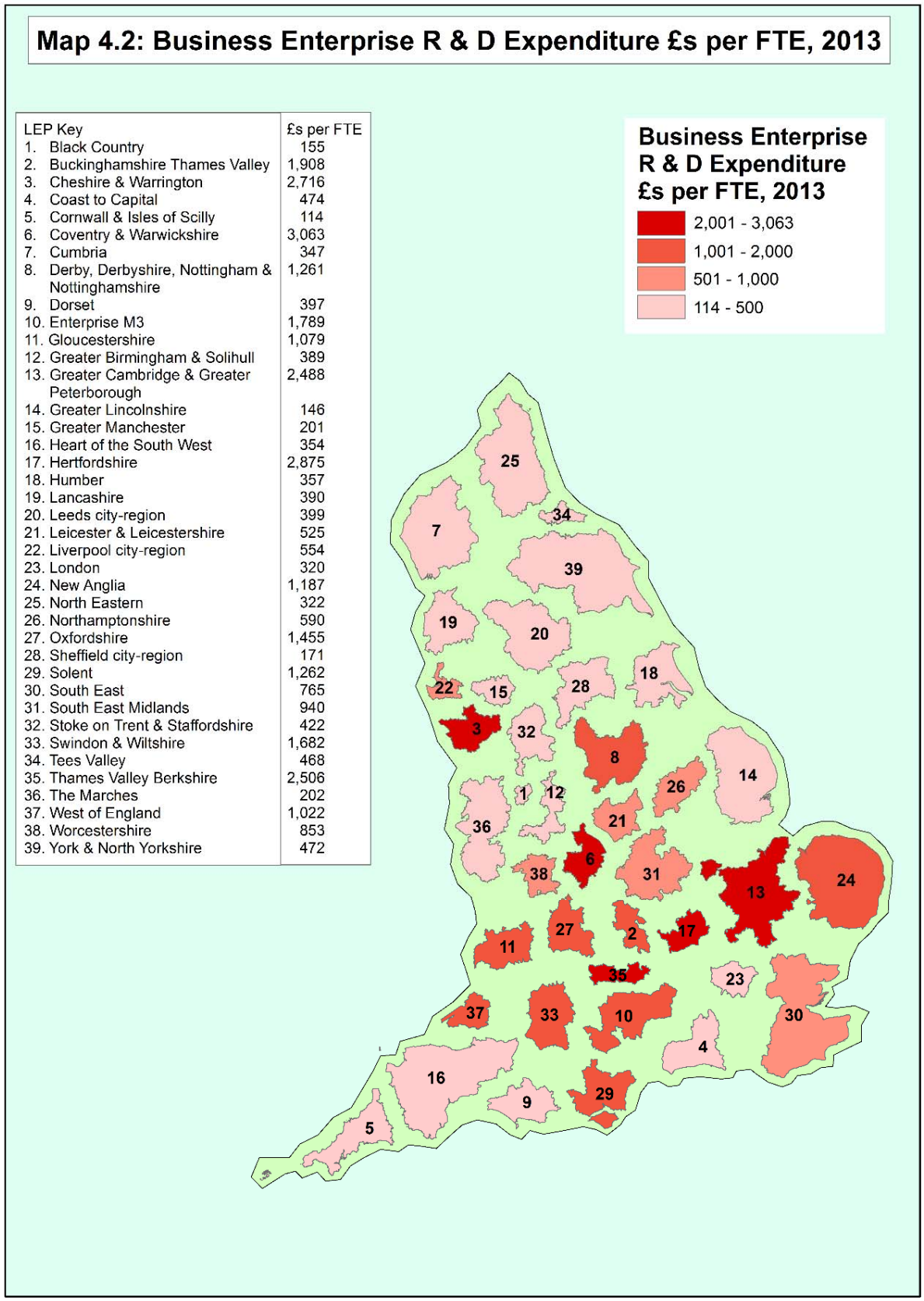
Source: ONS and business register and employment survey; Notes: London has been omitted but with a 20.8% share of FTE and a 7.8% share of BERD, it would appear well below the line.

Key to Figure 4.1

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

Map 4.2: Business Enterprise R & D Expenditure £s per FTE, 2013

LEP Key	£s per FTE
1. Black Country	155
2. Buckinghamshire Thames Valley	1,908
3. Cheshire & Warrington	2,716
4. Coast to Capital	474
5. Cornwall & Isles of Scilly	114
6. Coventry & Warwickshire	3,063
7. Cumbria	347
8. Derby, Derbyshire, Nottingham & Nottinghamshire	1,261
9. Dorset	397
10. Enterprise M3	1,789
11. Gloucestershire	1,079
12. Greater Birmingham & Solihull	389
13. Greater Cambridge & Greater Peterborough	2,488
14. Greater Lincolnshire	146
15. Greater Manchester	201
16. Heart of the South West	354
17. Hertfordshire	2,875
18. Humber	357
19. Lancashire	390
20. Leeds city-region	399
21. Leicester & Leicestershire	525
22. Liverpool city-region	554
23. London	320
24. New Anglia	1,187
25. North Eastern	322
26. Northamptonshire	590
27. Oxfordshire	1,455
28. Sheffield city-region	171
29. Solent	1,262
30. South East	765
31. South East Midlands	940
32. Stoke on Trent & Staffordshire	422
33. Swindon & Wiltshire	1,682
34. Tees Valley	468
35. Thames Valley Berkshire	2,506
36. The Marches	202
37. West of England	1,022
38. Worcestershire	853
39. York & North Yorkshire	472



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015; Data from the Office for National Statistics. Map layout by EIUA.

Higher Education R&D Expenditure

4.9 Higher Education institutions account for the second largest amount of R&D expenditure, 24% of the total R&D spend in England in 2012. Map 4.3 shows the geographical distribution of Higher Education R&D expenditure (HERD) by FTE. Three NUTS2 regions have the highest spend (with figures between £500 and £750):

- Berkshire, Buckinghamshire and Oxfordshire (Buckinghamshire Thames Valley, Oxfordshire, South East Midlands and Thames Valley Berkshire LEPs);
- Inner London (part London LEP);
- East Anglia (Greater Cambridge & Greater Peterborough and New Anglia LEPs).

4.10 (Inner) London's second-placed ranking in HERD spend per FTE contrasts markedly with its relatively low ranking in its BERD performance (where London as a whole ranked 33rd in the LEP area ranking in 2013). London's comparative advantage in R&D spend very much lies with its universities. Also, in contrast to the pattern of BERD, the next relatively high level of HE spend (with figures between £250 and £500) is found in a grouping of northern and midlands NUTS2 regions and their constituent LEP areas:

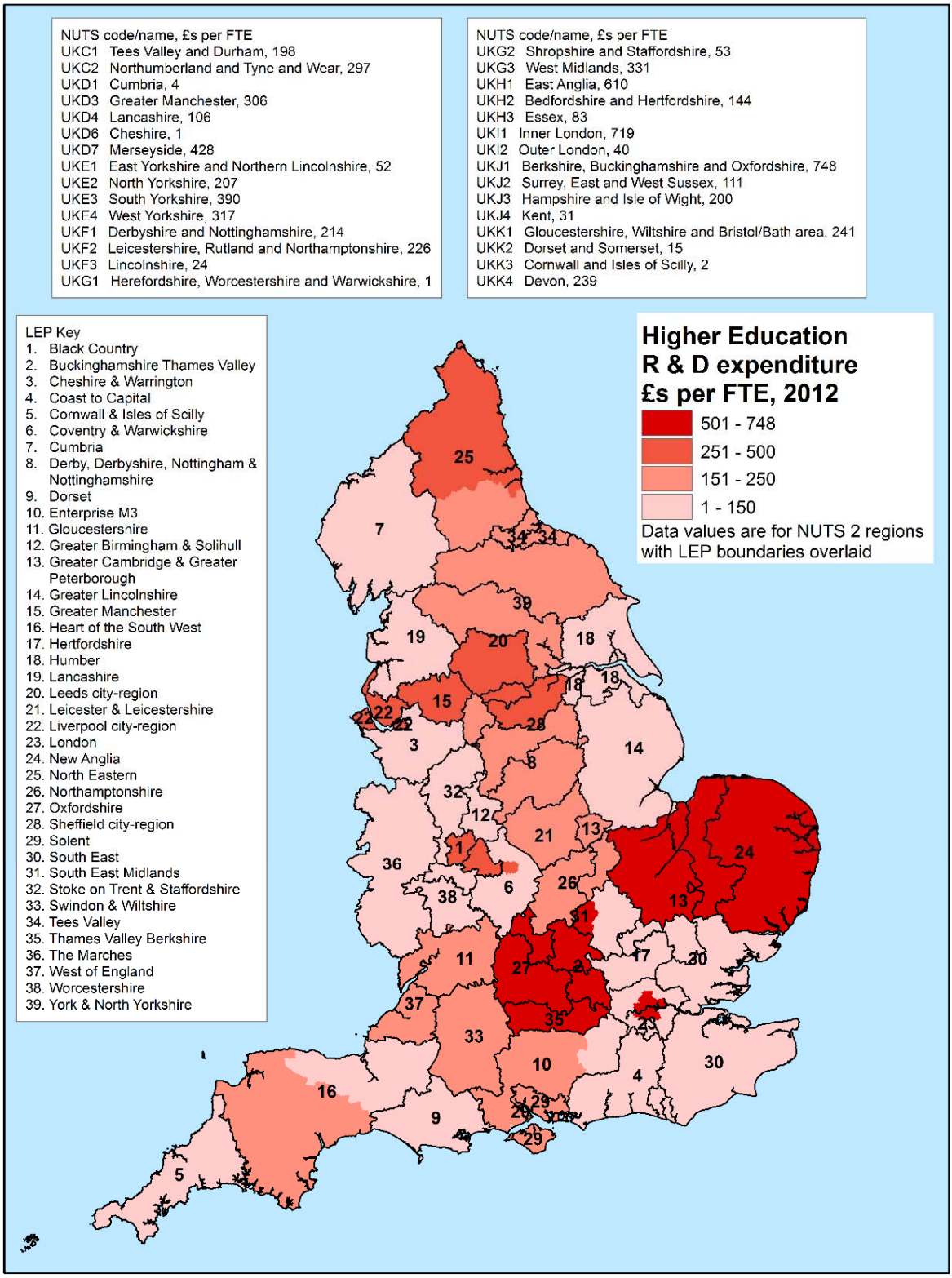
- Merseyside (Liverpool City Region);
- South Yorkshire (Sheffield City Region and small part Leeds City Region);
- West Midlands (parts Greater Birmingham and Solihull, Black Country and Coventry and Warwickshire LEP areas);
- West Yorkshire (Leeds City Region);
- Greater Manchester (Greater Manchester LEP area);
- Northumberland and Tyne and Wear (North Eastern LEP area).

4.11 There is a relatively more even geographical balance of HERD spend than is the case for BERD and this more even balance can also be seen in Figure 4.2, which charts the difference between regional shares of FTE and total HERD spend, even though there are only 8 NUTS2 regions with shares of spend above their workforce shares. In terms of above 'expected' performance in relation to employment share, the following regions and LEP areas stand out:

- Inner London (London LEP);
- Berkshire, Buckinghamshire and Oxfordshire (parts Buckinghamshire Thames Valley, Oxfordshire, South East Midlands and Thames Valley Berkshire LEPs);
- East Anglia (parts Greater Cambridge & Greater Peterborough and New Anglia LEPs).

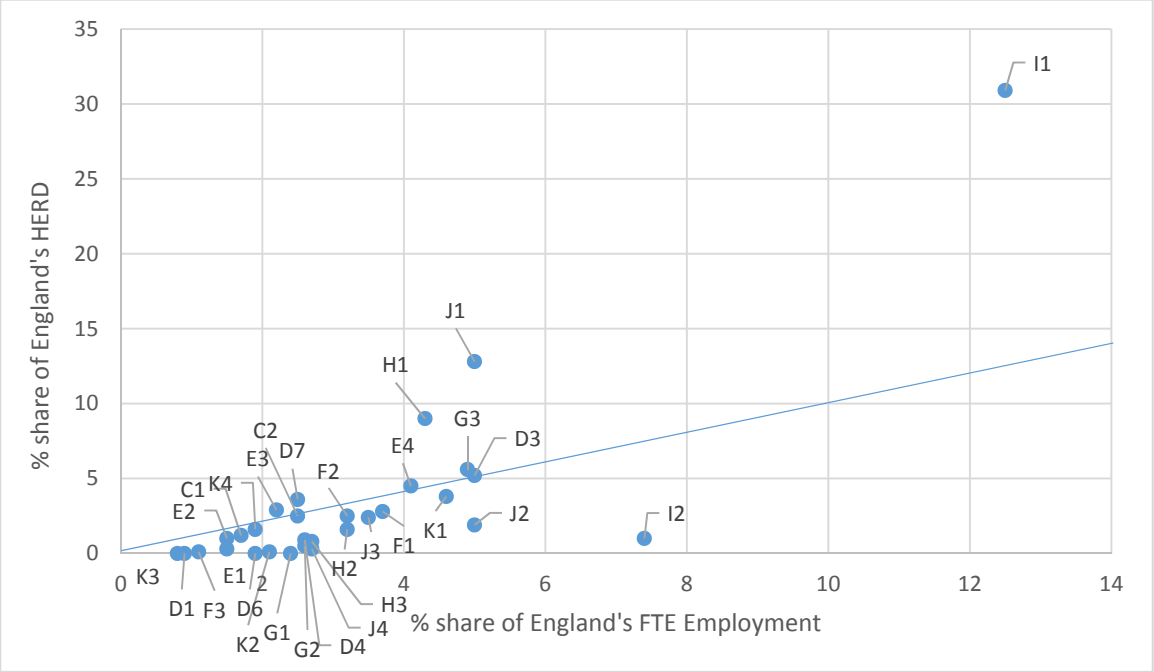
4.12 Outer London (London LEP and part Coast to Capital LEP area) has a share of HERD well below what its workforce size would suggest along with, notably, Surrey, East and West Sussex (parts Coast to Capital, Enterprise M3 and South East LEP areas).

Map 4.3: Higher Education R & D Expenditure £s per FTE, 2012



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Eurostat: Higher Education R & D expenditure (HERD), data are estimated; & business register and employment survey.
Notes: R & D expenditure data are NUTS 2 based. Map layout by EIUA.

Figure 4.2: NUTS 2 – Shares of England's Higher Education R&D Expenditure (HERD) and Shares of England's FTE Employment, 2012



Source: Eurostat and business register and employment survey. Note: HERD data are estimated.

Key to Figure 4.2: NUTS 2 code match to LEPs (with LEP's share of NUTS 2's FTE Employment 2012)

NUTS 2 code	LEP name	NUTS 2 code	LEP name
C1	Tees Valley (61%) North Eastern (39%)	G3	Greater Birmingham and Solihull (50%) Black Country (38%) Coventry and Warwickshire (12%)
C2	North Eastern (100%)		
D1	Cumbria (100%)	H1	New Anglia (62%) Gtr. Cambridge & Gtr. Peterborough (51%)
D3	Greater Manchester (100%)		
D4	Lancashire (100%)	H2	Hertfordshire (69%) South East Midlands (31%) Gtr. Cambridge & Gtr. Peterborough (6%)
D6	Cheshire and Warrington (100%)		
D7	Liverpool City Region (100%)		
E1	Humber (100%) Greater Lincolnshire (37%) York, North Yorkshire & East Riding (31%)	H3	South East (100%) Gtr. Cambridge & Gtr. Peterborough (6%)
		I1	London (100%)
E2	York, North Yorkshire & East Riding (100%) Leeds City Region (67%)	I2	London (100%) Coast to Capital (6%)
E3	Sheffield City Region (100%) Leeds City Region (14%)	J1	Thames Valley Berkshire (41%) Oxfordshire (28%) South East Midlands (25%) Buckinghamshire Thames Valley (18%)
E4	Leeds City Region (100%)		
F1	Derby, Derbyshire, Nottingham & Nottinghamshire (100%) Sheffield City Region (21%)	J2	Coast to Capital (57%) Enterprise M3 (32%) South East (14%)
F2	Leicester and Leicestershire (56%) Northamptonshire (42%) South East Midlands (34%) Gtr. Cambridge & Gtr. Peterborough (2%)	J3	Solent (80%) Enterprise M3 (48%)
		J4	South East (100%)
F3	Greater Lincolnshire (100%)	K1	West of England (48%) Swindon and Wiltshire (27%) Gloucestershire (25%)
G1	Coventry and Warwickshire (47%) Worcestershire (40%) Greater Birmingham and Solihull (18%) The Marches (13%)	K2	Dorset (59%) Heart of the South West (41%)
G2	Stoke-on-Trent and Staffordshire (69%) The Marches (31%) Greater Birmingham and Solihull (25%)	K3	Cornwall and Isles of Scilly (100%)
		K4	Heart of the South West (100%)

Notes: % shares of each NUTS 2's FTE employment can exceed 100% due to overlapping LEP boundaries; see map 4.3 for NUTS 2 names in full.

Government R&D Expenditure

4.13 Government R&D expenditure (GovERD) accounted for some 8% of total R&D spend in England in 2012. Map 4.4 shows the distribution of GovERD by FTE. The highest figures (between £250 and £370) are centred on a grouping of LEP areas in NUTS2 regions in the south west and south stretching from parts of the West of England, Gloucestershire, Oxfordshire through Buckinghamshire Thames Valley, Swindon and Wiltshire, Thames Valley Berkshire to Enterprise M3 and Solent LEP areas. The next grouping (with figures between £150 and £250) is more widely spread. In the south, levels of spend in the South East (Kent) LEP area is matched in parts of Greater Cambridge and Greater Peterborough in East Anglia and in York and North Yorkshire with its overlapping Leeds City Region in the north.

4.14 Figure 4.3 charts the distribution of NUTS2 regions' employment share in relation to GovERD. 7 regions had shares above their shares of FTE employment, 23 below.

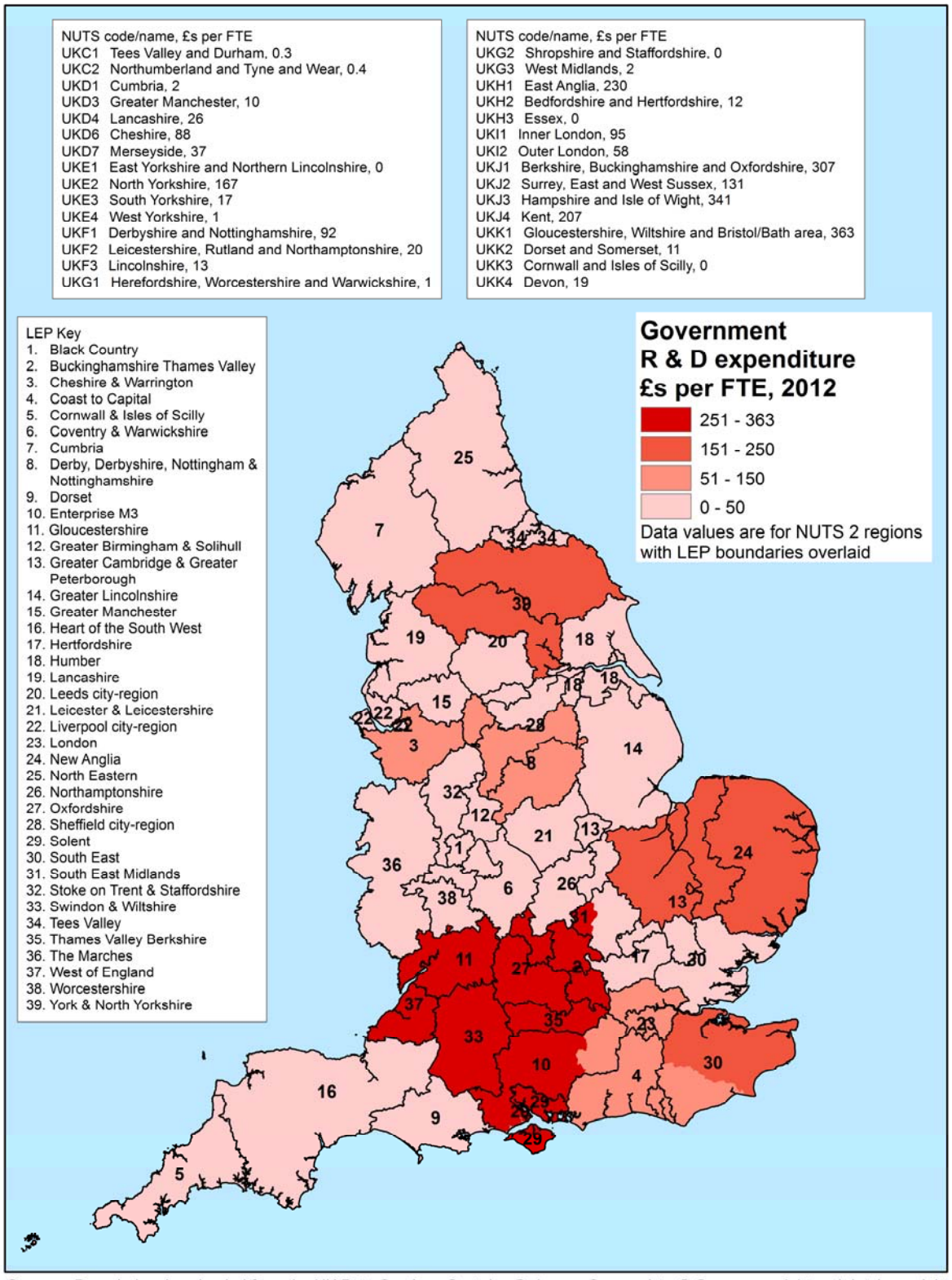
4.15 In terms of above 'expected' performance in relation to employment share, the following regions and LEP areas stand out:

- Gloucestershire, Wiltshire and Bristol/Bath area (parts Gloucestershire, Swindon and Wiltshire and West of England LEP areas);
- Berkshire, Buckinghamshire and Oxfordshire (parts Buckinghamshire Thames Valley, Oxfordshire, South East Midlands and Thames Valley Berkshire LEP areas);
- Hampshire and Isle of Wight (parts Enterprise M3 and Solent LEP areas);
- East Anglia (parts Greater Cambridge & Greater Peterborough and New Anglia LEP areas).

4.16 Inner London has a share of GovERD on a par with its workforce size but Outer London share is below what would be 'expected'. Other regions and LEP areas with shares of government R&D expenditure below what their workforce size might suggest include, notably:

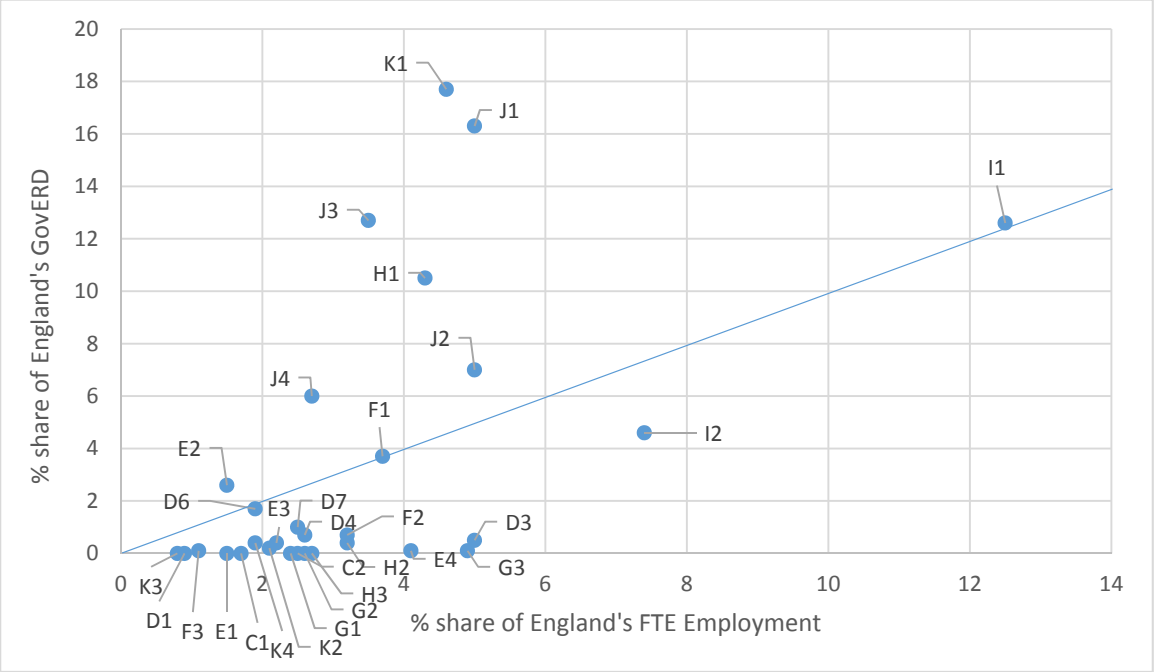
- Greater Manchester (Greater Manchester LEP area);
- West Midlands (parts Black Country, Coventry and Warwickshire and Greater Birmingham and Solihull LEP areas);
- West Yorkshire (Leeds City Region LEP area).

Map 4.4: Government R & D Expenditure £s per FTE, 2012



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Eurostat: Total intramural R&D expenditure (GERD) by sectors; & business register and employment survey; Notes: R & D expenditure data are NUTS 2 based. Map layout by EIUA.

Figure 4.3: NUTS 2 – Shares of England's Government R&D Expenditure (GovERD) and Shares of England's FTE Employment, 2012



Source: ONS and business register and employment survey

Key to Figure 4.3: NUTS 2 code match to LEPs (with LEP's share of NUTS 2's FTE Employment 2012)

NUTS 2 code	LEP name	NUTS 2 code	LEP name
C1	Tees Valley (61%) North Eastern (39%)	G3	Greater Birmingham and Solihull (50%) Black Country (38%) Coventry and Warwickshire (12%)
C2	North Eastern (100%)		
D1	Cumbria (100%)	H1	New Anglia (62%) Gtr. Cambridge & Gtr. Peterborough (51%)
D3	Greater Manchester (100%)		
D4	Lancashire (100%)	H2	Hertfordshire (69%) South East Midlands (31%) Gtr. Cambridge & Gtr. Peterborough (6%)
D6	Cheshire and Warrington (100%)		
D7	Liverpool City Region (100%)		
E1	Humber (100%) Greater Lincolnshire (37%) York, North Yorkshire & East Riding (31%)	H3	South East (100%) Gtr. Cambridge & Gtr. Peterborough (6%)
		I1	London (100%)
E2	York, North Yorkshire & East Riding (100%) Leeds City Region (67%)	I2	London (100%) Coast to Capital (6%)
E3	Sheffield City Region (100%) Leeds City Region (14%)	J1	Thames Valley Berkshire (41%) Oxfordshire (28%) South East Midlands (25%) Buckinghamshire Thames Valley (18%)
E4	Leeds City Region (100%)		
F1	Derby, Derbyshire, Nottingham & Nottinghamshire (100%) Sheffield City Region (21%)	J2	Coast to Capital (57%) Enterprise M3 (32%) South East (14%)
F2	Leicester and Leicestershire (56%) Northamptonshire (42%) South East Midlands (34%) Gtr. Cambridge & Gtr. Peterborough (2%)	J3	Solent (80%) Enterprise M3 (48%)
		J4	South East (100%)
F3	Greater Lincolnshire (100%)	K1	West of England (48%) Swindon and Wiltshire (27%) Gloucestershire (25%)
G1	Coventry and Warwickshire (47%) Worcestershire (40%) Greater Birmingham and Solihull (18%) The Marches (13%)	K2	Dorset (59%) Heart of the South West (41%)
G2	Stoke-on-Trent and Staffordshire (69%) The Marches (31%) Greater Birmingham and Solihull (25%)	K3	Cornwall and Isles of Scilly (100%)
		K4	Heart of the South West (100%)

Note: % shares of each NUTS 2's FTE employment can exceed 100% due to overlapping LEP boundaries; see map 4.4 for NUTS 2 names in full.

Private Non-Profit R&D Expenditure

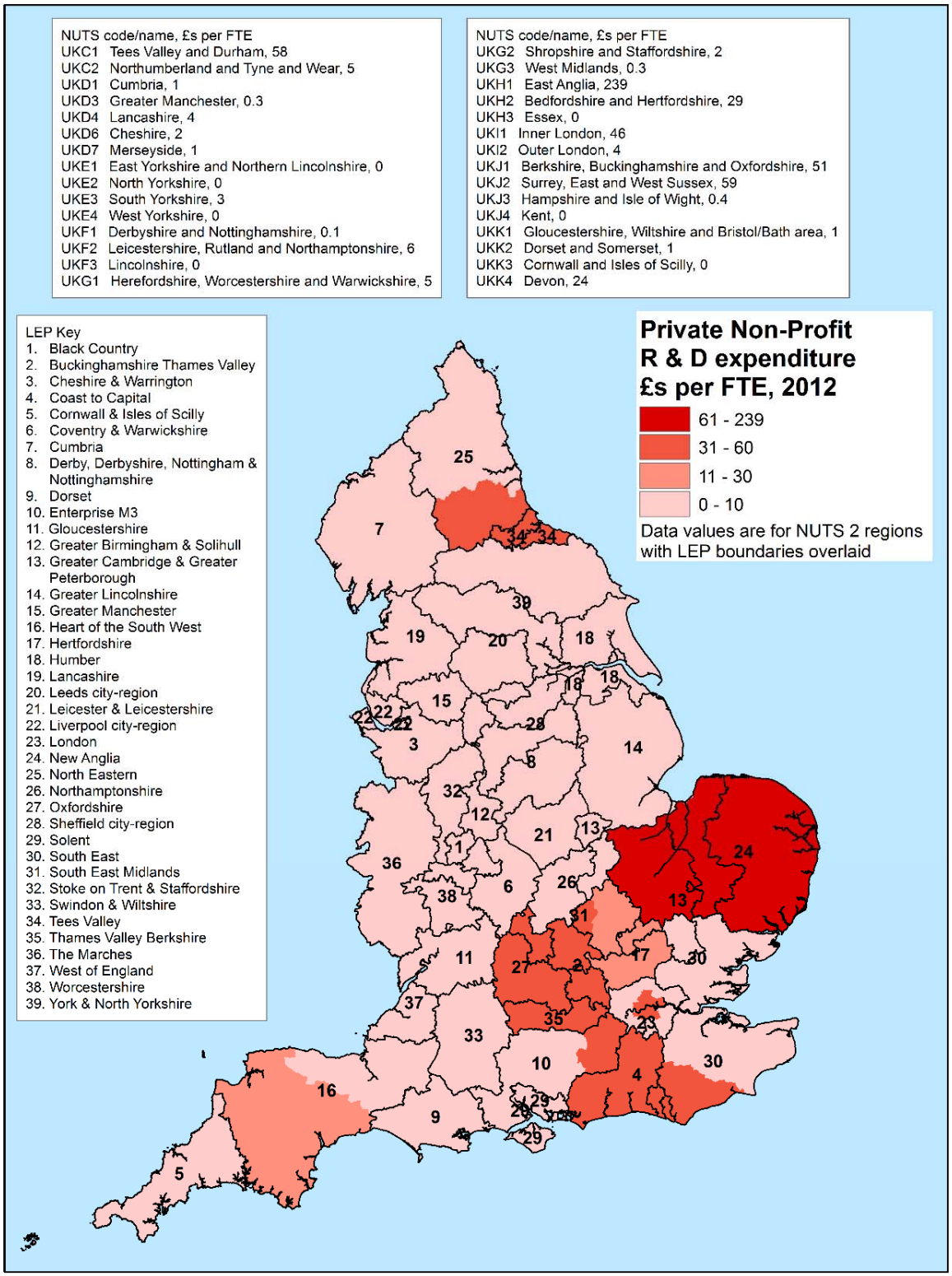
4.17 The final category of R&D spend is the much smaller amounts accounted for by third sector private non-profit organisations, which together accounted for 2% of total R&D spend in England in 2012. Map 4.5 shows the distribution of private non-profit expenditure on R&D by FTE. East Anglia (part Greater Cambridge and Greater Peterborough and New Anglia LEP areas) has by far the highest spend (£239) nearly four times that of each of the next regional grouping of LEP areas: Surrey, East and West Sussex (parts Coast to Capital, Enterprise M3 and South East LEP areas) and Berkshire, Buckinghamshire and Oxfordshire (parts of the Buckinghamshire and Berkshire Thames Valley, Oxfordshire and South East Midlands LEP areas) in the south and Tees Valley and Durham (parts North Eastern and Tees Valley LEP areas) in the north.

4.18 Figure 4.4 charts the distribution of NUTS2 regions by shares of FTE and expenditure on R&D by private non-profit organisations. Only 6 regions had shares above their shares of FTE employment, 24 below.

4.19 Of these 6, the ones that stand out are:

- East Anglia (parts Greater Cambridge & Greater Peterborough and New Anglia LEP areas);
- Surrey, East and West Sussex (parts Coast to Capital, Enterprise M3 and South East LEP areas); and
- Inner London.

Map 4.5: Private Non-Profit R & D Expenditure £s per FTE, 2012



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Notes: R & D expenditure data are NUTS 2 based. Map layout by EIUA.

Figure 4.4: NUTS 2 – Shares of England's Private Non-Profit sector R&D Expenditure (PNPRD) and Shares of England's FTE Employment, 2012

Source: Eurostat and business register and employment survey; Note: PNPRD data are estimated.

Key to Figure 4.4: NUTS 2 code match to LEPs (with LEP's share of NUTS 2's FTE Employment 2012)

NUTS 2 code	LEP name	NUTS 2 code	LEP name
C1	Tees Valley (61%) North Eastern (39%)	G3	Greater Birmingham and Solihull (50%) Black Country (38%) Coventry and Warwickshire (12%)
C2	North Eastern (100%)		
D1	Cumbria (100%)	H1	New Anglia (62%) Gtr. Cambridge & Gtr. Peterborough (51%)
D3	Greater Manchester (100%)		
D4	Lancashire (100%)	H2	Hertfordshire (69%) South East Midlands (31%) Gtr. Cambridge & Gtr. Peterborough (6%)
D6	Cheshire and Warrington (100%)		
D7	Liverpool City Region (100%)		
E1	Humber (100%) Greater Lincolnshire (37%) York, North Yorkshire & East Riding (31%)	H3	South East (100%) Gtr. Cambridge & Gtr. Peterborough (6%)
		I1	London (100%)
E2	York, North Yorkshire & East Riding (100%) Leeds City Region (67%)	I2	London (100%) Coast to Capital (6%)
E3	Sheffield City Region (100%) Leeds City Region (14%)	J1	Thames Valley Berkshire (41%) Oxfordshire (28%) South East Midlands (25%) Buckinghamshire Thames Valley (18%)
E4	Leeds City Region (100%)		
F1	Derby, Derbyshire, Nottingham & Nottinghamshire (100%) Sheffield City Region (21%)	J2	Coast to Capital (57%) Enterprise M3 (32%) South East (14%)
F2	Leicester and Leicestershire (56%) Northamptonshire (42%) South East Midlands (34%) Gtr. Cambridge & Gtr. Peterborough (2%)	J3	Solent (80%) Enterprise M3 (48%)
		J4	South East (100%)
F3	Greater Lincolnshire (100%)	K1	West of England (48%) Swindon and Wiltshire (27%) Gloucestershire (25%)
G1	Coventry and Warwickshire (47%) Worcestershire (40%) Greater Birmingham and Solihull (18%) The Marches (13%)	K2	Dorset (59%) Heart of the South West (41%)
G2	Stoke-on-Trent and Staffordshire (69%) The Marches (31%) Greater Birmingham and Solihull (25%)	K3	Cornwall and Isles of Scilly (100%)
		K4	Heart of the South West (100%)

Note: % shares of each NUTS 2's FTE employment can exceed 100% due to overlapping LEP boundaries; see map 4.5 for NUTS 2 names in full.

Total R&D Expenditure

4.20 To get a picture of total R&D expenditure across all four spend categories, we present the NUTS2-level data for 2012. For completeness, we have included the NUTS2 data for BERD in Appendix D (D1).

4.21 Map 4.6 shows the distribution of total R&D expenditure by NUTS2 regions and their constituent LEP areas. Three regions dominate, with figures between £2 billion and £3.1 billion:

- Inner London
- Berkshire, Buckinghamshire and Oxfordshire (parts Buckinghamshire Thames Valley, Oxfordshire, South East Midlands and Thames Valley Berkshire LEP areas);
- East Anglia (parts Greater Cambridge & Greater Peterborough and New Anglia LEP areas).

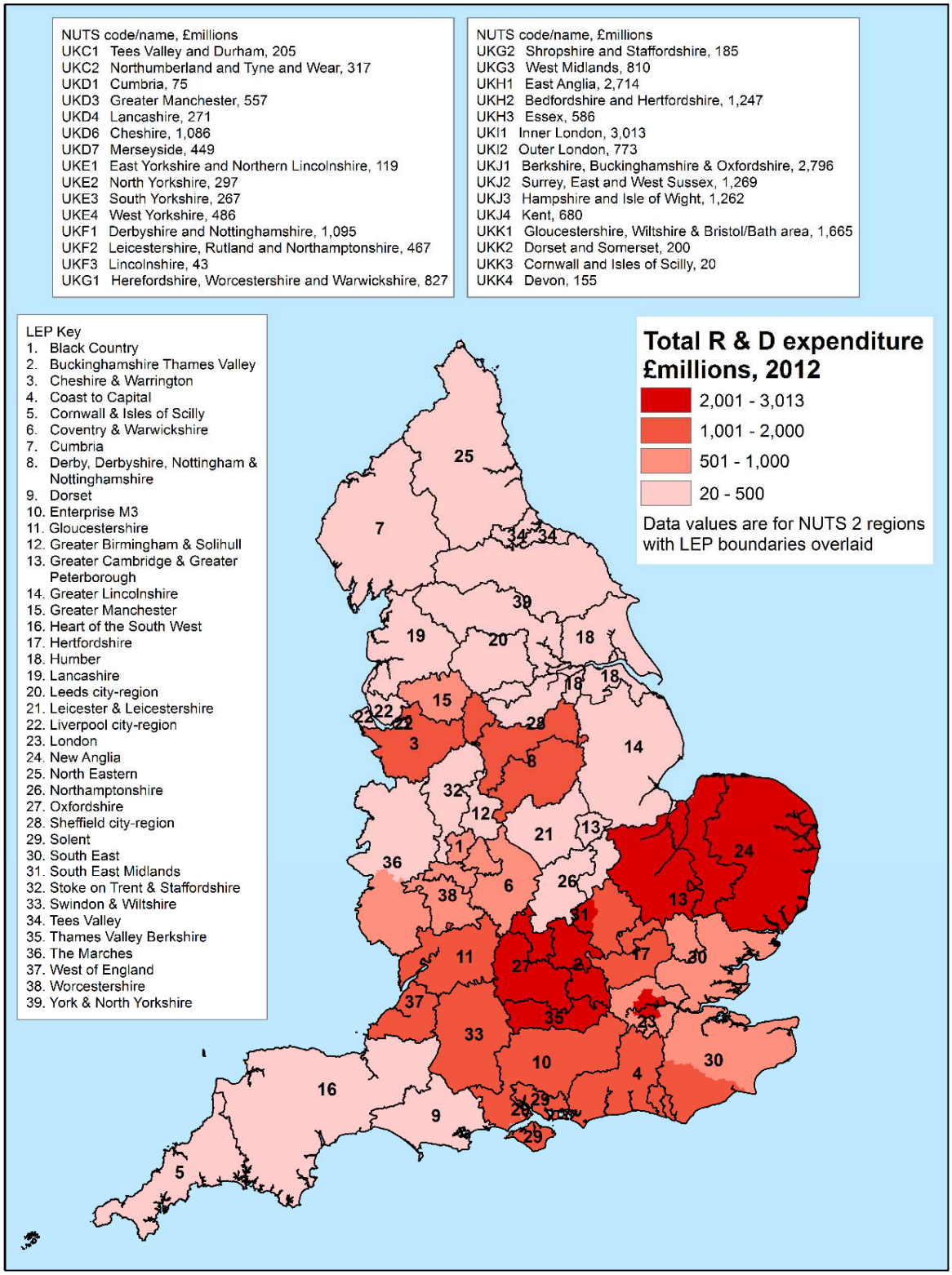
4.22 The next grouping (with figures between £1 billion and £2 billion) extends the geography of the leading group westwards, southwards and eastwards (linking Berkshire, Buckinghamshire and Oxfordshire and Anglia) with two regions in the midlands and north west:

- Gloucestershire, Wiltshire and Bristol/Bath area (parts Gloucestershire, Swindon and Wiltshire and West of England LEP areas);
- Surrey, East and West Sussex (parts Coast to Capital, Enterprise M3 and South East LEP areas); and
- Hampshire and Isle of Wight (parts Enterprise M3 and Solent LEP areas);
- Bedfordshire and Hertfordshire (parts Hertfordshire, South East Midlands and Greater Cambridge and Greater Peterborough);
- Derbyshire and Nottinghamshire (Derby, Derbyshire, Nottingham & Nottinghamshire, part Sheffield City Region); and
- Cheshire (Cheshire and Warrington LEP area).

4.23 Map 4.7 shows how the map changes when allowance is made for workforce size, total expenditure by FTE. Inner London drops into the second grouping to be replaced by Cheshire (the Cheshire and Warrington LEP area). The second grouping in terms of total R&D spend is extended when recalculated by FTE to include Herefordshire, Worcestershire and Warwickshire (parts Coventry and Warwickshire, Worcestershire, Greater Birmingham and Solihull and The Marchers LEP areas) in the Midlands, Kent (part of the South East LEP area) and Essex (parts of the South East and Greater Cambridge and Greater Peterborough LEP areas) in the south east and North Yorkshire (parts York, NORTH Yorkshire and East Riding and Leeds City Region LEP areas).

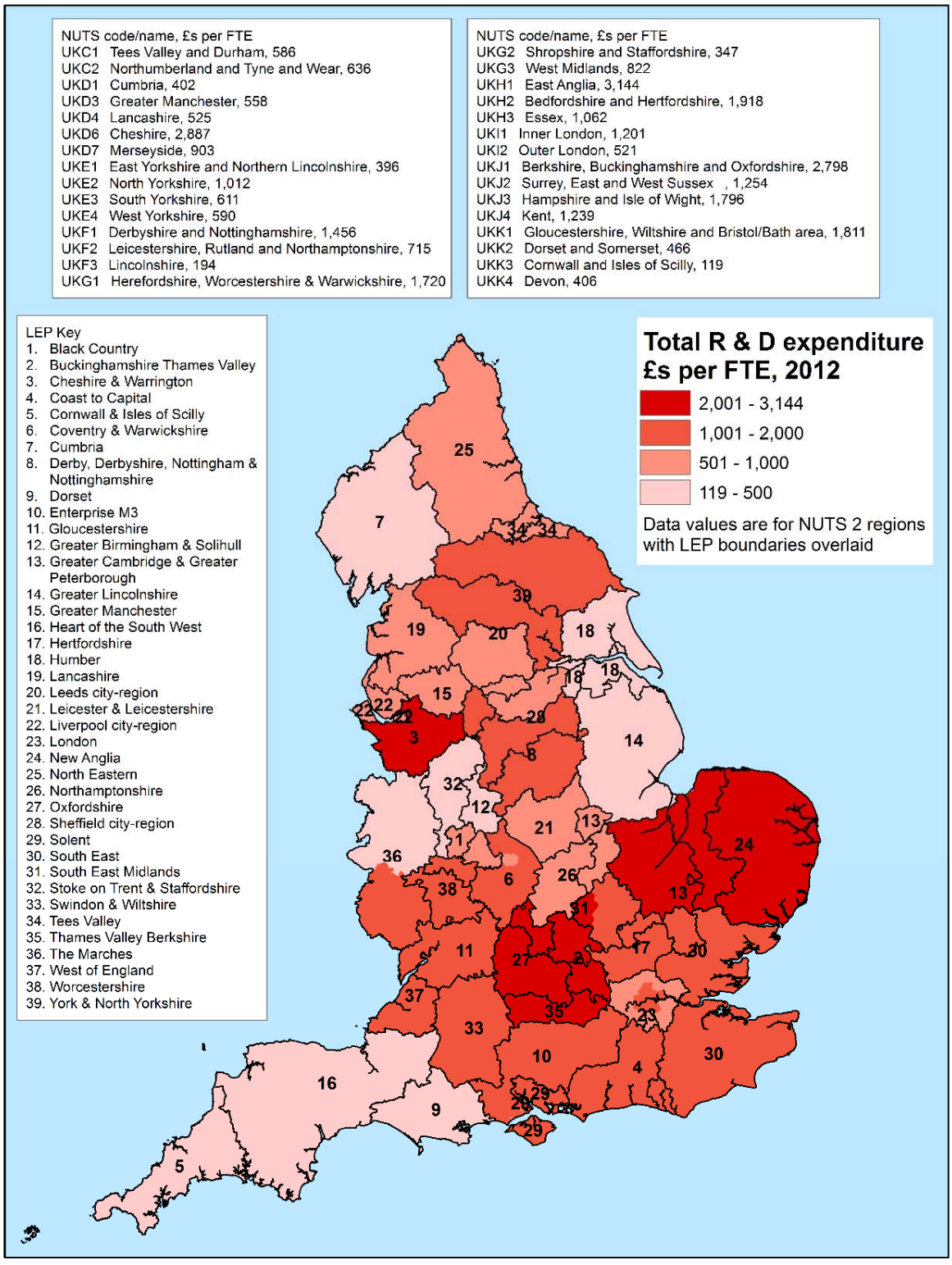
4.24 Finally Figure 4.5 charts the distribution of NUTS2 regions by shares of total R&D expenditure and total FTE employment, showing those with spend greater than and those with spend less than their respective shares of FTE employment (respectively, above and below the line).

Map 4.6: Total, All Sectors, R & D Expenditure, 2012



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Eurostat: Total R&D expenditure (GERD) by sectors; BERD and GovERD elements are actual figures. HERD and PNPRD figures are estimated. Notes: R & D expenditure data are NUTS 2 based. Map layout by EIUA.

Map 4.7: Total All Sectors R & D Expenditure £s per FTE, 2012



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Eurostat: Total R&D expenditure (GERD) by sectors; BERD and GovERD elements are actual figures. HERD and PNPRD figures are estimated. FTE employment data are from the business register and employment survey; Notes: R & D expenditure data are NUTS 2 based. Map layout by EIUA.

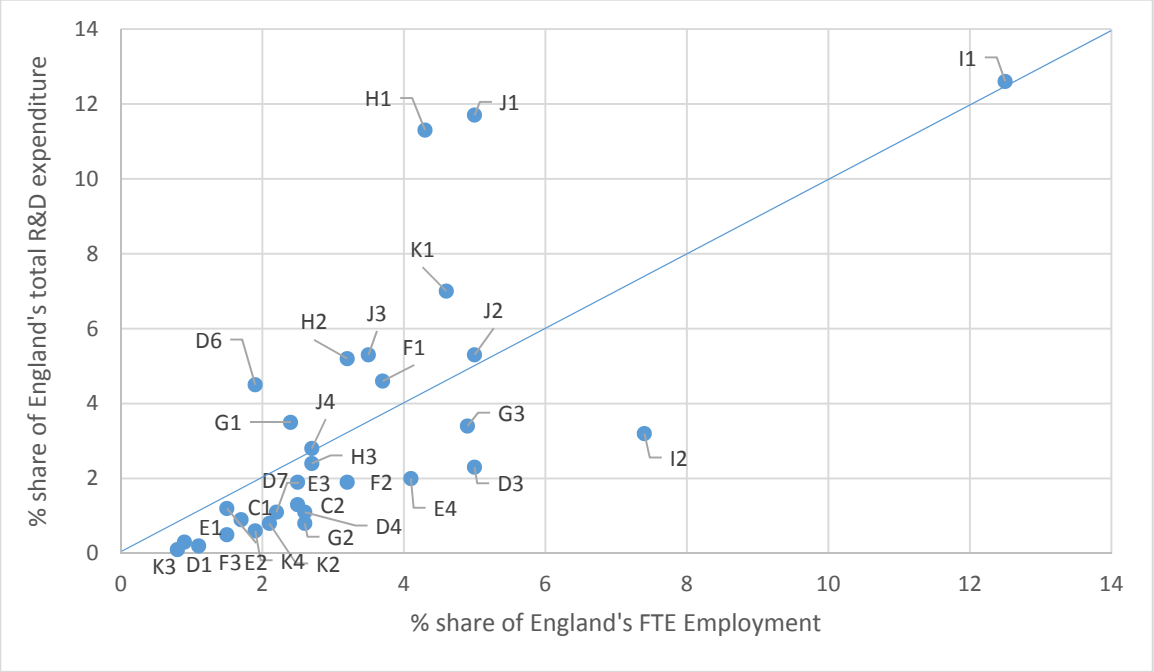
4.25 In terms of above 'expected' performance in relation to employment share, the following regions and LEP areas stand out:

- East Anglia (parts Greater Cambridge & Greater Peterborough and New Anglia LEP areas);
- Berkshire, Buckinghamshire and Oxfordshire (parts Buckinghamshire Thames Valley, Oxfordshire, South East Midlands and Thames Valley Berkshire LEP areas);
- Cheshire (Cheshire and Warrington LEP);
- Gloucestershire, Wiltshire and Bristol/Bath area (parts Gloucestershire, Swindon and Wiltshire and West of England LEP areas);
- Bedfordshire and Hertfordshire (parts Greater Cambridge & Greater Peterborough, Hertfordshire and South East Midlands LEP areas);
- Gloucestershire, Wiltshire and Bristol/Bath area (Gloucestershire, Swindon and Wiltshire and West of England LEPs); and
- Hampshire and Isle of Wight (parts Enterprise M3 and Solent LEP areas).

4.26 Outer London has a share of total R&D spend well below what its workforce size would suggest, along with, notably:

- Greater Manchester (Greater Manchester LEP area);
- West Yorkshire (Leeds City Region LEP area);
- West Midlands (Black Country, Coventry and Warwickshire; and Greater Birmingham and Solihull LEPs).

Figure 4.5: NUTS 2 – Shares of England's Total R&D Expenditure (GERD) and Shares of England's FTE Employment, 2012



Source: ONS and business register and employment survey

Key to Figure 4.5: NUTS 2 code match to LEPs (with LEP's share of NUTS 2's FTE Employment 2012)

NUTS 2 code	LEP name	NUTS 2 code	LEP name
C1	Tees Valley (61%) North Eastern (39%)	G3	Greater Birmingham and Solihull (50%) Black Country (38%) Coventry and Warwickshire (12%)
C2	North Eastern (100%)		
D1	Cumbria (100%)	H1	New Anglia (62%) Gtr. Cambridge & Gtr. Peterborough (51%)
D3	Greater Manchester (100%)		
D4	Lancashire (100%)	H2	Hertfordshire (69%) South East Midlands (31%) Gtr. Cambridge & Gtr. Peterborough (6%)
D6	Cheshire and Warrington (100%)		
D7	Liverpool City Region (100%)		
E1	Humber (100%) Greater Lincolnshire (37%) York, North Yorkshire & East Riding (31%)	H3	South East (100%) Gtr. Cambridge & Gtr. Peterborough (6%)
		I1	London (100%)
E2	York, North Yorkshire & East Riding (100%) Leeds City Region (67%)	I2	London (100%) Coast to Capital (6%)
E3	Sheffield City Region (100%) Leeds City Region (14%)	J1	Thames Valley Berkshire (41%) Oxfordshire (28%) South East Midlands (25%) Buckinghamshire Thames Valley (18%)
E4	Leeds City Region (100%)		
F1	Derby, Derbyshire, Nottingham & Nottinghamshire (100%) Sheffield City Region (21%)	J2	Coast to Capital (57%) Enterprise M3 (32%) South East (14%)
F2	Leicester and Leicestershire (56%) Northamptonshire (42%) South East Midlands (34%) Gtr. Cambridge & Gtr. Peterborough (2%)	J3	Solent (80%) Enterprise M3 (48%)
		J4	South East (100%)
F3	Greater Lincolnshire (100%)	K1	West of England (48%) Swindon and Wiltshire (27%) Gloucestershire (25%)
G1	Coventry and Warwickshire (47%) Worcestershire (40%) Greater Birmingham and Solihull (18%) The Marches (13%)	K2	Dorset (59%) Heart of the South West (41%)
G2	Stoke-on-Trent and Staffordshire (69%) The Marches (31%) Greater Birmingham and Solihull (25%)	K3	Cornwall and Isles of Scilly (100%)
		K4	Heart of the South West (100%)

Note: % shares of each NUTS 2's FTE employment can exceed 100% due to overlapping LEP boundaries; see map 4.6 for NUTS 2 names in full.

Innovate UK investments in innovative activity

4.27 Innovate UK is the national innovation agency taking on the role previously performed by the Technology Strategy Board to accelerate economic growth through the stimulation and support of business-led innovation (Technology Strategy Board, 2014).

4.28 It has a database of innovation grants that it, and its predecessor, the Technology Strategy Board, have awarded since April 2010, including some active programmes for which they took responsibility in that period (such as Regional Development Agency expenditure). The database breaks grants down into 17 broad categories and gives figures for both number of participants and size of grant. A number of the grants - including 'fast track' and 'feasibility studies', 'European' and 'collaborative R&D' - are also broken down by Innovate UK's priority investment areas, most of which 'read across' to the 11 industrial strategy sectors and 8 'great technologies' (Table 4.1).

4.29 The public sector financial support the agency provides is an increasingly significant contributor to the 'money' element of the innovation framework, as well as an' indicator of collaborative activity in innovation for the 'structures and incentives' and 'broader environment' elements.

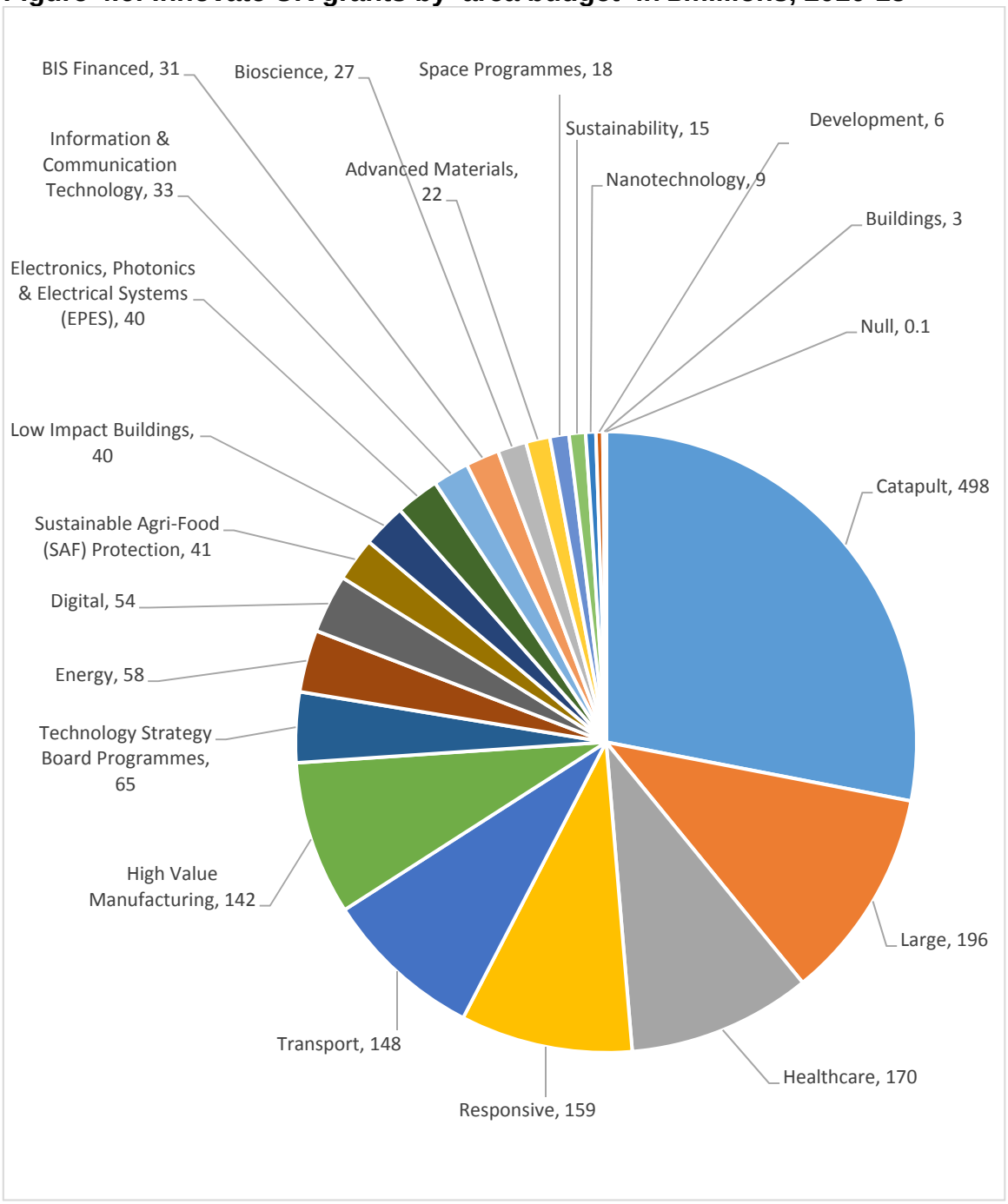
Table 4.1: Innovate UK's priority investment areas, the 'Great Technologies' and Industrial Strategy sectors

Innovate UK's Priority Areas	Great Technologies	Industrial Strategy Sectors
Advanced Materials	Advanced Materials	-
Agriculture & food	Agri-science	Agricultural technologies
Biosciences	Synthetic Biology	-
Built environment	-	Construction
Digital Economy	Big Data	Information economy International education (Education exports) Professional and business services
Electronics, sensors and photonics	Robotics and Autonomous Systems	-
Emerging technologies	-	-
Energy	Energy Storage	Nuclear Offshore wind Oil and gas
Health and care	Regenerative Medicine	Life sciences
Information and communications technology	-	-
Resource efficiency	-	-
Space	Satellites	-
Transport	-	Automotive Aerospace
Urban living	-	-

Source: Technology Strategy Board (2014)

4.30 Innovate UK grants are classified by budget area. Figure 4.6 shows the split of grants in England for 21 budget areas. Grants totalling £1,776 million were awarded between April 2010 and the start of 2015. Funding of the Catapult programme has been single largest category of spend, £498 million (28% of the total) followed by large projects (11%), healthcare (10%), responsive (9%), transport and high value manufacturing (both 8%).

Figure 4.6: Innovate UK grants by 'area budget' in £millions, 2010-15



Source: Innovate UK; Notes: These data include all grants awarded since 1 April 2010 as well as some active programmes that have become Innovate UK's responsibility since that time.

4.31 Table 4.2 shows the distribution of total spend across LEP areas. In Table 4.2, LEPs are ranked in a 'traffic light' colouring by top, middle and bottom thirds. All LEP areas received some funding.

4.32 The investments flag up the innovative activity being supported in some of the older industrial regions and provide a contrast, for example, to the broad north-south pattern visible in the geography of R&D expenditure. Six of the top third of LEP areas in terms of Innovate UK funding are in the north with Tees Valley leading the way followed by Coventry and Warwickshire, North Eastern and Sheffield City

Region. Oxfordshire, West of England and Greater Cambridge and Greater Peterborough head the southern regions. The capital, London is in the top third. Of the Sheffield and Leicester 'second-tier' city region LEP areas, Sheffield and Leicester are in the top third but the others - Liverpool, Derby and Nottingham, Birmingham and Leeds - are grouped in the middle third with Manchester just outside.

Table 4.2: Total Innovate UK funding by LEP area – rankings based on £s per FTE, 2010-2015

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

Source: Innovate UK

4.33 Table D1 in Appendix D2, shows the ranking of LEP areas in terms of total spend and across the 21 grant categories. The West of England and London LEP areas had the highest coverage, with funding in all 21 grant streams. Rural Cornwall and the Isles of Scilly had the lowest coverage, with grants in half of the funding streams. The average ranking across the funding streams that each LEPs received ranged from 5 in rural Oxfordshire to 28 in rural Cumbria.

4.34 The high ranking of the two north eastern LEP areas is heavily influenced by the funding of their High Value Manufacturing Catapult Centres. While the Catapults are, as already noted, national programmes, their location does nevertheless reflect local expertise in the technologies in question and represent local as well as national 'knowledge assets'. The spend on Catapults to date has been focused on the 12 LEP areas in England listed, in descending order of funding, in Table 4.3: the eight hosting the Catapults and four with projects linked to the programme.

Table 4.3: Innovate UK funding – Catapults

LEP area	Region	Classification	Catapult	Rank in spend per FTE
Tees Valley	NE	3rd Tier	High Value Manufacturing: Centre for Process Innovation (Redcar/ Darlington)	1
North Eastern	NE	2nd Tier	High Value Manufacturing (Wilton/ Sedgefield)	2
Coventry and Warwickshire	WM	3rd Tier	High Value Manufacturing (Coventry & Ansty)	3
West of England	SW	2nd Tier	High Value Manufacturing (Bristol)	4
Oxfordshire	SE	Rural	Satellite Applications (Harwell)	5
Sheffield City Region	YH	2nd Tier	High Value Manufacturing (Rotherham)	6
South East Midlands	EM	3rd Tier	Transport Systems (Milton Keynes)	7
London	L	Capital	Cell Therapy Connected Digital Economy Future Cities	8
Leicester and Leicestershire	EM	2nd Tier	-	9
Thames Valley Berkshire	SE	Lon C-R	-	10
Enterprise M3	SE	Lon C-R	-	11
Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier	-	12

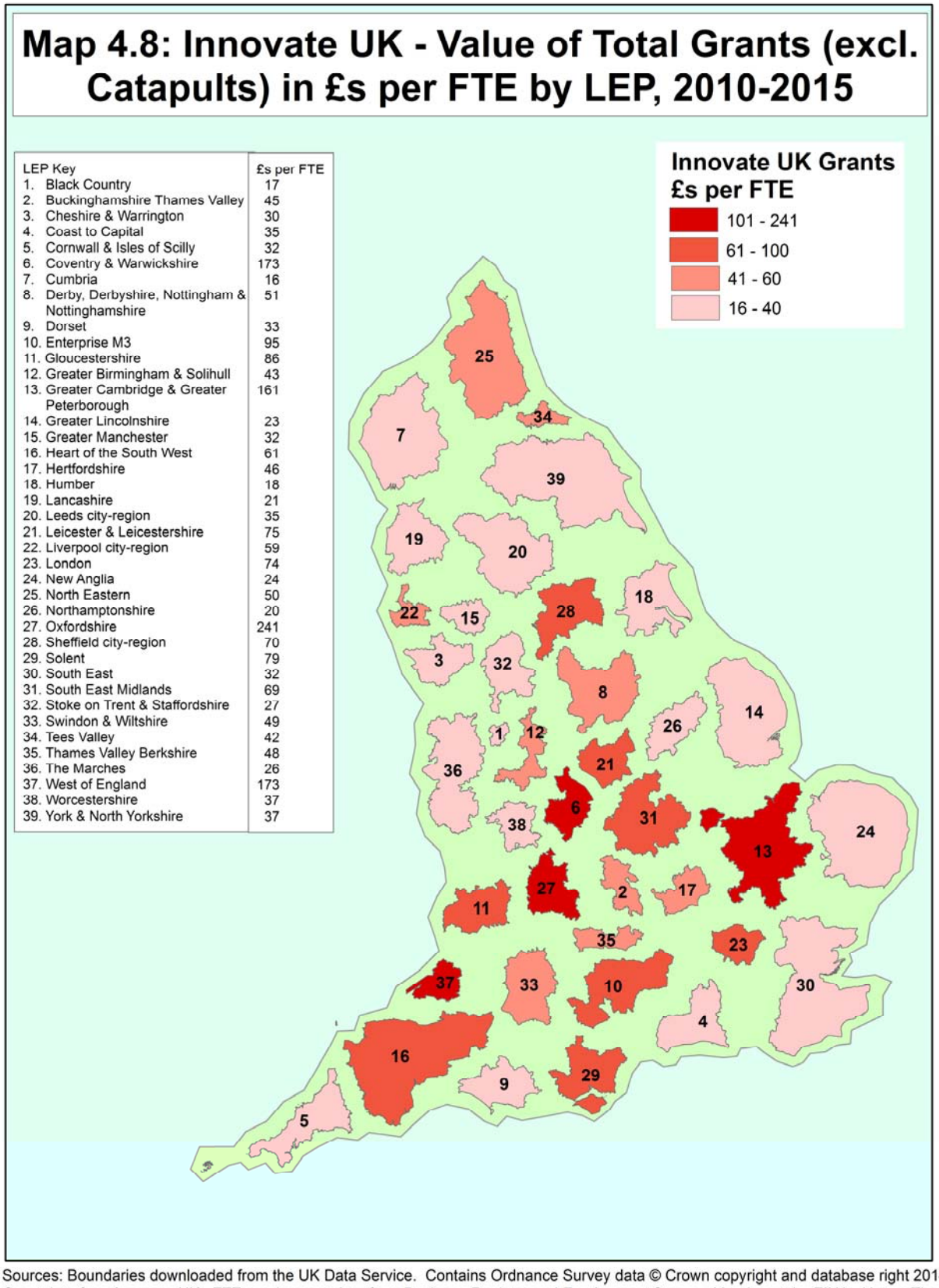
Source: Innovate UK; Note: table correct at February 2015.

4.35 The two north eastern LEP areas – third-tier Tees Valley and second-tier North Eastern – head the ranking in terms of spend per FTE. The top six LEP areas include five hosting Advanced Manufacturing Catapults: Tees Valley, North Eastern, Coventry and Warwickshire, West of England and Sheffield City Region.

4.36 The significance of these advanced manufacturing investments are reinforced when the total spend less the Catapult Centres is analysed. Map 4.8 and Table 4.4 show the distribution. While Coventry and Warwickshire remain highly ranked, both north eastern LEP areas slip down the ranking, which is now led by rural Oxfordshire.

Map 4.8: Innovate UK - Value of Total Grants (excl. Catapults) in £s per FTE by LEP, 2010-2015

LEP Key	£s per FTE
1. Black Country	17
2. Buckinghamshire Thames Valley	45
3. Cheshire & Warrington	30
4. Coast to Capital	35
5. Cornwall & Isles of Scilly	32
6. Coventry & Warwickshire	173
7. Cumbria	16
8. Derby, Derbyshire, Nottingham & Nottinghamshire	51
9. Dorset	33
10. Enterprise M3	95
11. Gloucestershire	86
12. Greater Birmingham & Solihull	43
13. Greater Cambridge & Greater Peterborough	161
14. Greater Lincolnshire	23
15. Greater Manchester	32
16. Heart of the South West	61
17. Hertfordshire	46
18. Humber	18
19. Lancashire	21
20. Leeds city-region	35
21. Leicester & Leicestershire	75
22. Liverpool city-region	59
23. London	74
24. New Anglia	24
25. North Eastern	50
26. Northamptonshire	20
27. Oxfordshire	241
28. Sheffield city-region	70
29. Solent	79
30. South East	32
31. South East Midlands	69
32. Stoke on Trent & Staffordshire	27
33. Swindon & Wiltshire	49
34. Tees Valley	42
35. Thames Valley Berkshire	48
36. The Marches	26
37. West of England	173
38. Worcestershire	37
39. York & North Yorkshire	37



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2014. Grant data from Innovate UK. FTE employment data from Business Register and Employment Survey. Map layout by EIUA. Notes: These data includes all grants awarded since 1 April 2010 as well as some active programmes that have become Innovate UK's responsibility since that time. The location data shown will be based on the address the company registered for the project. This may be a company's registered office or head office rather than the location of the innovation project activity itself.

Table 4.4: Total Innovate UK funding (less Catapults) by LEP area – rankings based on £s per FTE, 2010-2015

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

Source: Innovate UK

Innovate UK investments by grant category

High value manufacturing

4.37 Given the large investments in Catapults, it is not surprising that the north eastern LEP areas slip down the ranking in terms of grants earmarked for high value manufacturing activities separate from the Catapults (Table 4.5). The south western West of England and Gloucestershire LEP areas head the rankings along with Coventry and Warwickshire in the West Midlands. Greater Manchester, of the old industrial regions, is also in the top third of grant recipients. This top third also includes new industrial LEP areas like Greater Cambridge and Greater Peterborough, Dorset, Oxfordshire and Enterprise M3.

Table 4.5: Innovate UK grants 2010-15, high value manufacturing – ranking based on £s per FTE

LEP	Region	Classification	Rank
West of England	SW	2nd Tier	1
Gloucestershire	SW	Urban-rural	2
Coventry and Warwickshire	WM	3rd Tier	3
Swindon and Wiltshire	SW	3rd Tier	4
London	L	Capital	5
Leicester and Leicestershire	EM	2nd Tier	6
Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier	7
Dorset	SW	3rd Tier	8
Solent	SE	3rd Tier	9
Oxfordshire	SE	Rural	10
Greater Manchester	NW	2nd Tier	11
Enterprise M3	SE	Lon C-R	12
South East Midlands	EM (part SE & EoE)	3rd Tier	13
Tees Valley	NE	3rd Tier	14
Buckinghamshire Thames Valley	SE	Lon C-R	15
Sheffield City Region	YH (part EM)	2nd Tier	16
Liverpool City Region	NW	2nd Tier	17
Cheshire and Warrington	NW	3rd Tier	18
North Eastern	NE	2nd Tier	19
Hertfordshire	EoE	Lon C-R	20
Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier	21
Black Country	WM	2nd Tier	22
Greater Lincolnshire	EM (part YH)	Rural	23
Greater Birmingham and Solihull	WM	2nd Tier	24
Leeds City Region	YH	2nd Tier	25
Cornwall and the Isles of Scilly	SW	Rural	26
Heart of the South West	SW	3rd Tier	27
South East	SE (part EoE)	Lon C-R	28
Stoke-on-Trent and Staffordshire	WM	3rd Tier	29
York and North Yorkshire	YH	Rural	30
Thames Valley Berkshire	SE	Lon C-R	31
Humber	YH	3rd Tier	32
Lancashire	NW	3rd Tier	33
Worcestershire	WM	Urban-rural	34
The Marches	WM	Rural	35
Coast to Capital	SE (part London)	Lon C-R	36
Cumbria	NW	Rural	37
New Anglia	EoE	3rd Tier	38
Northamptonshire	EM	3rd Tier	-

Source: Innovate UK

Innovate UK grants - large and responsive

4.38 Table 4.6 shows the ranking by LEP of large and responsive grants. All LEP areas received responsive grants and two thirds, 26, had large grants. As the table shows, there is no clear pattern between the two categories. Only two of the top third of responsive grant recipients are in the top third of large grants, rural Oxfordshire and third-tier Solent.

Table 4.6: Innovate UK grants 2010-15, large and responsive grants – ranking based on £s per FTE

LEP	Region	Classification	Large	Responsive
Oxfordshire	SE	Rural	4	1
Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier	12	2
Sheffield City Region	YH (part EM)	2nd Tier	10	3
Leicester and Leicestershire	EM	2nd Tier	15	4
Liverpool City Region	NW	2nd Tier	21	5
South East Midlands	EM (part SE & EoE)	3rd Tier	20	6
Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier	11	7
North Eastern	NE	2nd Tier	19	8
Solent	SE	3rd Tier	5	9
Cheshire and Warrington	NW	3rd Tier	-	10
Enterprise M3	SE	Lon C-R	17	11
Hertfordshire	EoE	Lon C-R	22	12
Buckinghamshire Thames Valley	SE	Lon C-R	-	13
Coventry and Warwickshire	WM	3rd Tier	1	14
West of England	SW	2nd Tier	2	15
Thames Valley Berkshire	SE	Lon C-R	26	16
London	L	Capital	6	17
Gloucestershire	SW	Urban-rural	8	18
Greater Manchester	NW	2nd Tier	-	19
Stoke-on-Trent and Staffordshire	WM	3rd Tier	14	20
Worcestershire	WM	Urban-rural	7	21
Cornwall and the Isles of Scilly	SW	Rural	-	22
New Anglia	EoE	3rd Tier	18	23
Leeds City Region	YH	2nd Tier	23	24
Dorset	SW	3rd Tier	24	25
Heart of the South West	SW	3rd Tier	3	26
Lancashire	NW	3rd Tier	-	27
Greater Birmingham and Solihull	WM	2nd Tier	9	28
Northamptonshire	EM	3rd Tier	-	29
York and North Yorkshire	YH	Rural	-	30
Coast to Capital	SE (part London)	Lon C-R	25	31
Greater Lincolnshire	EM (part YH)	Rural	-	32
South East	SE (part EoE)	Lon C-R	16	33
Swindon and Wiltshire	SW	3rd Tier	-	34
Cumbria	NW	Rural	-	35

The Marches	WM	Rural	13	36
Humber	YH	3rd Tier	-	37
Tees Valley	NE	3rd Tier	-	38
Black Country	WM	2nd Tier	-	39

Source: Innovate UK

Innovate UK grants - across the Great Technologies

4.39 Table 4.7 shows the ranking of LEPs by grants in the categories that overlap with the 8 Great Technologies, ranked by total funding received. All LEP areas received some funding in one or more of the Great Technologies. 35 had funding in at least one Technology in the top third of the rankings, the four exceptions being Stoke on Trent and Staffordshire, New Anglia, Black Country and Cumbria, whose grants fell in either the middle or bottom thirds.

4.40 In terms of coverage, Oxfordshire and Enterprise M3 stand out with funding in the top third of 7 of the 8 Great Technologies. For Greater Cambridge and Greater Peterborough and Thames Valley Berkshire the corresponding figure is 6 and, for West of England and Buckinghamshire Thames Valley, 5. The first three of these are ranked first in funding for four of the Technologies: Oxfordshire (Regenerative Medicine); Enterprise M3 (Big Data and Satellites); and Greater Cambridge and Greater Peterborough (Robotics and Autonomous Systems).

4.41 In addition to its funding for Catapults, Tees Valley also stands out with the second highest grant awards in both Robotics and Autonomous Systems and Synthetic Biology. Other LEP areas, relatively low in the total spend rankings, show some strengths in particular technologies: rural York and North Yorkshire ranked first in Agri-science, third-tier Northamptonshire third in Robotics and Autonomous Systems and rural Cornwall and Isles of Scilly ranked first in Energy storage.

Table 4.7: Innovate UK grants 2010-15, related to Great Technologies (and Industrial Strategy Sectors) – rankings based on £s per FTE

Industrial Strategy Sectors			Life sciences	Nuclear Offshore wind Oil and gas	Information economy International education Professional and business services	Agricultural technologies					
Great Technologies			Regenerative medicine	Energy storage	Big data	Agri-science	Robotics & Autonomous Systems	Synthetic Biology	Advanced Materials	Satellites	
Innovate UK specific grants	Region	Classification	Healthcare	Energy	Digital	Sustainable Agri-Food (SAF) Protection	Electronics, Photonics & Electrical Systems	Bioscience	Advanced Materials	Space Programmes	Total – all grants
Tees Valley	NE	3rd Tier	14	34	30	14	2	2	22	-	1
Coventry and Warwickshire	WM	3rd Tier	19	11	15	6	31	7	1	-	2
Oxfordshire	SE	Rural	1	17	11	9	5	4	3	3	3
West of England	SW	2nd Tier	25	2	5	28	8	27	8	7	4
North Eastern	NE	2nd Tier	10	15	26	20	12	16	27	8	5
Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier	2	3	4	3	1	3	15	15	6
Sheffield City Region	YH (part EM)	2nd Tier	11	4	21	18	9	34	4	26	7
South East Midlands	EM (part SE & EoE)	3rd Tier	22	23	19	22	7	22	16	11	8
Enterprise M3	SE	Lon C-R	4	7	1	11	16	10	11	1	9
Gloucestershire	SW	Urban-rural	21	9	10	12	30	35	2	12	10
London	L	Capital	5	24	2	32	18	25	24	18	11
Solent	SE	3rd Tier	9	16	3	21	10	19	25	10	12
Leicester and Leicestershire	EM	2nd Tier	20	13	16	7	14	30	6	16	13
Heart of the South West	SW	3rd Tier	28	8	17	31	23	13	26	13	14
Liverpool City Region	NW	2nd Tier	3	21	7	36	27	5	13	29	15
Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier	17	19	25	19	20	15	9	9	16
Swindon and Wiltshire	SW	3rd Tier	6	5	18	13	13	28	30	17	17
Thames Valley Berkshire	SE	Lon C-R	8	12	6	26	11	20	5	6	18
Hertfordshire	EoE	Lon C-R	12	33	28	35	15	1	31	2	19
Buckinghamshire Thames Valley	SE	Lon C-R	7	32	12	23	6	31	7	5	20
Greater Birmingham and Solihull	WM	2nd Tier	26	31	27	8	24	24	12	-	21
Worcestershire	WM	Urban-rural	36	35	14	34	25	8	21	21	22
York and North Yorkshire	YH	Rural	16	14	20	1	26	6	32	-	23
Coast to Capital	SE (part	Lon C-R	18	10	8	29	29	17	29	23	24

	London)										
Leeds City Region	YH	2nd Tier	15	27	22	25	4	26	20	28	25
Dorset	SW	3rd Tier	34	20	38	38	32	-	14	4	26
Greater Manchester	NW	2nd Tier	23	28	24	27	19	11	23	24	27
South East	SE (part EoE)	Lon C-R	13	25	29	10	28	21	34	22	28
Cornwall and the Isles of Scilly	SW	Rural	-	1	33	37	-	-	-	14	29
Cheshire and Warrington	NW	3rd Tier	27	6	37	30	34	23	17	-	30
Stoke-on-Trent and Staffordshire	WM	3rd Tier	35	30	23	24	22	32	18	-	31
The Marches	WM	Rural	-	39	32	4	-	18	-	-	32
New Anglia	EoE	3rd Tier	31	22	34	15	17	14	36	27	33
Greater Lincolnshire	EM (part YH)	Rural	-	29	36	2	21	9	28	19	34
Lancashire	NW	3rd Tier	33	37	9	39	35	33	10	-	35
Northamptonshire	EM	3rd Tier	30	26	13	33	3	29	37	-	36
Humber	YH	3rd Tier	24	18	-	5	-	12	35	-	37
Black Country	WM	2nd Tier	32	38	31	16	-	36	33	20	38
Cumbria	NW	Rural	29	36	35	17	33	37	19	25	39

Source: Innovate UK

4.42 Table 4.8 shows the ranking of LEPs by grants in other Innovate UK funding categories including some that overlap with Automotive and Aerospace and Construction Industrial Strategy Sectors. Nanotechnology has uses that cut across a number of Great Technologies and Industrial Strategy Sectors, most notably Synthetic Biology, Advanced Materials and Transport (automotive and aerospace engineering).

4.43 All LEP areas had funding in at least two of the eight categories and 29 ranked in the top third in at least one of them. Oxfordshire and Greater Cambridge and Greater Peterborough are again notable for their ranking in the top third of six of the eight categories, with the former coming first in Sustainability and Nanotechnology and the latter first in Development projects. West of England ranks first in three categories: ICT, Low impact buildings and BIS Financed. Coventry and Warwickshire ranks first in Transport and Coast to Capital first in Buildings.

Table 4.8: Innovate UK grants 2010-15, other priority areas (and Industrial Strategy Sectors) – rankings based on £s per FTE

Industrial Strategy Sectors			Automotive Aerospace						Construction		
Innovate UK specific grants	Region	Classification	Transport	Information & Communication Technology	Sustainability	Nanotechnology	Development	BIS Financed	Low Impact Buildings	Buildings	Total – all grants
Tees Valley	NE	3rd Tier	22	-	4	20	-	-	-	-	1
Coventry and Warwickshire	WM	3rd Tier	1	16	5	15	5	-	5	3	2
Oxfordshire	SE	Rural	2	3	1	1	2	5	3	-	3
West of England	SW	2nd Tier	9	1	30	18	9	1	1	5	4
North Eastern	NE	2nd Tier	12	20	16	9	7	-	23	11	5
Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier	8	7	2	4	1	-	2	-	6
Sheffield City Region	YH (part EM)	2nd Tier	10	14	9	16	-	-	26	-	7
South East Midlands	EM (part SE & EoE)	3rd Tier	5	23	10	3	12	2	8	-	8
Enterprise M3	SE	Lon C-R	4	5	14	6	13	-	25	2	9
Gloucestershire	SW	Urban-rural	6	19	7	-	10	3	9	-	10
London	L	Capital	29	2	15	7	18	8	7	8	11
Solent	SE	3rd Tier	13	8	35	25	6	4	32	7	12
Leicester and Leicestershire	EM	2nd Tier	3	9	8	10	15	-	11	-	13
Heart of the South West	SW	3rd Tier	14	28	17	22	-	-	14	-	14
Liverpool City Region	NW	2nd Tier	25	15	3	13	-	9	30	6	15
Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier	11	18	26	11	19	-	-	4	16
Swindon and Wiltshire	SW	3rd Tier	30	12	22	-	-	7	19	-	17
Thames Valley Berkshire	SE	Lon C-R	27	10	24	-	17	-	6	-	18
Hertfordshire	EoE	Lon C-R	21	27	34	27	-	-	10	-	19
Buckinghamshire Thames Valley	SE	Lon C-R	7	-	11	-	-	-	-	-	20
Greater Birmingham and Solihull	WM	2nd Tier	17	26	18	8	-	-	12	12	21
Worcestershire	WM	Urban-rural	19	-	32	2	-	-	13	-	22
York and North Yorkshire	YH	Rural	33	6	21	5	4	-	21	-	23
Coast to Capital	SE (part London)	Lon C-R	16	4	33	14	14	-	16	1	24
Leeds City Region	YH	2nd Tier	32	17	19	12	11	-	18	9	25
Dorset	SW	3rd Tier	18	11	-	-	-	-	27	-	26
Greater Manchester	NW	2nd Tier	36	22	12	19	-	-	20	-	27

South East	SE (part EoE)	Lon C-R	15	21	37	17	-	-	24	10	28
Cornwall and the Isles of Scilly	SW	Rural	31	-	36	-	-	-	22	-	29
Cheshire and Warrington	NW	3rd Tier	20	34	6	21	-	-	29	-	30
Stoke-on-Trent and Staffordshire	WM	3rd Tier	28	29	28	23	3	-	34	-	31
The Marches	WM	Rural	24	25	13	24	-	-	31	-	32
New Anglia	EoE	3rd Tier	23	24	38	26	-	-	15	-	33
Greater Lincolnshire	EM (part YH)	Rural	35	13	29	-	-	-	28	-	34
Lancashire	NW	3rd Tier	26	30	20	-	-	-	35	-	35
Northamptonshire	EM	3rd Tier	37	31	25	-	16	-	33	-	36
Humber	YH	3rd Tier	38	33	23	-	8	-	-	-	37
Black Country	WM	2nd Tier	34	-	27	-	-	6	17	-	38
Cumbria	NW	Rural	-	32	31	-	-	-	4	-	39

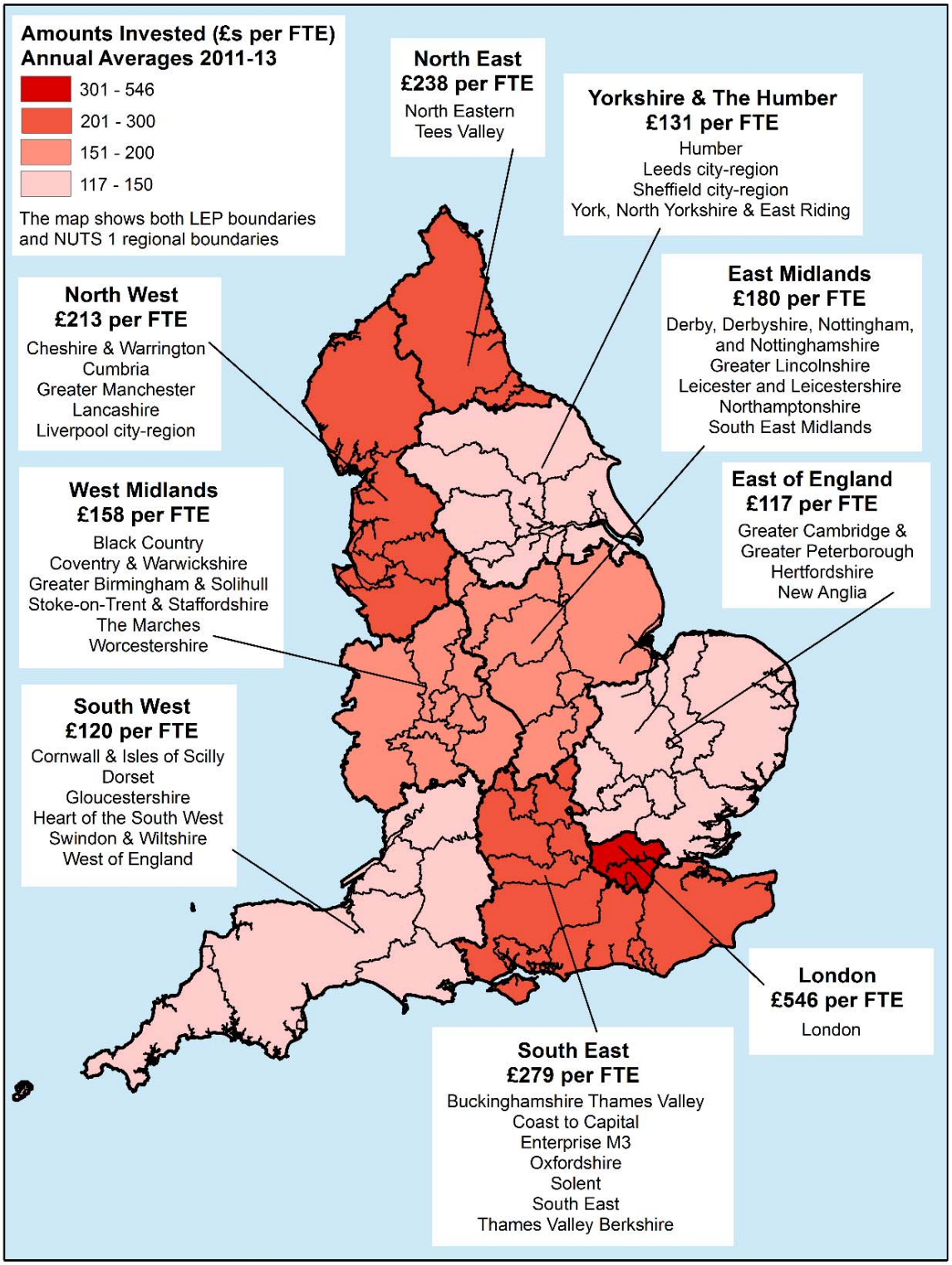
Source: Innovate UK

Regional Private Equity and Venture Capital Expenditure

4.44 As an indicator of the geography of private equity and venture capital expenditure, we use the figures published by the British Venture Capital Association. The data are for investments made by Association members and are reported at regional level. Map 4.9 shows the pattern for regional investments per FTE employment over the period 2011-13. London leads by some distance, with a figure nearly five times that of the lowest in East of England.

4.45 There is a regional hierarchy headed by London and the South East, followed by the North East and North West, then East and West Midlands, Yorkshire and the Humber and finally the South West and East of England.

Map 4.9: Investments by British Private Equity and Venture Capital Association Members, Annual Averages 2011-13



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Investment data are from the BVCA British Private Equity & Venture Capital Report on Investment Activity 2013. Data refer to investments made by BVCA Members. FTE data are from the Business Register and Employment Survey. 6 LEPs cross regional boundaries but they are labelled just once under the region that they principally fall within. Map layout by EIUA.

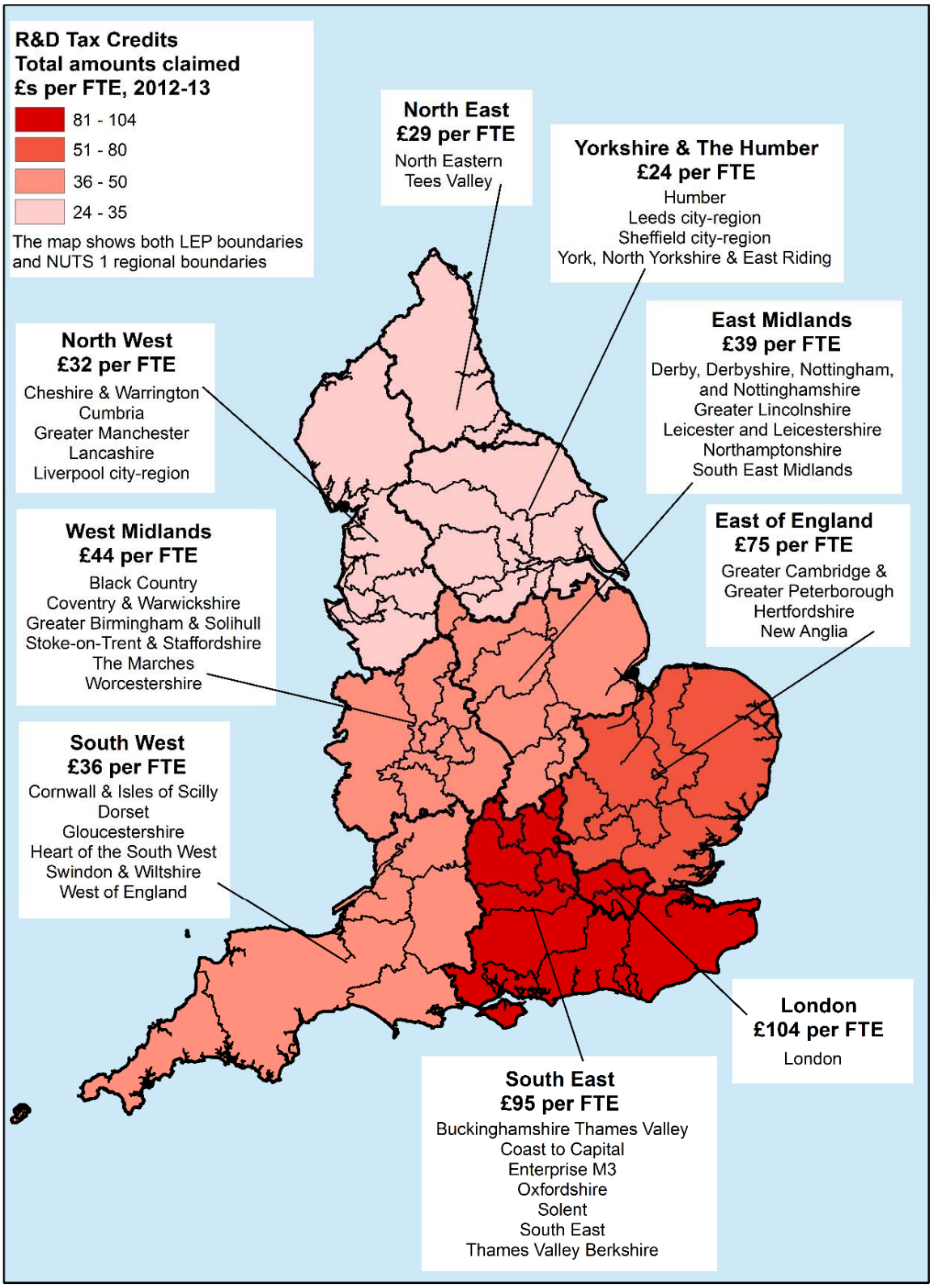
Research and Development Tax Credits

4.46 As an indicator of both levels of innovation activity and innovation support we have used HMRC regional data on R&D tax credits. The data are for total amounts claimed and have been calculated per FTE for the period, 2012-13 (see Map 4.10).

4.47 A different hierarchy from that for venture capital investments is apparent. London and the South East still have the largest figures and head the ranking but the East of England, notably, and West Midlands move up the rankings above the North West, North East and Yorkshire and the Humber, which slip down.

4.48 London has a figure over four times that of the lowest, Yorkshire and the Humber.

Map 4.10: R & D Tax Credits, Total Amounts Claimed, per FTE, 2012-13



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. R & D Tax Credit data are from HMRC. FTE data are from the Business Register and Employment Survey. 6 LEPs cross regional boundaries but they are labelled just once under the region that they principally fall within. Map layout by EIUA.

4.2 Talent

4.49 One of the most important elements of the Allas innovation framework is 'talent', the 'human capital required to demand, develop, share and exploit new and existing knowledge' (BIS, 2014a). We have selected two datasets for our 'headline' indicators of talent, the Annual Population Survey and Higher Education Statistics Agency (HESA) data:

Annual Population Survey:

- the numbers of residents employed as science, research, engineering and technology professionals and associate professionals; and
- qualification levels: the proportion of the working age populations with NVQ at different levels and those with no qualifications;

HESA:

- academic staff numbers, student participation in university education, undergraduate and postgraduate degrees awarded including in science and engineering, numbers of international students and graduate retention numbers of students by degree level and country of origin; degrees awarded by subject; graduate retention.

4.50 The headline indicators together attempt to capture the local skills base and share of employment in innovative activities and occupations. They highlight the talent-pool of those who are training in higher level qualifications (a proxy for highly qualified human capital), the retention rate of this talent and the numbers working locally in higher education. As Allas (BIS, 2014a) argues, the number of international students is an important source of knowledge flows between countries and an indication of the quality of the (in this case, local) higher education system. The percentage of undergraduate and postgraduate degrees in science and engineering highlights the qualifications that impact particularly positively on innovation.

4.51 The broad coverage of occupations and skill levels is designed to reflect the argument in Allas (BIS, 2014a) that successful innovation processes not only require human capital at the high end of educational attainment but also a well-educated and qualified population more generally. Higher level skills are also a key influence on firms' absorptive capacity and demand for different kinds of innovation. The indicators thus measure both 'push' and 'drag' factors in relation to innovation at local, LEP area, level.

Talent: Residents employed in science, research and engineering and technology professions

4.52 Map 4.11 and Table 4.9 provide a recent snapshot of residents employed in 'science and technology' occupations across the LEP areas, a reflection of the industrial and employment structures that we will return to below in the discussion of indicators of the 'structures and incentives' element of the framework. The proportions of the workforce employed in these jobs range from 4.4% in the second-tier Black Country LEP area to 12.9% in the rural Oxfordshire LEP area. 17 LEP

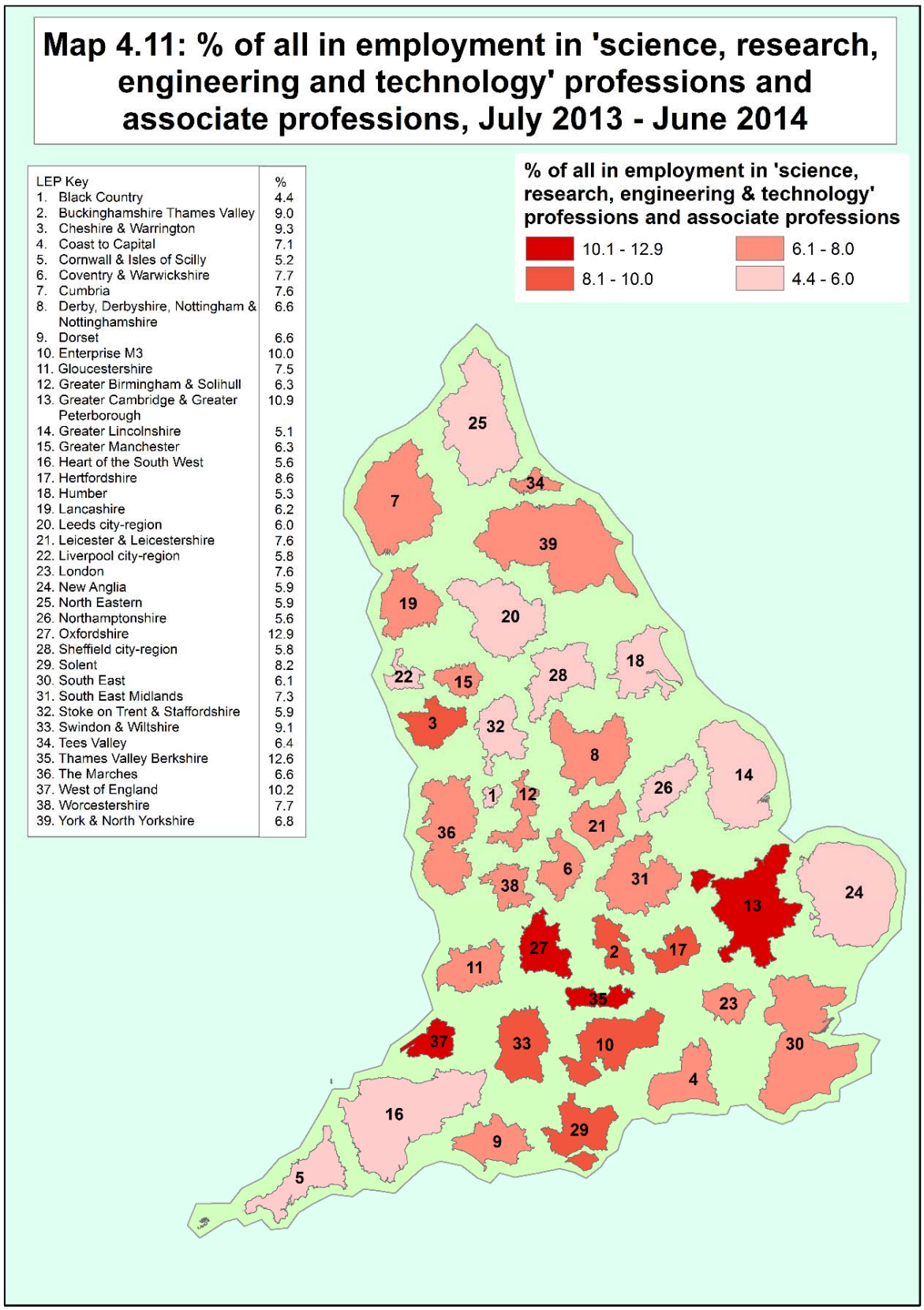
areas have shares above and 22 shares below the average figure for England of 7.2%.

4.53 The highest shares are in a belt of 'hi-tech' LEP areas stretching from the West of England and Swindon and Wiltshire in the south west through Buckinghamshire Thames Valley, Enterprise M3, Thames Valley Berkshire and Oxfordshire to Greater Cambridge and Greater Peterborough in the East of England. The last three of these LEP areas all have shares of 'science and technology' jobs one and a half times or more that of the national. Third-tier Cheshire and Warrington has the highest share in the north and third-tier Coventry and urban-rural Warwickshire and Worcestershire the highest in the Midlands. Unsurprisingly, the pattern is similar to that for R&D expenditure with the south east band of LEPs extended to include the second-tier West of England LEP area in the South West and outlying third-tier Cheshire and Warrington in the north.

4.54 The lowest shares are scattered across a mix of old industrial and predominantly rural LEP areas in the midlands (Black Country, Greater Lincolnshire, Stoke-on-Trent and Staffordshire and Northamptonshire), the south west (Cornwall and Isles of Scilly and Heart of the South West), the north and north west (Humber, Sheffield City Region, North Eastern and Liverpool City Region) and eastern England (New Anglia).

Map 4.11: % of all in employment in 'science, research, engineering and technology' professions and associate professions, July 2013 - June 2014

LEP Key	%
1. Black Country	4.4
2. Buckinghamshire Thames Valley	9.0
3. Cheshire & Warrington	9.3
4. Coast to Capital	7.1
5. Cornwall & Isles of Scilly	5.2
6. Coventry & Warwickshire	7.7
7. Cumbria	7.6
8. Derby, Derbyshire, Nottingham & Nottinghamshire	6.6
9. Dorset	6.6
10. Enterprise M3	10.0
11. Gloucestershire	7.5
12. Greater Birmingham & Solihull	6.3
13. Greater Cambridge & Greater Peterborough	10.9
14. Greater Lincolnshire	5.1
15. Greater Manchester	6.3
16. Heart of the South West	5.6
17. Hertfordshire	8.6
18. Humber	5.3
19. Lancashire	6.2
20. Leeds city-region	6.0
21. Leicester & Leicestershire	7.6
22. Liverpool city-region	5.8
23. London	7.6
24. New Anglia	5.9
25. North Eastern	5.9
26. Northamptonshire	5.6
27. Oxfordshire	12.9
28. Sheffield city-region	5.8
29. Solent	8.2
30. South East	6.1
31. South East Midlands	7.3
32. Stoke on Trent & Staffordshire	5.9
33. Swindon & Wiltshire	9.1
34. Tees Valley	6.4
35. Thames Valley Berkshire	12.6
36. The Marches	6.6
37. West of England	10.2
38. Worcestershire	7.7
39. York & North Yorkshire	6.8



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2014. Occupation data from Annual Population Survey. Map layout by EIUA.

Table 4.9: Residents employed in science, research, engineering and technology professions, July 2013 – June 2014

LEP area	Region	Classification	% all in employment who are in 'science, research, engineering & technology' professions & associated professions - Jul 2013 - Jun 2014	Index England =100
Oxfordshire	South East	Rural	12.9	179
Thames Valley Berkshire	South East	Lon C-R	12.6	175
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	10.9	151
West of England	South West	2nd Tier	10.2	142
Enterprise M3	South East	Lon C-R	10.0	139
Cheshire and Warrington	North West	3rd Tier	9.3	129
Swindon and Wiltshire	South West	3rd Tier	9.1	126
Buckinghamshire Thames Valley	South East	Lon C-R	9.0	125
Hertfordshire	East of England	Lon C-R	8.6	119
Solent	South East	3rd Tier	8.2	114
Coventry and Warwickshire	West Midlands	3rd Tier	7.7	107
Worcestershire	West Midlands	Urban-rural	7.7	107
Cumbria	North West	Rural	7.6	106
Leicester and Leicestershire	East Midlands	2nd Tier	7.6	106
London	London	Capital	7.6	106
Gloucestershire	South West	Urban-rural	7.5	104
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	7.3	101
England			**7.2**	**100**
Coast to Capital	South East (part London)	Lon C-R	7.1	99
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	6.8	94
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	6.6	92
The Marches	West Midlands	Rural	6.6	92
Dorset	South West	3rd Tier	6.6	92
Tees Valley	North East	3rd Tier	6.4	89
Greater Manchester	North West	2nd Tier	6.3	88
Greater Birmingham and Solihull	West Midlands	2nd Tier	6.3	88
Lancashire	North West	3rd Tier	6.2	86
South East	South East (part East of England)	Lon C-R	6.1	85
Leeds City Region	Yorkshire and Humber	2nd Tier	6.0	83
New Anglia	East of England	3rd Tier	5.9	82
North Eastern	North East	2nd Tier	5.9	82
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	5.9	82
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	5.8	81
Liverpool City Region	North West	2nd Tier	5.8	81
Heart of the South West	South West	3rd Tier	5.6	78
Northamptonshire	East Midlands	3rd Tier	5.6	78
Humber	Yorkshire and Humber	3rd Tier	5.3	74
Cornwall and Isles of Scilly	South West	Rural	5.2	72
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	5.1	71
Black Country	West Midlands	2nd Tier	4.4	61

Source: Annual Population Survey

Talent: NVQ-level qualifications

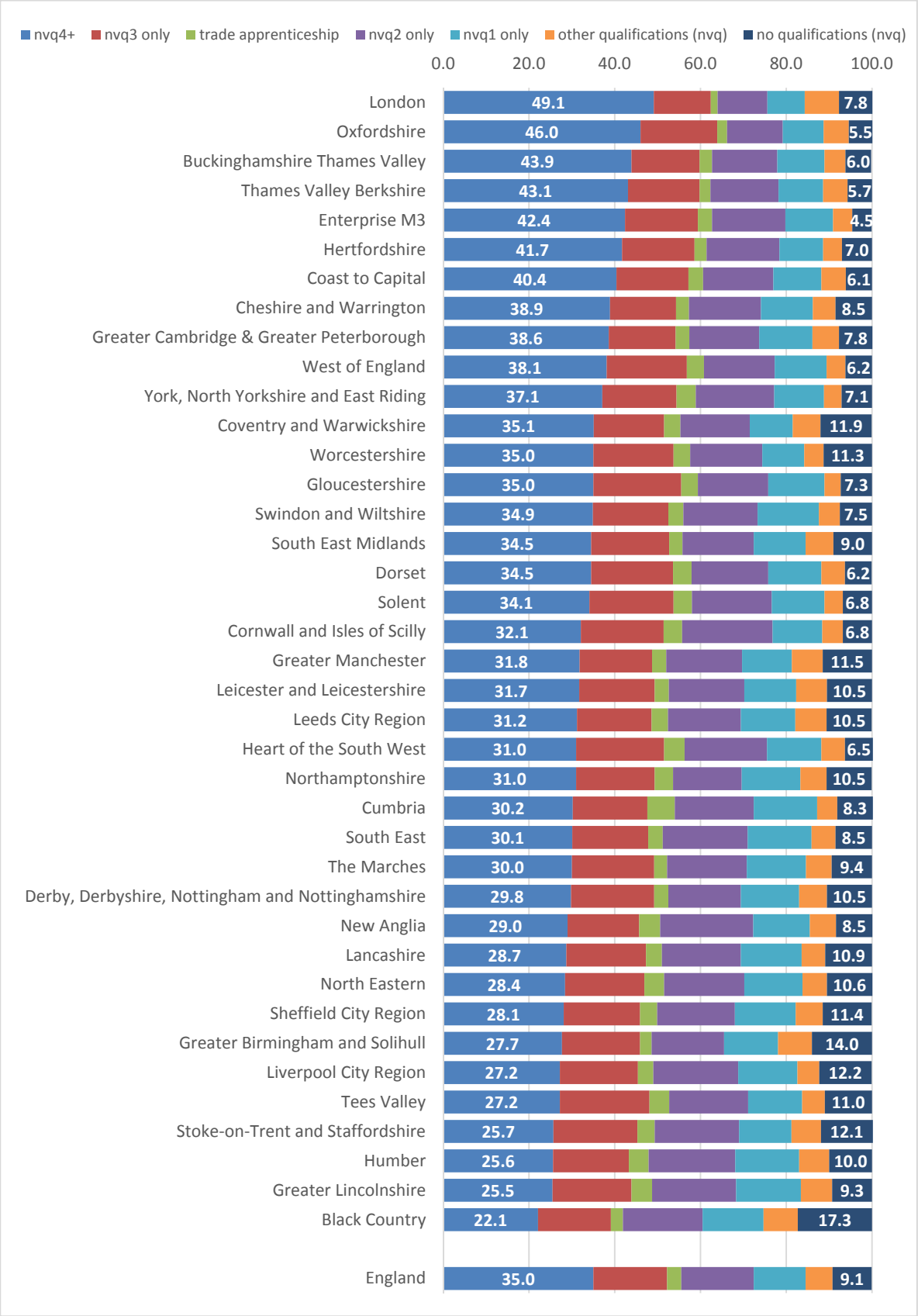
Higher level qualifications (NVQ levels 4 and above)

4.55 Figure 4.7 shows, for each LEP area, the breakdown of the working-age population by different NVQ qualification levels, from NVQ4+ - effectively equivalent to post 'Advanced level' qualifications and including undergraduate, masters and doctoral degree levels - to 'no qualifications'.

4.56 The Figure orders LEP areas by the share accounted for by the highest level, NVQ4+. Only 15 of the 39 LEP areas have shares of their working-age populations with NVQ4+ qualifications at or above the national level (35%). The capital, London, leads (49%) followed by the 'Greater Thames Valley 6' cluster of LEPs: in descending order Oxfordshire, Buckinghamshire Thames Valley, Thames Valley Berkshire, Enterprise M3, Hertfordshire and Coast to Capital. Third-tier Chester and Warrington is the highest ranked of Northern LEP areas with a share matching that of rhird-tier Greater Cambridge and Greater Peterborough (39%). The only other northern LEP area with an above national share of its workforce qualified at NVQ4 and above is rural York, North Yorkshire and East Riding (37%).

4.57 The share of the workforce with NVQ levels 4 and above in each of London and Oxfordshire is more than twice the corresponding figure for the LEP area with the lowest share, the Black Country. The LEP areas with workforces with relatively low levels of NVQ4+ qualifications are mainly in the midlands and north with a few exceptions: one in eastern England (New Anglia), a couple in the south east (South East and Solent) and three in the south west (Heart of the South West, Cornwall and the Isles of Scilly and Dorset).

Figure 4.7: % of working age with NVQ 4+/3/2/1/ other qualifications (nvq)/ no qualifications, 2013



Source: Annual Population Survey

Intermediate level qualifications (NVQ3: Advanced Apprenticeships, technicians and trainee managers)

4.58 In our LEP consultation, the issue of technician-level training and 'pathways to higher level skills' was raised by a number of LEPs in the fast growing, 'hi-tech' areas in the south. NVQ level 3 roughly equates to this important intermediate-level qualification. Table 4.10 shows the different shares of NVQ3 level qualifications across the LEP areas.

Table 4.10: % of working age with NVQ 3 only, 2013

LEP area	Region	Classification	% with NVQ3 only - aged 16-64	Index England=100
Tees Valley	North East	3rd Tier	20.9	122
Gloucestershire	South West	Urban-rural	20.5	119
Heart of the South West	South West	3rd Tier	20.5	119
Solent	South East	3rd Tier	19.6	114
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	19.6	114
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	19.4	113
Cornwall and Isles of Scilly	South West	Rural	19.3	112
The Marches	West Midlands	Rural	19.2	112
Dorset	South West	3rd Tier	19.1	111
West of England	South West	2nd Tier	18.7	109
Worcestershire	West Midlands	Urban-rural	18.7	109
Lancashire	North West	3rd Tier	18.6	108
North Eastern	North East	2nd Tier	18.5	108
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	18.4	107
Northamptonshire	East Midlands	3rd Tier	18.3	106
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	18.2	106
Greater Birmingham and Solihull	West Midlands	2nd Tier	18.2	106
Liverpool City Region	North West	2nd Tier	18.2	106
Oxfordshire	South East	Rural	17.9	104
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	17.8	103
South East	South East (part East of England)	Lon C-R	17.7	103
Humber	Yorkshire and Humber	3rd Tier	17.7	103
Swindon and Wiltshire	South West	3rd Tier	17.6	102
Leicester and Leicestershire	East Midlands	2nd Tier	17.6	102
Leeds City Region	Yorkshire and Humber	2nd Tier	17.4	101
Cumbria	North West	Rural	17.4	101
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	17.3	101

Enterprise M3	South East	Lon C-R	17.0	99
Black Country	West Midlands	2nd Tier	17.0	99
Hertfordshire	East of England	Lon C-R	16.9	98
Greater Manchester	North West	2nd Tier	16.9	98
Coast to Capital	South East (part London)	Lon C-R	16.8	98
Thames Valley Berkshire	South East	Lon C-R	16.7	97
New Anglia	East of England	3rd Tier	16.7	97
Coventry and Warwickshire	West Midlands	3rd Tier	16.4	95
Buckinghamshire Thames Valley	South East	Lon C-R	15.9	92
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	15.6	91
Cheshire and Warrington	North West	3rd Tier	15.4	90
London	London	Capital	13.3	77
England			**17.2**	**100**

Source: Annual Population Survey

4.59 12 LEP areas have shares of NVQ level 3 qualifications below the national, England average and it is noticeable that London has the lowest share by some considerable distance, a situation that will need to be addressed by the forthcoming devolution of powers over skills and training. Cheshire and Warrington and Greater Cambridge and Greater Peterborough and five of the 'Greater Thames Valley 6' LEPs also have workforce shares of NVQ3 level qualifications below the national average – in areas that rank highly in terms of R&D expenditure and innovation assets. These areas are not without skill constraints.

No qualifications

4.60 The LEP areas experiencing the constraints imposed by levels of intermediate skills, however, do not appear to be suffering from the 'drag' effect of workforces with high levels of workers with no qualifications. As Table 4.11 shows, the broad North-South pattern of high-level skills is reversed for the share of working age populations with no qualifications. 18 LEP areas have shares of workers with no qualifications in their workforces above the national, England average (9%). All of these are in the Midlands and North. The lowest shares are in a band of South Eastern LEP areas comprising, in ascending order, Enterprise M3, Oxfordshire, Thames Valley Berkshire, Buckinghamshire Thames Valley and Coast to Capital of the 'Greater Thames Valley 6' and a group of South Western LEP areas: West of England, Dorset, Heart of the South West and Cornwall and the Isles of Scilly and Heart of the South West.

Table 4.11: % of working age with no qualifications, Jan 2013-Dec 2013

LEP area	Region	Classification	% with no qualifications (NVQ) - aged 16-64	Index England= 100
Black Country	West Midlands	2nd Tier	17.3	190
Greater Birmingham and Solihull	West Midlands	2nd Tier	14.0	154
Liverpool City Region	North West	2nd Tier	12.2	134
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	12.1	133
Coventry and Warwickshire	West Midlands	3rd Tier	11.9	131
Greater Manchester	North West	2nd Tier	11.5	126
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	11.4	125
Worcestershire	West Midlands	Urban-rural	11.3	124
Tees Valley	North East	3rd Tier	11.0	121
Lancashire	North West	3rd Tier	10.9	120
North Eastern	North East	2nd Tier	10.6	116
Leeds City Region	Yorkshire and Humber	2nd Tier	10.5	115
Leicester and Leicestershire	East Midlands	2nd Tier	10.5	115
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	10.5	115
Northamptonshire	East Midlands	3rd Tier	10.5	115
Humber	Yorkshire and Humber	3rd Tier	10.0	110
The Marches	West Midlands	Rural	9.4	103
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	9.3	102
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	9.0	99
New Anglia	East of England	3rd Tier	8.5	93
South East	South East (part East of England)	Lon C-R	8.5	93
Cheshire and Warrington	North West	3rd Tier	8.5	93
Cumbria	North West	Rural	8.3	91
London	London	Capital	7.8	86
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	7.8	86
Swindon and Wiltshire	South West	3rd Tier	7.5	82
Gloucestershire	South West	Urban-rural	7.3	80
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	7.1	78
Hertfordshire	East of England	Lon C-R	7.0	77
Cornwall and Isles of Scilly	South West	Rural	6.8	75
Solent	South East	3rd Tier	6.8	75
Heart of the South West	South West	3rd Tier	6.5	71
Dorset	South West	3rd Tier	6.2	68
West of England	South West	2nd Tier	6.2	68
Coast to Capital	South East (part London)	Lon C-R	6.1	67
Buckinghamshire Thames Valley	South East	Lon C-R	6.0	66
Thames Valley Berkshire	South East	Lon C-R	5.7	63
Oxfordshire	South East	Rural	5.5	60
Enterprise M3	South East	Lon C-R	4.5	49
England			**9.1**	**100**

Source: Annual Population Survey

Talent: Higher Education

Undergraduate education

4.61 The latest HESA data for 2013/14 show students qualifying for undergraduate honours degrees; in total and by 'science, technology, engineering and mathematics' (STEM) and non-STEM subjects. There were 308,127 students graduating with honours degrees in England. HEIs in the London LEP area had the most, with just over 54,000, 18% of the total and roughly the same number as that of the combined total of the next three LEP areas in the rankings: Leeds City Region, Greater Manchester and North Eastern (Table 4.12). These four LEP areas together with the next four in the rankings - South East, Derby, Derbyshire, Nottingham and Nottinghamshire, Solent and South East Midlands - accounted for just over half of all the graduates.

4.62 After London, all nine of the LEP areas in second-tier city regions with their large civic universities feature in the top 15 in terms of the total number of graduates. The capital city and second-tier city-region LEPs are joined in the top 15 by the South East LEP area that falls within the wider capital city-region, and Solent and Lancashire LEP areas that are both in third-tier city-regions.

Table 4.12; Students graduating with first degrees with honours in HEIs by LEP area, 2013/14

LEP	Region	Classification	First degrees with honours	%
London	London	Capital	54,338	17.6
Leeds City Region	Yorkshire and Humber	2nd Tier	20,025	6.5
Greater Manchester	North West	2nd Tier	17,388	5.6
North Eastern	North East	2nd Tier	15,470	5.0
South East	South East (part East of England)	Lon C-R	14,105	4.6
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	13,941	4.5
Solent	South East	3rd Tier	12,504	4.1
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	11,186	3.6
Lancashire	North West	3rd Tier	11,150	3.6
West of England	South West	2nd Tier	11,094	3.6
Greater Birmingham and Solihull	West Midlands	2nd Tier	10,909	3.5
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	10,902	3.5
Liverpool City Region	North West	2nd Tier	10,067	3.3
Leicester and Leicestershire	East Midlands	2nd Tier	9,419	3.1
Heart of the South West	South West	3rd Tier	9,318	3.0
Coventry and Warwickshire	West Midlands	3rd Tier	8,044	2.6
Coast to Capital	South East (part London)	Lon C-R	7,814	2.5
Enterprise M3	South East	Lon C-R	7,036	2.3
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	6,228	2.0

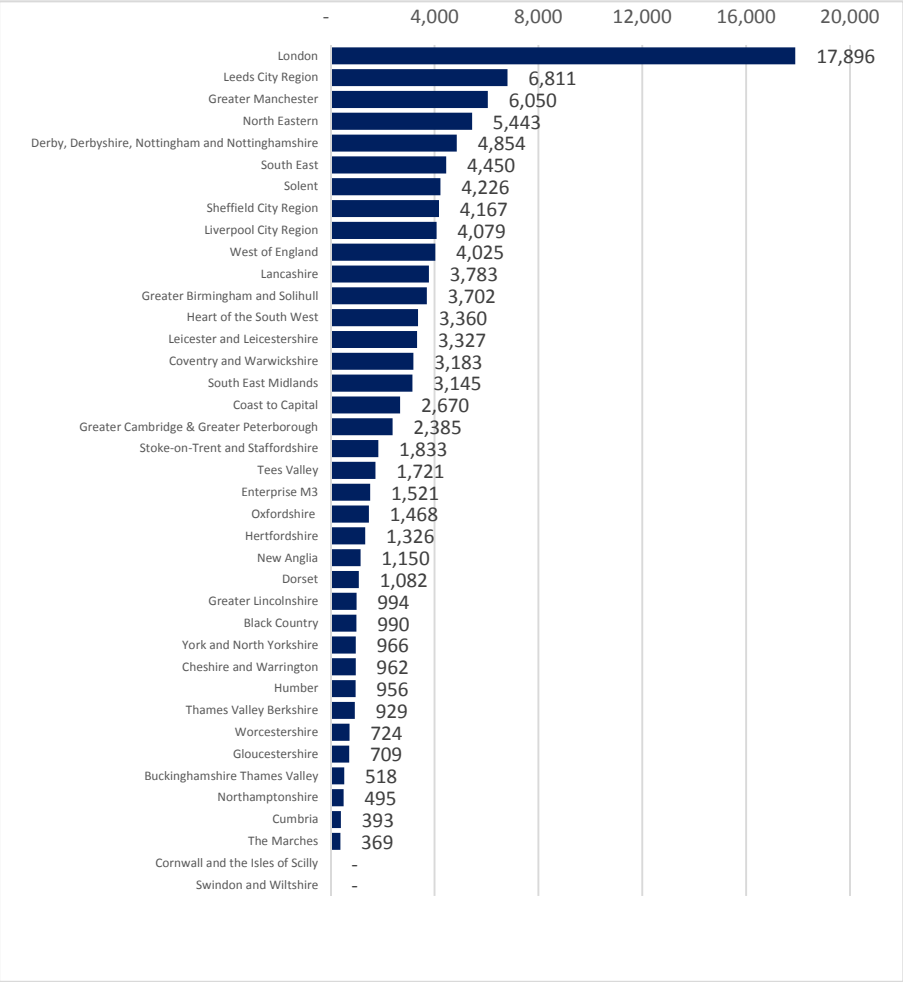
Oxfordshire LEP	South East	Rural	5,095	1.7
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	4,289	1.4
Hertfordshire	East of England	Lon C-R	4,087	1.3
York and North Yorkshire	Yorkshire and Humber	Rural	4,042	1.3
Dorset	South West	3rd Tier	3,924	1.3
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	3,734	1.2
New Anglia	East of England	3rd Tier	3,587	1.2
Humber	Yorkshire and Humber	3rd Tier	3,369	1.1
Black Country	West Midlands	2nd Tier	2,952	1.0
Tees Valley	North East	3rd Tier	2,948	1.0
Northamptonshire	East Midlands	3rd Tier	2,589	0.8
Thames Valley Berkshire	South East	Lon C-R	2,503	0.8
Cheshire and Warrington	North West	3rd Tier	2,284	0.7
Gloucestershire	South West	Urban-rural	2,212	0.7
Worcestershire	West Midlands	Urban-rural	2,042	0.7
Buckinghamshire Thames Valley	South East	Lon C-R	1,935	0.6
Cumbria	North West	Rural	1,525	0.5
Cornwall and the Isles of Scilly	South West	Rural	1,134	0.4
The Marches	West Midlands	Rural	412	0.1
Swindon and Wiltshire	South West	3rd Tier	0	0.0
England			308,127	100

Source: HESA

4.63 In terms of broad subject areas, the 308,127 graduates in England HEIs were split roughly one third: two thirds STEM and non-STEM (104,434 and 203,693 respectively). Figures 4.8 and 4.9 show the distribution of graduates in STEM and non-STEM subjects across the LEP areas. The rankings mirror the rankings for total graduates, although the balance between STEM and non-STEM graduates varies. STEM graduates account for 90% of the total number of graduates in rural The Marches with its single, specialised agricultural HEI compared with just 19% of the total in third-tier Northamptonshire and none in rural Cornwall and the Isles of Scilly. All nine LEP areas in second-tier city regions have the balance of STEM graduates in their graduating student numbers equal to or above the England average: from Greater Birmingham and Solihull (equal to the England average of 33.9%) to Liverpool City Region (with graduates in STEM subjects accounting for 40.5% of the total).

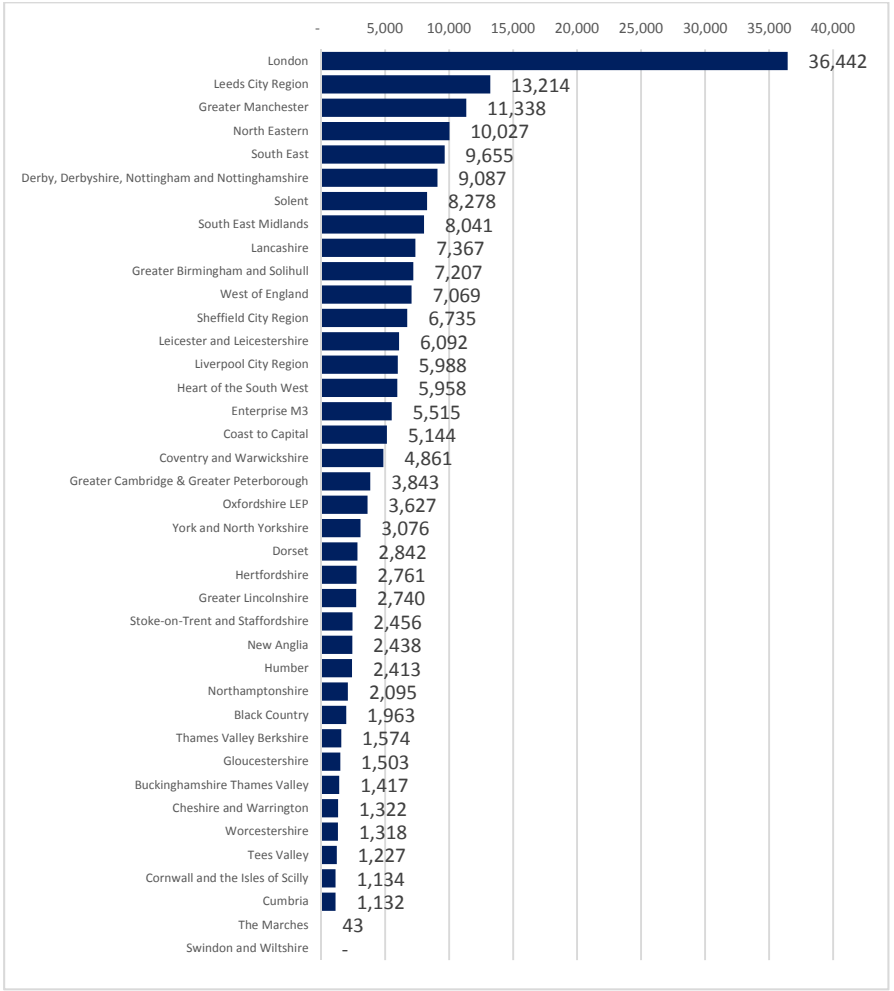
4.64 Map 4.12 shows the distribution of STEM graduates across the LEP areas. London leads with a total number of 17,986 STEM graduates, a total roughly matched by the combined figures of three LEP areas in large northern second-tier city-regions: Leeds City Region, Greater Manchester and North Eastern. The next group is a mix of LEP areas in second and third-tier city regions in the north (Sheffield City Region, Liverpool City Region and Lancashire), the midlands (Derby, Derbyshire, Nottingham and Nottinghamshire, Greater Birmingham and Solihull, Leicester and Leicestershire, Coventry and Warwickshire and South East Midlands), the south (South East and Solent) and south west (West of England and Heart of the South West).

Figure 4.8: First degree with honours: STEM subjects, 2013/14



Source: HESA

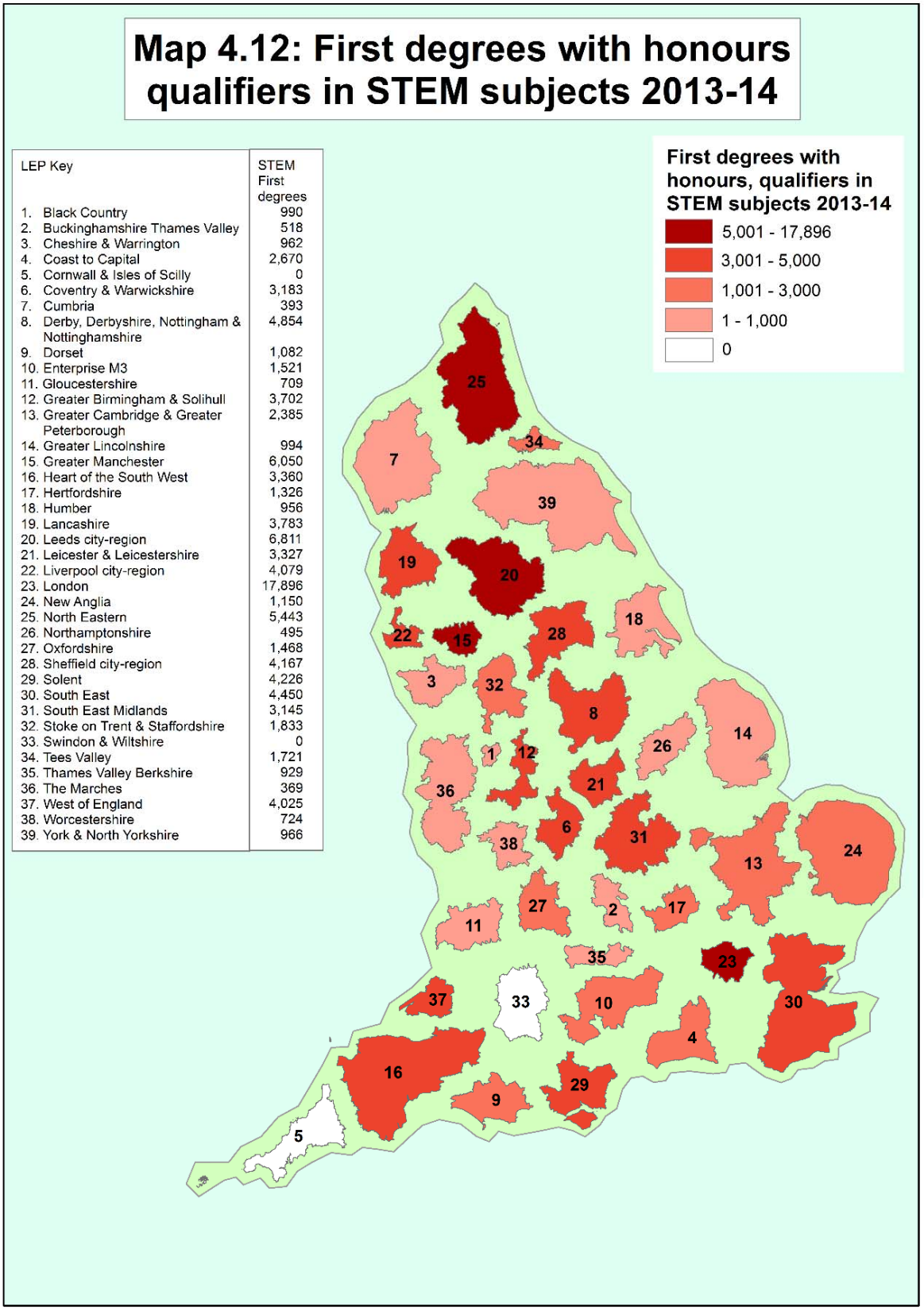
Figure 4.9: First degree with honours: non-STEM subjects, 2013/14



Source: HESA

Map 4.12: First degrees with honours qualifiers in STEM subjects 2013-14

LEP Key	STEM First degrees
1. Black Country	990
2. Buckinghamshire Thames Valley	518
3. Cheshire & Warrington	962
4. Coast to Capital	2,670
5. Cornwall & Isles of Scilly	0
6. Coventry & Warwickshire	3,183
7. Cumbria	393
8. Derby, Derbyshire, Nottingham & Nottinghamshire	4,854
9. Dorset	1,082
10. Enterprise M3	1,521
11. Gloucestershire	709
12. Greater Birmingham & Solihull	3,702
13. Greater Cambridge & Greater Peterborough	2,385
14. Greater Lincolnshire	994
15. Greater Manchester	6,050
16. Heart of the South West	3,360
17. Hertfordshire	1,326
18. Humber	956
19. Lancashire	3,783
20. Leeds city-region	6,811
21. Leicester & Leicestershire	3,327
22. Liverpool city-region	4,079
23. London	17,896
24. New Anglia	1,150
25. North Eastern	5,443
26. Northamptonshire	495
27. Oxfordshire	1,468
28. Sheffield city-region	4,167
29. Solent	4,226
30. South East	4,450
31. South East Midlands	3,145
32. Stoke on Trent & Staffordshire	1,833
33. Swindon & Wiltshire	0
34. Tees Valley	1,721
35. Thames Valley Berkshire	929
36. The Marches	369
37. West of England	4,025
38. Worcestershire	724
39. York & North Yorkshire	966



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. 'First degree with honours' qualifier statistics are from HESA. Map layout by EIUA.

Postgraduate education

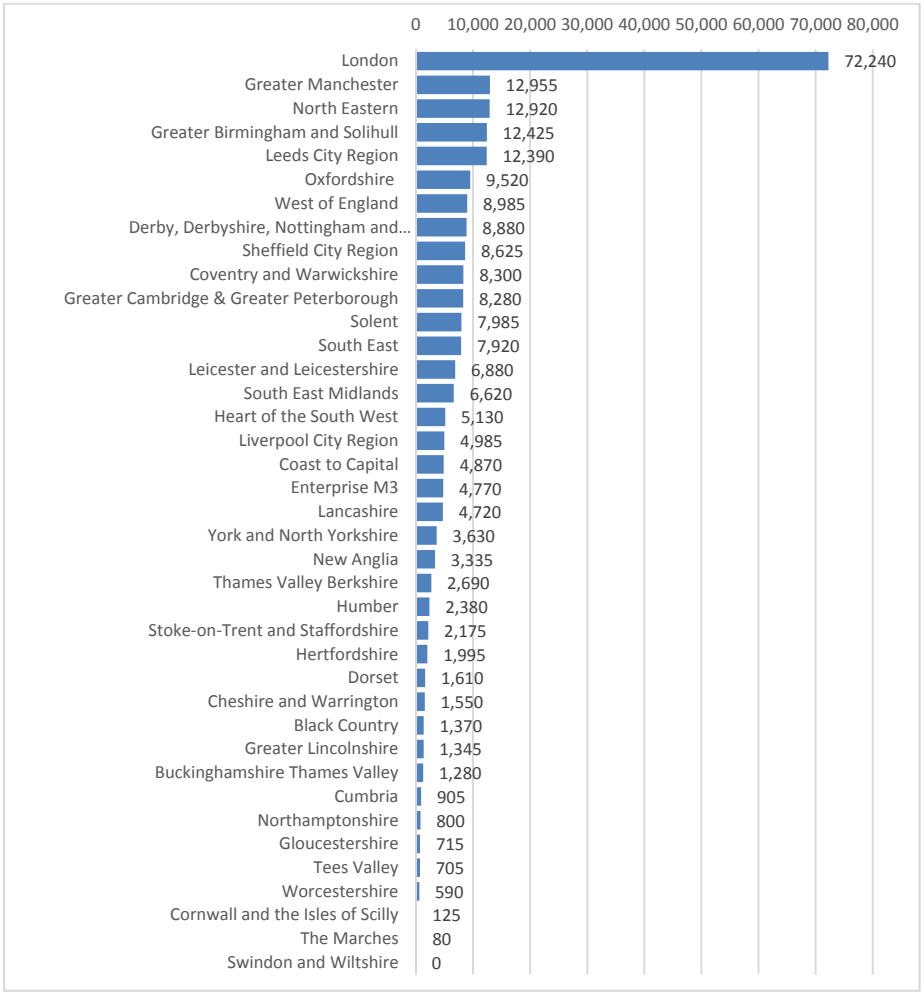
4.65 The latest HESA data on enrolments in postgraduate education underline the significance, in terms of numbers, of students coming for postgraduate study in England from abroad. In 2013/14, 250,555 students enrolled for full-time postgraduate education in England. Of these, 105,830 (42%) were domiciled in the UK. There were 144,725 registered full-time postgraduate students (58%) in English HEIs from outside the UK, split between 28,250 from other European Union countries (11.3% of the total) and 116,475 from non-European Union countries (46.5% of the total).

4.66 Figures 4.10 and 4.11 show the distribution across LEP areas of total and non-UK postgraduate enrolments.

4.67 The dominance of London's HEI cluster again stands out. It had 72,240 postgraduate enrolments, of which 43,065 (60%) were students from outside the UK. Its total enrolments were some five and a half times the number of each of the second and third highest LEP areas, Greater Manchester and North Eastern, with enrolments of 12,955 and 12,920 respectively. HEIs in six LEP areas together account for just over half of all postgraduate enrolments in England: London, Greater Manchester, North Eastern, Greater Birmingham and Solihull, Leeds City Region and Oxfordshire. And three of these account for half of non-UK postgraduate enrolments: London, North Eastern and Greater Birmingham and Solihull. Adding Leeds city-region, Greater Manchester, and Coventry and Warwickshire pushes the total to over two thirds.

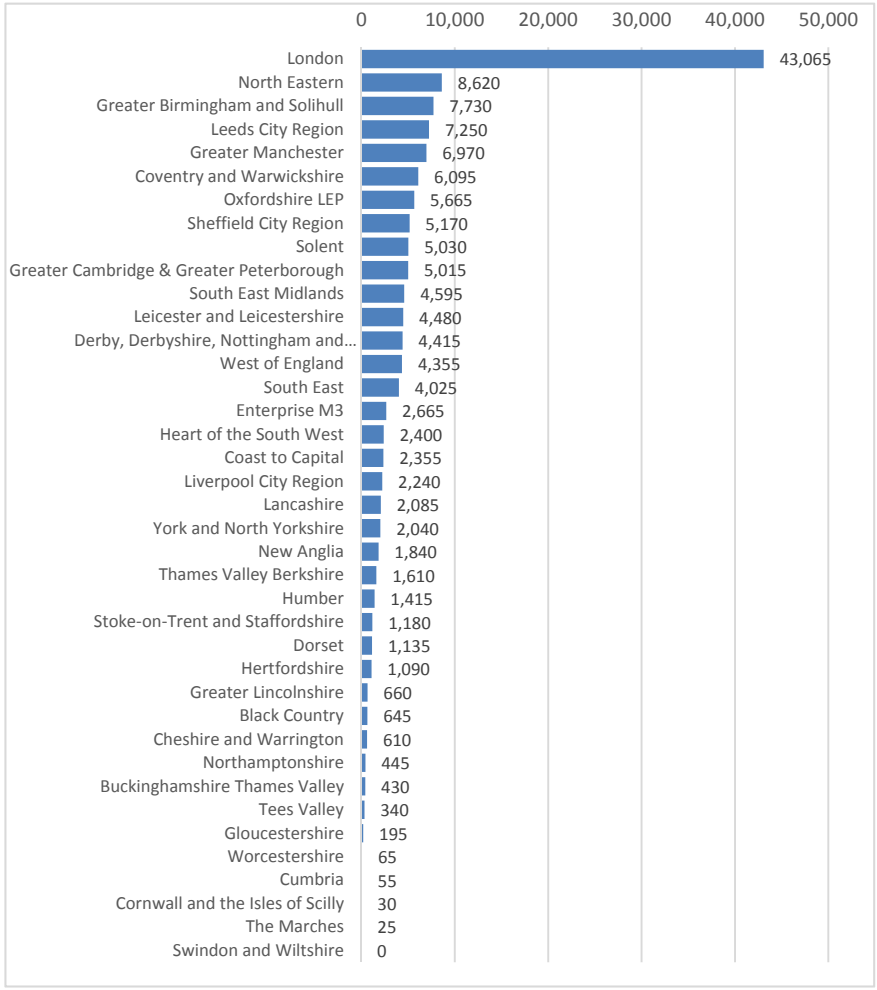
4.68 Map 4.13 shows the distribution of these non-UK postgraduate student enrolments in HEIs across the LEP areas.

Figure 4.10: Full-time total postgraduate enrolments, 2013/14



Source: HESA

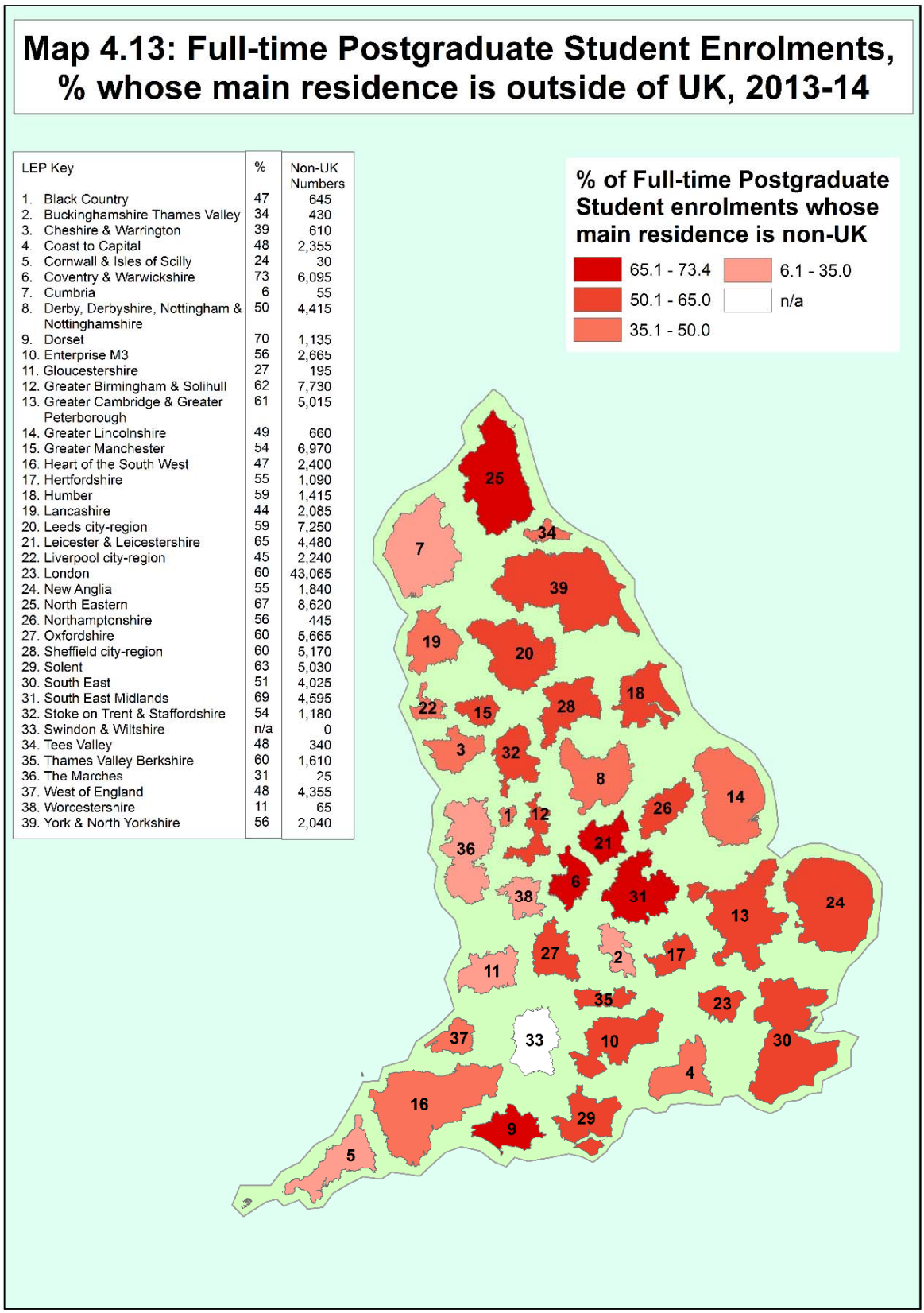
Figure 4.11: Full-time non-UK postgraduate enrolments, 2013/14



Source: HESA

Map 4.13: Full-time Postgraduate Student Enrolments, % whose main residence is outside of UK, 2013-14

LEP Key	%	Non-UK Numbers
1. Black Country	47	645
2. Buckinghamshire Thames Valley	34	430
3. Cheshire & Warrington	39	610
4. Coast to Capital	48	2,355
5. Cornwall & Isles of Scilly	24	30
6. Coventry & Warwickshire	73	6,095
7. Cumbria	6	55
8. Derby, Derbyshire, Nottingham & Nottinghamshire	50	4,415
9. Dorset	70	1,135
10. Enterprise M3	56	2,665
11. Gloucestershire	27	195
12. Greater Birmingham & Solihull	62	7,730
13. Greater Cambridge & Greater Peterborough	61	5,015
14. Greater Lincolnshire	49	660
15. Greater Manchester	54	6,970
16. Heart of the South West	47	2,400
17. Hertfordshire	55	1,090
18. Humber	59	1,415
19. Lancashire	44	2,085
20. Leeds city-region	59	7,250
21. Leicester & Leicestershire	65	4,480
22. Liverpool city-region	45	2,240
23. London	60	43,065
24. New Anglia	55	1,840
25. North Eastern	67	8,620
26. Northamptonshire	56	445
27. Oxfordshire	60	5,665
28. Sheffield city-region	60	5,170
29. Solent	63	5,030
30. South East	51	4,025
31. South East Midlands	69	4,595
32. Stoke on Trent & Staffordshire	54	1,180
33. Swindon & Wiltshire	n/a	0
34. Tees Valley	48	340
35. Thames Valley Berkshire	60	1,610
36. The Marches	31	25
37. West of England	48	4,355
38. Worcestershire	11	65
39. York & North Yorkshire	56	2,040



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Data are from HESA. 'Non-UK' comprise of 'Other European' and 'Non-European'. Map layout by EIUA.

Research-based doctorate degrees

4.69 Table 4.13 lists by LEP area the number of research-based doctorate degrees awarded in STEM and non-STEM subjects in England in 2013/14. 17,183 doctorate degrees were awarded, split two thirds: one third STEM: non-STEM (11,251 and 5,932, respectively) – a balance the mirror opposite of that for undergraduate degrees.

4.70 London again has the largest share of all doctorate degrees, 23% - a higher share than its share of undergraduate degrees (18%). Greater Manchester comes second, with a third of London's figure, closely followed by 'the Oxbridge' LEP areas - Greater Cambridge & Greater Peterborough and Oxfordshire – and Leeds City Region. These five LEP areas together accounted for half of the total doctoral degrees awarded.

Table 4.13: Research-based doctorate degrees awarded by LEP area, 2013/14

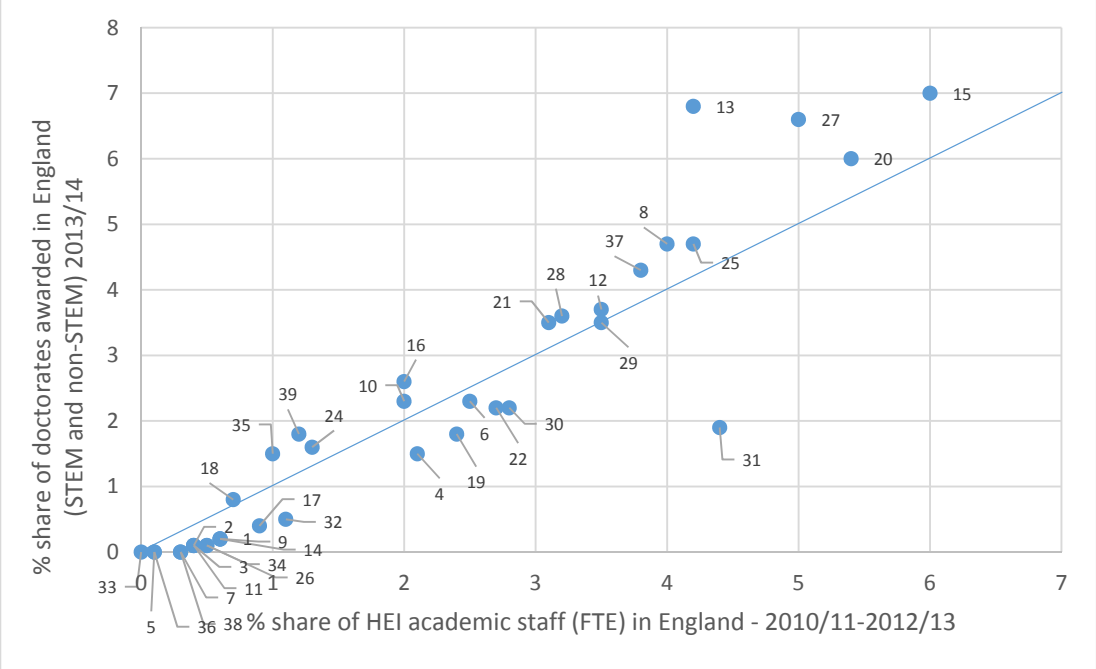
Qualification Obtained: Doctorate degree that meets the criteria for a research based degree, 2013/14. Sum of Full-Person Equivalent , Ranked by total								
LEP			STEM	%	non-STEM	%	Total	%
London	London	Capital	2,614	23.2	1,365	23.0	3,979	23.2
Greater Manchester	North West	2nd Tier	846	7.5	351	5.9	1,197	7.0
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	831	7.4	340	5.7	1,170	6.8
Oxfordshire	South East	Rural	707	6.3	433	7.3	1,139	6.6
Leeds City Region	Yorkshire and Humber	2nd Tier	613	5.4	416	7.0	1,029	6.0
North Eastern	North East	2nd Tier	511	4.5	302	5.1	813	4.7
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	610	5.4	194	3.3	804	4.7
West of England	South West	2nd Tier	537	4.8	205	3.5	742	4.3
Greater Birmingham and Solihull	West Midlands	2nd Tier	427	3.8	206	3.5	633	3.7
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	468	4.2	149	2.5	617	3.6
Leicester and Leicestershire	East Midlands	2nd Tier	431	3.8	171	2.9	602	3.5
Solent	South East	3rd Tier	403	3.6	191	3.2	593	3.5
Heart of the South West	South West	3rd Tier	228	2.0	225	3.8	453	2.6
Enterprise M3	South East	Lon C-R	247	2.2	156	2.6	403	2.3
Coventry and Warwickshire	West Midlands	3rd Tier	244	2.2	153	2.6	397	2.3
South East	South East (part East of England)	Lon C-R	161	1.4	224	3.8	385	2.2
Liverpool City Region	North West	2nd Tier	282	2.5	88	1.5	370	2.2
South East Midlands	East Midlands (part South East & East of	3rd Tier	223	2.0	97	1.6	320	1.9

	England)							
Lancashire	North West	3rd Tier	155	1.4	163	2.7	317	1.8
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	169	1.5	146	2.5	315	1.8
New Anglia	East of England	3rd Tier	179	1.6	96	1.6	275	1.6
Coast to Capital	South East (part London)	Lon C-R	134	1.2	127	2.1	260	1.5
Thames Valley Berkshire	South East	Lon C-R	158	1.4	100	1.7	257	1.5
Humber	Yorkshire and Humber	3rd Tier	73	0.6	57	1.0	130	0.8
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	39	0.3	41	0.7	80	0.5
Hertfordshire	East of England	Lon C-R	53	0.5	10	0.2	63	0.4
Dorset	South West	3rd Tier	15	0.1	23	0.4	38	0.2
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	18	0.2	11	0.2	29	0.2
Black Country	West Midlands	2nd Tier	15	0.1	13	0.2	28	0.2
Gloucestershire	South West	Urban-rural	13	0.1	12	0.2	25	0.1
Tees Valley	North East	3rd Tier	16	0.1	9	0.2	25	0.1
Northamptonshire	East Midlands	3rd Tier	5	0.0	13	0.2	18	0.1
Cheshire and Warrington	North West	3rd Tier	3	0.0	9	0.2	12	0.1
Buckinghamshire Thames Valley	South East	Lon C-R	6	0.1	5	0.1	11	0.1
Cumbria	North West	Rural	5	0.0	3	0.1	8	0.0
Worcestershire	West Midlands	Urban-rural	-	-	8	0.1	8	0.0
Cornwall and Isles of Scilly	South West	Rural	-	-	5	0.1	5	0.0
The Marches	West Midlands	Rural	2	0.0	-	-	2	0.0
Swindon and Wiltshire	South West	3rd Tier	-	-	-	-	-	-
England			11,251	100.0	5,932	100.0	17,183	100.0

Source: HESA

4.71 Figure 4.12 plots the LEP area shares of total doctorates against shares of academic staff to make some, admittedly crude, allowance for size. London's share of doctorates awarded is slightly below that of its share of academic staff. 16 of the 39 LEP areas had shares of doctorates awarded greater than their share of staff (above the line in the chart). The 'Oxbridge' LEP areas stand out in this group along with Thames Valley Berkshire, York, North Yorkshire and East Riding, Heart of the South West and New Anglia.

Figure 4.12: % share of England's HEI academic staff (FTE 2010/11-2012/13) vs % share of England's doctorates (all – STEM and non-STEM) - awarded 2013/14



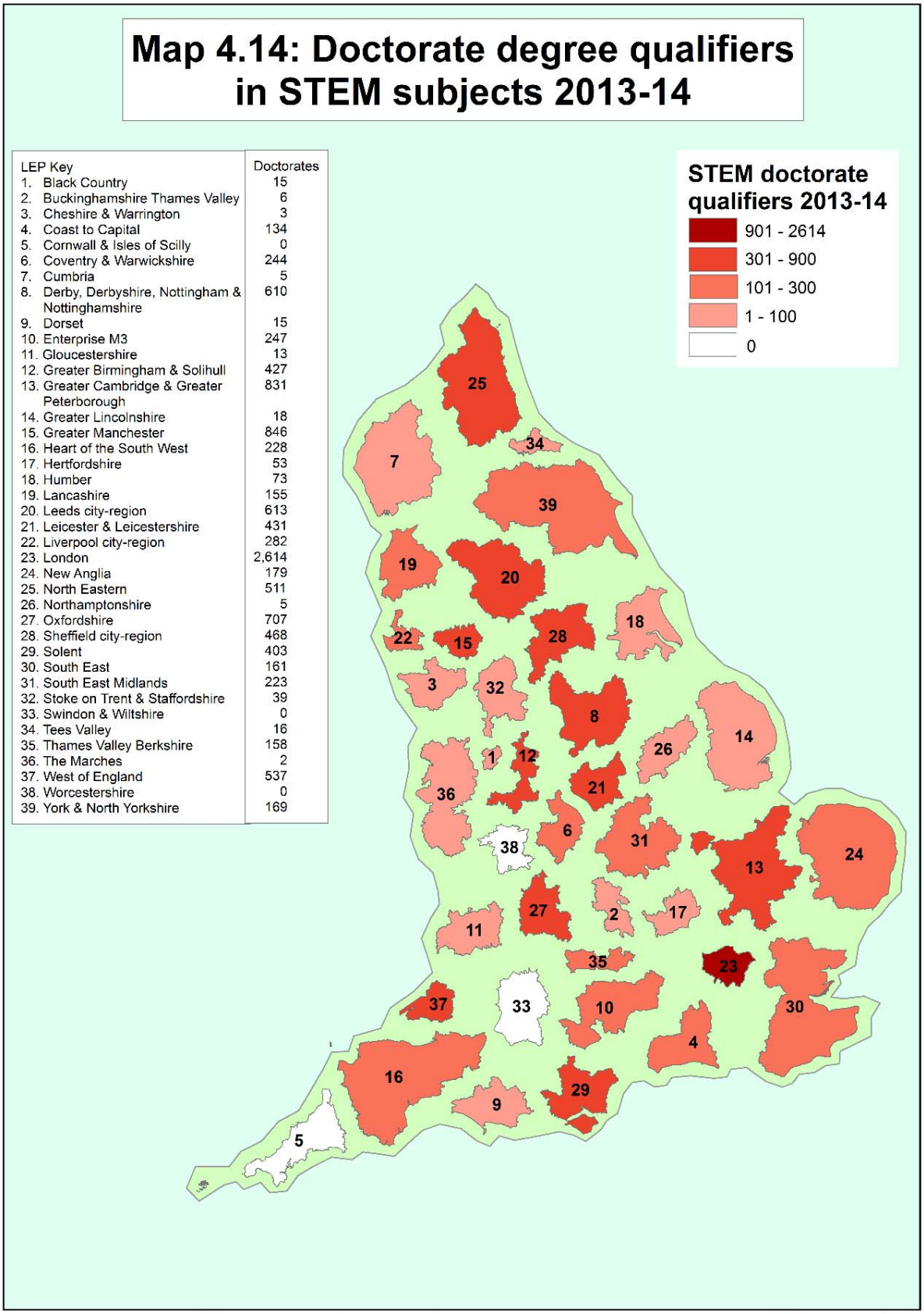
Source: HESA; Notes: London has been omitted for presentational reasons but it has a 24.3% share of HEI staff and a 23.2% share of doctorates, so would appear just below the line.

Key	LEP
1	Black Country
2	Buckinghamshire Thames Valley
3	Cheshire and Warrington
4	Coast to Capital
5	Cornwall and Isles of Scilly
6	Coventry and Warwickshire
7	Cumbria
8	Derby, Derbyshire, Nottingham and Nottinghamshire
9	Dorset
10	Enterprise M3
11	Gloucestershire
12	Greater Birmingham and 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 and Leicestershire
22	Liverpool City Region
-	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 and Staffordshire
33	Swindon and Wiltshire
34	Tees Valley
35	Thames Valley Berkshire
36	The Marches
37	West of England
38	Worcestershire
39	York, North Yorkshire and East Riding

4.72 HEIs in the same five LEP areas also accounted for half of the doctoral degrees awarded in STEM subjects, see Table 4.13. Map 4.14 shows the distribution across the LEP areas. Outside of London, there is a relatively even balance regionally. HEIs in the next 13 LEP areas in the ranking together had 60% of STEM doctorates: with 5 in the north, 3 in the midlands, 1 in eastern England, 3 in the south east and 1 in the south west.

Map 4.14: Doctorate degree qualifiers in STEM subjects 2013-14

LEP Key	Doctorates
1. Black Country	15
2. Buckinghamshire Thames Valley	6
3. Cheshire & Warrington	3
4. Coast to Capital	134
5. Cornwall & Isles of Scilly	0
6. Coventry & Warwickshire	244
7. Cumbria	5
8. Derby, Derbyshire, Nottingham & Nottinghamshire	610
9. Dorset	15
10. Enterprise M3	247
11. Gloucestershire	13
12. Greater Birmingham & Solihull	427
13. Greater Cambridge & Greater Peterborough	831
14. Greater Lincolnshire	18
15. Greater Manchester	846
16. Heart of the South West	228
17. Hertfordshire	53
18. Humber	73
19. Lancashire	155
20. Leeds city-region	613
21. Leicester & Leicestershire	431
22. Liverpool city-region	282
23. London	2,614
24. New Anglia	179
25. North Eastern	511
26. Northamptonshire	5
27. Oxfordshire	707
28. Sheffield city-region	468
29. Solent	403
30. South East	161
31. South East Midlands	223
32. Stoke on Trent & Staffordshire	39
33. Swindon & Wiltshire	0
34. Tees Valley	16
35. Thames Valley Berkshire	158
36. The Marches	2
37. West of England	537
38. Worcestershire	0
39. York & North Yorkshire	169



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015.
The doctorate statistics are from HESA and refer to doctorates that meet the criteria for a research based higher degree. Map layout by EIUA.

Graduate retention

4.73 Using the HESA 'Destination of Leavers from Higher Education' survey it is possible to measure graduate retention rate by the home region of HE students. Table 4.14 lists the rates for LEP areas by their home regions. It shows the LEP areas in which students were domiciled prior to study and the region in which students were domiciled six months after graduation. The highest rates - above 75% - are in some of the large second-tier city-region LEP areas in the north and midlands - Liverpool City Region, Black Country, Greater Manchester, Lancashire, North Eastern, Tees Valley and Greater Birmingham and Solihull – and London.

4.74 The lowest retention rates are in LEP areas in the more rural eastern England and midlands and wider London city-region area: Hertfordshire (the lowest at 50%) in eastern England; Northamptonshire, South East Midlands, Greater Lincolnshire and The Marches in the midlands; along with Buckinghamshire Thames Valley and Enterprise M3 in the south east.

4.75 It is noticeable that the retention rates for graduates domiciled in the south east and eastern England regions of the innovative 'Greater Thames Valley Six' LEP areas - Coast to Capital, Thames Valley Berkshire, Enterprise M3, Buckinghamshire Thames Valley, Oxfordshire and Hertfordshire - are relatively low. The rates range from 50% for Hertfordshire in the East of England to 67% for Coast to Capital in the London city-region. As Table 4.14 also shows, however, a noticeably high proportion of graduates from these LEP areas are domiciled in the London region after graduation. There is a clear and significant 'London effect' that draws students away from these LEP areas.

Table 4.14: Graduate retention rates, 6 months after graduation, % retained in home region and % in the London region, 2012/13

Region	LEP	Classification	Retention in region (where known)	% in London
NW	Liverpool City Region	2nd Tier	83.4	4.7
WM	Black Country	2nd Tier	82.5	4.2
NW	Greater Manchester	2nd Tier	81.7	5.0
LON	London	Capital	81.7	81.7
NW	Lancashire	3rd Tier	80.5	4.8
NE	North Eastern	2nd Tier	79.9	4.9
NE	Tees Valley	3rd Tier	77.8	4.5
WM	Greater Birmingham and Solihull	2nd Tier	75.6	6.7
SW	Cornwall and the Isles of Scilly	Rural	74.9	9.6
Y&H	Leeds City Region	2nd Tier	74.9	6.5
Y&H	Humber	3rd Tier	72.8	5.8
NW	Cumbria	Rural	72.8	5.4
SW	West of England	2nd Tier	72.7	10.6
SW	Heart of the South West	3rd Tier	71.6	11.1
WM	Stoke-on-Trent and Staffordshire	3rd Tier	70.8	5.2
EE	New Anglia	3rd Tier	70.5	13.0
Y&H / EM	Sheffield City Region	2nd Tier	70.1	5.7
SE	Solent	3rd Tier	69.0	15.2
NW	Cheshire and Warrington	3rd Tier	68.7	7.4
EM	Leicester and Leicestershire	2nd Tier	68.1	8.0
Y&H	York and North Yorkshire	Rural	67.4	8.8
SE / LON	Coast to Capital	Lon C-R	66.9	35.1

WM	Coventry and Warwickshire	3rd Tier	66.6	9.7
WM	Worcestershire	Urban-rural	66.4	8.0
SE	Thames Valley Berkshire	Lon C-R	66.0	20.3
EM	Derby, Derbyshire, Nottingham and Nottinghamshire,	2nd Tier	64.9	7.2
SE	Oxfordshire	Rural	63.4	17.4
EE / EM	Greater Cambridge & Greater Peterborough	3rd Tier	62.5	16.7
SW	Dorset	3rd Tier	62.2	13.9
SE / EE	South East	Lon C-R	61.9	25.3
SW	Swindon and Wiltshire	3rd Tier	61.3	14.5
SW	Gloucestershire	Urban-rural	60.7	13.4
WM	The Marches	Rural	59.4	9.8
EM / Y&H	Greater Lincolnshire	Rural	59.3	8.9
EM / SE / EE	South East Midlands	3rd Tier	58.6	15.5
EM	Northamptonshire	3rd Tier	58.5	11.5
SE	Enterprise M3	Lon C-R	58.4	26.4
SE	Buckinghamshire Thames Valley	Lon C-R	53.1	27.0
EE	Hertfordshire	Lon C-R	50.2	31.6

Source: HESA Destination of Leavers from Higher Education survey; Note where LEP covers more than one region – retention rates have been calculated for the relevant home region for each part of each LEP. Where data were only available at county level, they were apportioned in accordance with Local Authority shares of the county's 18 to 24 year old population.

4.3 Knowledge Assets

4.76 Knowledge assets in the framework are 'the intermediary outputs of the system that provide an indicator of its quality and potential' (BIS, 2014a). We have selected four datasets for our 'headline' indicators of these assets:

- Output and quality of scientific research: publications and impact measure - by author, institution, sector and technology (Scopus and PubMed)
- Intellectual Property protection: patents – by patentee, institution, sector and technology (USPTO and Espacenet)
- Knowledge exchange/ collaboration - interactions between Higher Education Institutions and business and the wider community: collaborative research, consultancy, contract research, active patents (Higher Education Business and Community Interaction Survey - HE-BCI)

4.77 We have also mapped the presence of key 'science and technology' intermediary organisations including public sector research establishments, science parks, Enterprise Zones and Catapult Centres.

Output and quality of scientific research: publications

4.78 We used a number of metrics to gauge the volume, productivity and quality of research publications. We analysed the last two years of publication data available from Scopus, Pubmed and institutional repositories to assess the range of research activities within each LEP area. Primary (sometimes referred to as corresponding or lead) authors were identified using the information in the bibliographic information and assigned to a LEP area by address. Primary authors were used as they indicate the location of the lead research groupings in a LEP area and by extension, an indication of current research expertise. A period of 2 years of publication output was used to minimise the effect of researchers changing location. We use all publication output in contrast to the most recent HE REF exercise, which used a more selective sample of publications over a longer time period to measure impact. We identified 145,341 articles. For a discussion of the data and the methodology we used, see Appendix D3.

Publications by organisation in LEP areas

4.79 Figure 4.13 maps the number of publications by organisation in each LEP area, grouped into 3 clusters:

1 (shaded in pink in the Figure): LEP areas without a significant research-intensive university presence;
2 (shaded in blue): LEP areas with a research-intensive university presence;
3: London.

4.80 A line of best fit was calculated (r^2 = 0.81) as an indicator of the average publication output per organisation across LEP areas and three further groupings of LEP areas emerge, namely those:

- that lie approximately on the line of best fit (i.e. publishing at a rate consistent with the national picture for LEP areas with research intensive organisations present);
- below the line (publishing at a lower rate than the national average);
- above the line (with a greater than average level of output per organisation).

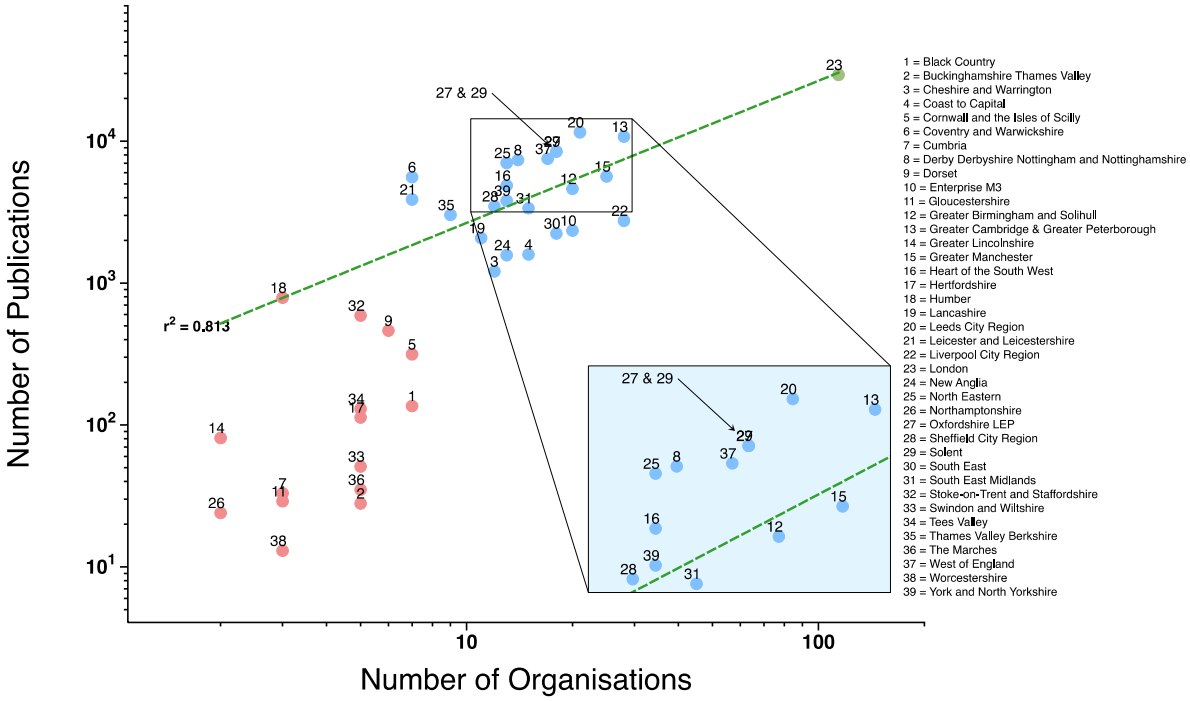


Figure 4.13: Comparison of the Publication Output and number of publishing organisations in each of the LEP areas

A plot of the sum of publications for a LEP area was plotted against the number of organisations publishing in that area. The data naturally identified two main cohorts: Group 1 (pink) and Group 2 (blue). This clustering was also confirmed using k-means analysis. London was identified separately from these groups (green). A line of best fit was plotted (dashed line) and the inset box is a magnified picture of Group 2 LEPs.

Publications by subject domain

4.81 We assigned publications to 11 Subject Domains depending upon the general theme of the journal in which the publication appeared. Figure 4.14 shows, for each LEP area, the variation of output in a domain from the average for that domain (see also Appendix D3). It identifies LEP areas where the quantity of publication output

per organisation is above average (green) or below average (blue). It is a measure of which LEP areas have publication outputs consistent with their counterparts as defined by the groupings in Fig. 4.13.

4.82 London produces by far the greatest quantity of publication output and has the greatest number of publishing organisations but, by allowing for output per organisation, Figure 4.14 overcomes the level of skew that London's critical mass would otherwise confer and allows the underlying performance – in a surrogate measure of relative productivity - of each LEP area to show through. The Figure needs to be interpreted carefully, however. Third-tier Coventry and Warwickshire clearly appears to be performing very well on this particular productivity measure, but this performance is only for a limited number of organisations. Comparison with other LEP areas is best viewed in Figure 4.17 which is a heat map of the relative quartile ranking of a LEP area based on a range of metrics relating to volume and quality of publication output (the darker the colour, the higher the rank). This type of chart allows a better definition of both volume and quality of a LEP's research performance, and is discussed in more detail later in the report. The impact of institutions being located in more than one LEP area also needs to be taken into account. The performance of second-tier Leeds City Region LEP area in Figure 4.14, for example, reflects the inclusion of the publishing output of The University of York, which is also separately included in the rural York and North Yorkshire LEP area.

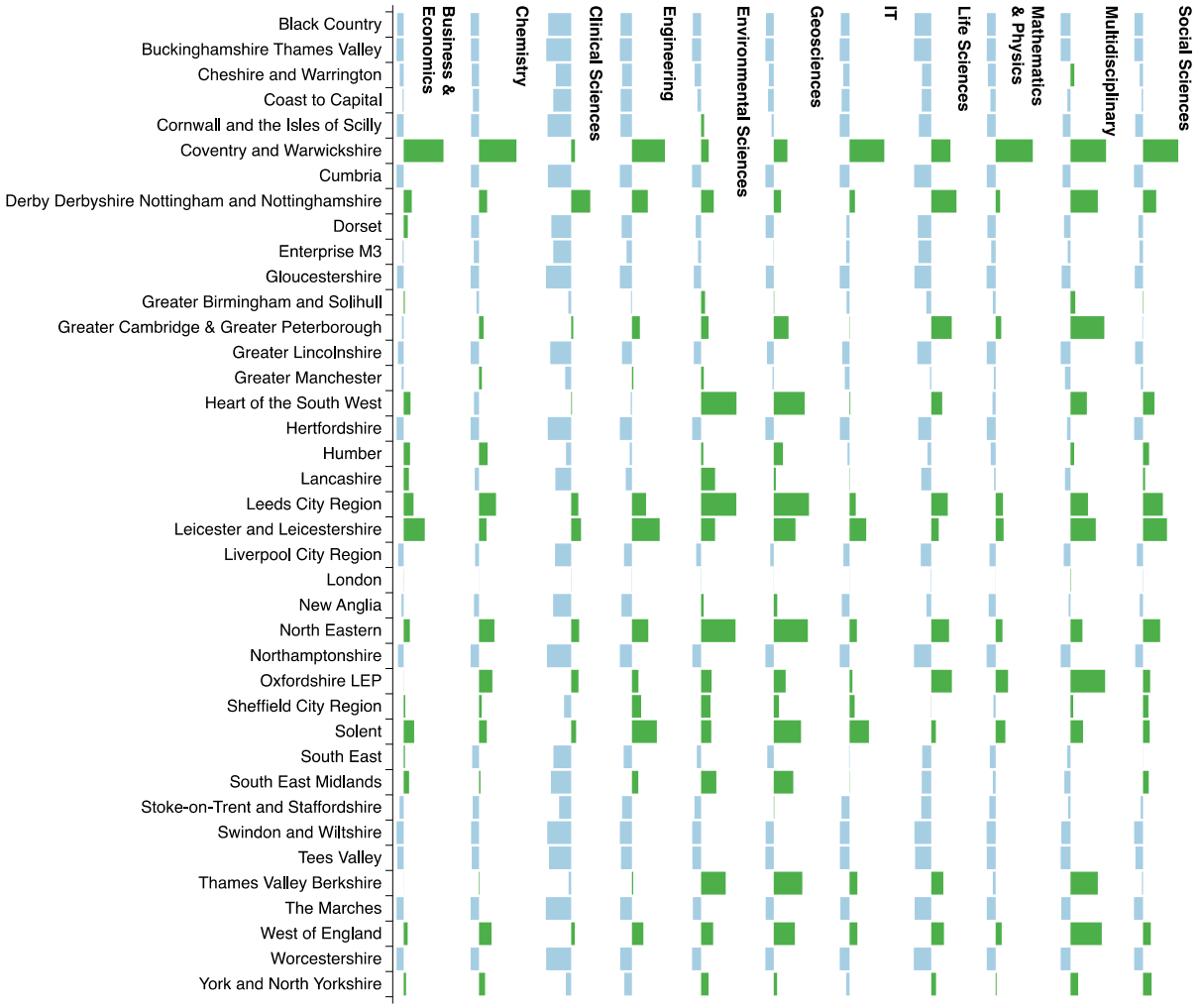


Figure 4.14: Variation of a LEP area's publication output volume within a research domain from the average for that domain

This graph shows for each LEP area and for each of the 11 publication domains, the variation of a LEP area from the line of best fit. LEP areas with small or no bars should be seen as performing at national levels, those with green bars as performing better than the national average and those with blue bars, performing below the national average.

Publications by research impact

4.83 We use a non-proprietary method for determining the "impact" of journal articles called an *h-index*, which is based upon citations. We calculate an average 3 year *h-index* score for a journal publication on the assumption that articles that will be more highly cited, tend to be published in journals with a higher *h-index* value because the journal *h-index* value is a function of the articles published within them (for definition of the *h-index*, see Appendix D3).

4.84 Figure 4.15 compares the impact of publications and the number of publishing organisations across LEP areas. The mapping of 'impact scores' (the median *h-index* values of publications) exhibits the same clustering as that for the volume of publications (Fig. 4.13). And so too does the mapping of the variation of a LEP area's publication output impact within a research domain from the average for that domain (Figure 4.16).

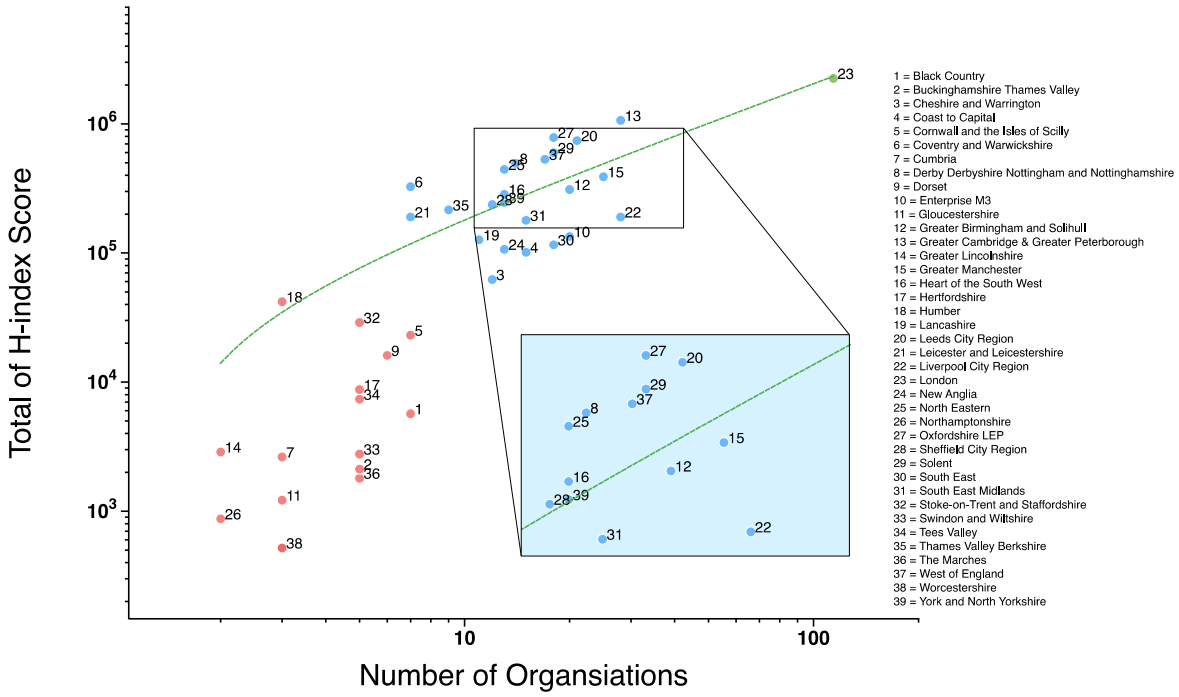


Figure 4.15: Comparison of the impact of publication output and number of publishing organisations in LEP areas

We plotted the sum of Total Median h-index, or Impact, for a LEP area against the number of organisations publishing in that area. The data naturally identified two main cohorts: Group 1 (pink) and Group 2 (blue). London was identified separately from these groups (green). This clustering was also confirmed using k-means analysis. A line of best fit was plotted (dashed line) - r2 = 0.80 - and the inset box is a magnified picture of the Group 2 LEP areas.

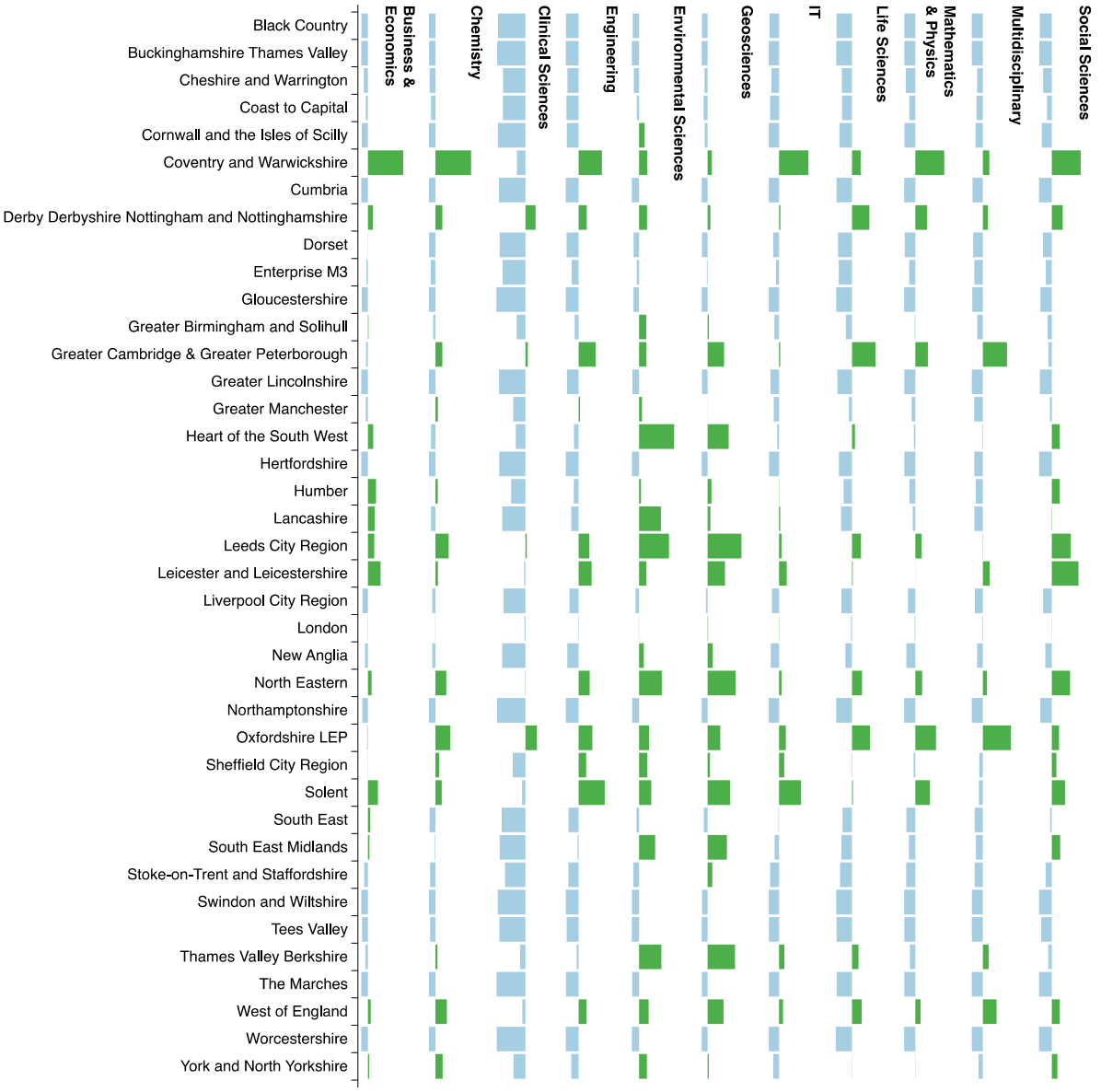


Figure 4.16: Variation of a LEP area's publication impact within a research domain from the average for that domain

This graph shows for each LEP area and for each of the 11 publication domains, the variation of a LEP area from the line of best fit. LEP areas with small or no bars should be seen as performing at national levels, those with green bars as performing better than the national average and those with blue bars, performing below the national average.

Publications by research activity and LEP area

4.85 Pulling together the different strands of the analysis of publishing activity in LEP areas, it is possible to identify 'hot-spots' of research activity using a 'heat map' (Figure 4.17). In the Figure, the values for LEP areas are ranked into quartiles and coloured accordingly. The darker the colour, the higher the quartile ranking. Each of the four panels provides a different view of the metrics of the research undertaken within a LEP area. The first two panels show two different views of the total publication output of a LEP area, one by raw numbers, and the other when an allowance in made for the number of publishing organisations in that area. Whilst this calculation overcomes the predominance of London's critical mass of activity (shown in green in the first panel), it should be treated carefully. For example, if a LEP area has 10 organisations one of which publishes 1,000 articles, and the other 9 each publish one, then the average volume of output per organisation will be dragged down compared to a LEP area with the same quantity of publications and the same number of organisations but with output more evenly spread across them.

4.86 We have also used two metrics to measure publication impact - impact per organisation and impact per publication (the bottom two panels in Figure 4.17). The Figure shows, for example, that the Thames Valley Berkshire LEP area has a relatively low overall volume of output (the first panel in the Figure) but within that output, it appears that at least one of its organisations is actively researching and publishing in Environmental Sciences and Geosciences (the second panel in the Figure). The overall impact per organisation is relatively low (9 publishing organisations) but the impact per publication is relatively high in Geosciences – highlighting a specific area of research focus and impact. Similarly, the Figure shows that the Greater Cambridge and Greater Peterborough LEP area ranks in the top quartiles for volume of publication output in Clinical Sciences, Engineering, Life Sciences, Multidisciplinary and Mathematics & Physics. It maintains that ranking for Life Sciences and Multidisciplinary when the number of organisations are taken into account (28 in total), but exhibits high impact per organisation for Chemistry and Clinical Sciences and more broadly across the board for impact per publication. This performance indicates that whilst a LEP area may not always produce the largest volume of publications in a field compared to other LEPs, the impact of the publications may be relatively high. It is important, therefore, to compare the data in all of the panels in the Figure to assess the particular research interests and impact of that output in individual LEP areas.

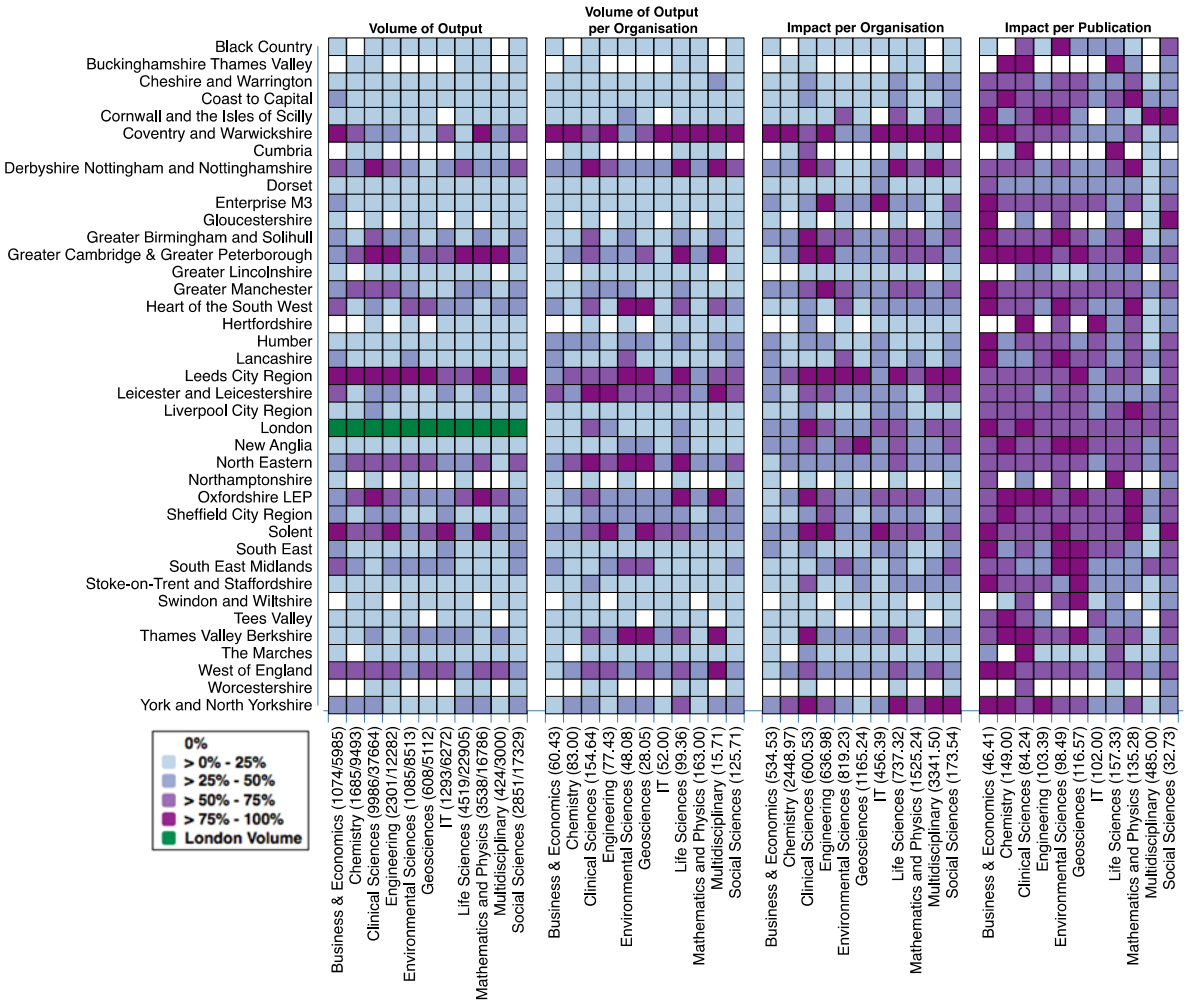


Figure 4.17: Comparison of the Volume (two left-hand panels) and Impact (two right-hand panels) of publications output by LEP areas across various research domains

Publications for each research domain were counted and assigned to a LEP area using primary author addresses. The two left-hand panels show metrics for the volume of publications and the two right-hand panels show metrics for the impact of output. Colours indicate quartile ranges of the LEP area as defined by the key. Where London is shaded in green, this indicates that the number of publications in London is significantly more than in any other LEP area and was, therefore, treated separately to provide a better definition of the relative levels of researchers across the remaining LEP areas. Research Domains are listed on the x-axis of the figure and the values in brackets are, in the 'volume of output' panel, the value of the highest number of articles in a LEP area and the total volume of articles, and in each of the other panels, the highest value in each domain. For example, the Chemistry domain in the final panel has a value of 149.00, which is the highest value of the average of the median *h-index* value of chemistry journals.

4.87 We recognise that the analysis charted in Figure 4.17 does not show the strengths of individual institutions within LEP areas - a deeper analysis that was beyond the scope of this report - but it does indicate collective research strengths. Table 4.15

lists the research domains in which LEP areas are particularly strong. It summarises research expertise by LEP area on the basis of high impact per organisation (i.e. falling in the top two quartiles) or a large number of publications (greater than 200 across the domain in question). It is not a ranking exercise but an overview of fields of research that are most active and have the greatest impact in each of the LEP areas.

Table 4.15: Research expertise across LEP areas

LEP area	Main areas of research activity	Major publishers
Black Country	Levels of activity are below the threshold for inclusion.	
Buckinghamshire and Thames Valley	Levels of activity are below the threshold for inclusion.	
Cheshire and Warrington	**Clinical Sciences** - Immunology, Microbiology, Psychology and Veterinary. **Life Sciences** - Animal Science, Biochemistry, Pharmacology, Ecology and Cancer Research **Social Sciences** - Cultural Studies, Political Studies, Sociology, Education and Planning.	University of Liverpool (Veterinary Station in Neston), Manchester Metropolitan (Crewe campus), Astrazeneca and Mid-Cheshire NHS Trust.
Coast to Capital	**Clinical Sciences** - Behavioural Neuroscience, Experimental and Cognitive Psychology, Neuropsychology and Psychology. **Life Sciences** - Agricultural Science, Animal Science, Ecology, Evolution and Behaviour, Genetics and Molecular Biology. **Social Sciences** - Cultural Studies, Education, Planning, History, Sociology and Political Science.	University of Sussex
Cornwall and the Isles of Scilly	**Environmental Sciences** - Ecology, Environmental Chemistry and Renewable Energy.	Cornwall campuses of The University of Exeter
Coventry and Warwickshire	**Business & Economics -** International Management, Econometrics, Finance, Strategy and Organisational Behaviour. **Chemistry** - General Chemistry, Chemical Engineering, Colloid Chemistry, Electrochemistry and Spectroscopy **Engineering** - Biomedical Engineering, Control Systems, Electronic and Electrical Engineering, Materials, Mechanical Engineering, Polymers and Coatings. **IT** - Information Systems, Artificial Intelligence, Hardware and Systems Architecture, Networks and Computational Theory. **Life Sciences** - Agricultural, Biochemistry, Cell Biology, Molecular Biology & Genetics, Physiology and Structural Biology. **Mathematics & Physics** - Applied Mathematics, Astronomy & Astrophysics, Discrete Mathematics	Universities of Coventry and Warwick

	and Combinatorics, Statistics. **Social Sciences** - Anthropology, Cultural Studies, Education, Gender Studies, Political Science.	
Cumbria	Levels of activity are below the threshold for inclusion.	
Derby, Derbyshire, Nottingham and Nottinghamshire	**Clinical Sciences** - Neuroscience, Cognitive Neuroscience, Psychology, Immunology. **Life Sciences** - Ageing, Agricultural, Agronomy, Animal Science, Biochemistry, Cell Biology, Food Sciences, Genetics and Molecular Biology, Pharmaceutical Science & Pharmacology, and Physiology.	Nottingham Trent University, Nottingham University Hospitals NHS Trust and Nottingham Trent University.
Dorset	Levels of activity are below the threshold for inclusion.	
Enterprise M3	**Engineering** - Control Systems, Electrical and Electronic Engineering, Materials, Mechanical Engineering and Polymers. **IT** - Artificial Intelligence, Computational Theory, Computer Vision and Pattern Recognition, Computer Networks and Signal Processing.	Royal Holloway (Egham, Surrey) and University of Surrey.
Gloucestershire	Levels of activity are below the threshold for inclusion.	
Greater Birmingham and Solihull	**Clinical Sciences** - Behavioural Neuroscience, Psychiatry, Cardiovascular, Psychology (Cognitive and Developmental), Immunology, Virology.	Aston University, University of Birmingham, University Hospitals Birmingham NHS Foundation Trust, Birmingham and Solihull Mental Health Foundation Trust, Sandwell NHS Trust and Public Health England.
Greater Cambridge and Greater Peterborough	**Clinical Sciences** - Microbiology, Behavioural Neuroscience, Cardiovascular, Immunology, Neuroscience, Parasitology, Psychology, Radiological and Ultrasound, Virology and Veterinary. **Engineering** - Biomedical Engineering, Ceramics and Composites, Structural Engineering, Computational Mechanics, Electrical and Electronic Engineering, Electronic, Optical & Magnetic Materials, Materials Science, Mechanical Engineering, Alloys and, Coatings and Films.	University of Cambridge, Babraham Institute, Sanger Institute, Cambridge University Hospitals, Food and Environment Research Agency. Additionally, some locally based companies also published works, including LGC, Medimmune Ltd and Quotient Bioresearch Ltd.
Greater Lincolnshire	Levels of activity are below the threshold for inclusion.	
Greater	**Clinical Sciences** - Behavioural Neuroscience,	University of

Manchester	Cardiovascular, Dentistry, Cognitive Psychology, Immunology, Biochemistry, Molecular Biology and Genetics, Neuroscience, Nursing, Parasitology, and Psychology. **Engineering** - Biomedical Engineering and Biomaterials, Construction, Ceramics and Composites, Control Systems, Electrical Engineering, Electronic, Optical and Magnetic Materials, Manufacturing, Alloys, Materials Chemistry and Science, Polymer Science, and Coatings. **Environmental Sciences** - Ecology, Energy, Environmental Chemistry, Science and Engineering, renewable Energy, Fuel Technology and Nuclear Energy. **Life Sciences** - Ageing, Agricultural Sciences, Animal Sciences, Biochemistry, Molecular Biology and Genetics, Biotechnology, Cancer Research, Cell Biology, Ecology, Endocrinology, Food Sciences, Pharmaceutical Science and Pharmacology, Physiology and Structural Biology. **Mathematics & Physics** - Acoustics, Applied Mathematics, Astronomy, Atomic and Molecular Physics, Optics, Condensed Matter Physics and Statistics. **Social Sciences** - Cultural Studies, Education, Planning, Linguistics, Philosophy, Social Sciences, Sociology, Political Science and Urban Studies.	Manchester, Manchester Metropolitan University, University of Salford, University of Bolton, North Manchester Clinical Psychiatry Service, Manchester Mental Health and Social Care Trust, University Hospital of South Manchester NHS Foundation Trust and Salford Royal NHS Foundation Trust.
Heart of the South West	**Clinical Sciences** - Behavioural Neuroscience, Cognitive Psychology, Psychology and Virology. Environmental Sciences - Energy, Environmental Chemistry, Environmental Science, Renewable Energy. **Life Sciences** - Agricultural, Animal Science, Aquatic Science, Ecology, Genetics, Molecular Biology, Physiology, Toxicology.	University of Exeter, Plymouth University, Plymouth Marine Laboratory, Peninsula College of Medicine and Dentistry, Royal Cornwall Hospitals NHS Trust, The Met Office.
Hertfordshire	Levels of activity are below the threshold for inclusion.	
Humber	**Business & Economics** - International Management and Econometrics **Clinical Science** - Nursing Social Science - Education and Political Science.	University of Hull.
Lancashire	**Business & Economics** - Management of Technology Innovation, Economics and Econometrics and International Management. **Environmental Science** - Ecology, Environmental Chemistry and Science, Environmental Engineering, Energy, Pollution. **Social Sciences** - Cultural Studies, Education, Linguistics, Sociology, Political Studies and Urban Transport.	Lancaster University, The University of Central Lancashire, Lancashire Care NHS Foundation Trust.
Leeds City Region	**Clinical Sciences** - Behavioural Neuroscience, Cardiovascular, Developmental Psychology,	University of Leeds, University of

	microbiology, Neurology, Neuroscience, Nursing, Psychology and Virology **Engineering** -Biomaterials and Biomedical Engineering, Composites, Civil Engineering, Electronic and Electrical Engineering, Optical and Magnetic Materials, Manufacturing, Materials Chemistry and Science, Polymers and Coatings. **Environmental Sciences** - Ecology, Energy, Environmental Chemistry, Environmental Engineering and Science, Fuels, Policy and Law, Conservation, Pollution, renewable Energy, Water Science. **Geosciences** - Atmospheric Sciences, Geochemistry and Geology and Planetary Sciences. **Life Sciences** - Agricultural, Animal Science, Aquatic Science, Biochemistry, Genetics and Molecular Biology, Biotechnology, Cell Biology, Drug Discovery, Ecology, Entomology, Pharmaceutical Science and Pharmacology, Structural Biology. **Social Sciences** - Communication and Cultural Studies, Geography and Planning, History, Law, Literature, Philosophy, Political Science, Sociology, Transport and Performing Arts.	Bradford, University of Huddersfield, University of York, Archaeology Data Service, Leeds Teaching Hospitals NHS Trust and Leeds Metropolitan University.
Leicester and Leicestershire	**Clinical Sciences** - Cardiovascular, Nutrition, Psychology, Physical and Sports Therapy, Immunology and Microbiology. **Engineering** - Automotive, Composites, Civil Engineering, Control Systems, Electronic and Electrical Engineering, Optical and Magnetic Materials, Manufacturing, Materials Chemistry, Mechanical Engineering and Polymers. **Social Sciences** - Archaeology, Communication, Education, Geography & Planning, History, Law and Sociology.	University of Leicester, De Montford University, Loughborough University and University Hospitals of Leicester NHS Trust.
Liverpool City Region	**Clinical Sciences** - Cardiovascular, Immunology, Parasitology and Psychology **IT** - Artificial Intelligence, Computational Theory and Computer Science Applications. **Life Sciences** - Agricultural, Biochemistry and Molecular Biology, Genetics, Ecology, Cancer Research, Pharmaceutical Science and Pharmacology, Physiology and Toxicology.	University of Liverpool, Royal Liverpool and Broadgreen University Hospital Trust, Liverpool John Moores University, Alder Hey Children's NHS Foundation Trust and Clatterbridge Cancer Centre NHS Foundation Trust.
London	**Clinical Sciences** - Microbiology, Psychology, Behavioural Neuroscience, Biochemistry, Molecular Biology, Genetics, Psychiatry, Cardiovascular, Cognitive Neuroscience, Dentistry, Cognitive Psychology, Immunology, Neuroscience, Parasitology, Radiological and Ultrasound Technology, Sociology, Veterinary and Virology. **Engineering** - Bioengineering and Biomaterials,	Long list of universities and hospitals – see Note D1 in Appendix D3.

	Composites, Civil Engineering, Control Systems, Electrical and Electronic Engineering, Materials Chemistry and Materials Science, Polymer Sciences and Coatings. **IT** - Artificial Intelligence, Computational Theory, Computer Graphics, Networks, Applications, Pattern Recognition, Information Systems and Management and Signal Processing. **Life Sciences** - Ageing, Agricultural, Animal Sciences, Biochemistry, Molecular Biology and Genetics, Biophysics, Biotechnology, Cancer Research, Cell Biology, Drug Discovery, Ecology, Entomology, Food Science, Pharmaceutical Science and Pharmacology, Physiology, Structural Biology and Toxicology. **Social Sciences** - Communication, Cultural Studies, Education, Gender Studies, Planning, History, Philosophy, Language, Law, Political Science, Sociology, Transport, Urban Studies, Performing Arts.	
New Anglia	**Clinical Sciences** - cardiovascular, Microbiology, Parasitology, Psychology, Veterinary and Virology. Environmental Sciences - Ecology, Environmental Chemistry, Environmental Science, Water Science, Conservation. **Geosciences** - Atmospheric Science, Earth Sciences, Geophysics and Oceanography. **Life Sciences** - Ageing, Agricultural Sciences, Aquatic Sciences, Biochemistry, Genetics and Molecular Biology, Cell Biology, Ecology, Food Science, Pharmaceutical Science. Social Sciences - Sociology and Social Sciences, Philosophy, Political Science, Cultural Studies and Education.	University of East Anglia, John Innes Centre, Institute of Food Research and the Centre for Environment, Fisheries and Aquaculture and the British Trust for Ornithology.
North Eastern	**Life Sciences** - Ageing, Agricultural, Crops, Animal Science, Aquatic Science, Biochemistry, Molecular Biology and Genetics, Biophysics, Biotechnology, Cell Biology, Developmental Biology, Ecology, Endocrinology, Food Science, Pharmaceutical Sciences and Pharmacology, Physiology, Structural Biology and Toxicology.	Newcastle University, the University of Newcastle-upon-Tyne, Durham University and the Food and Environment Research Agency.
Northamptonshire	Levels of activity are below the threshold for inclusion.	
Oxfordshire	**Clinical Sciences** - Behavioural Neuroscience, Biochemistry, Genetics and Molecular Biology, Cardiovascular, Neuroscience and Cognitive Neuroscience, Immunology, Microbiology, Parasitology, Psychology and Virology. **Engineering** - Biomedical Engineering, Computational Mechanics, Control Systems, Electrical and Electronic Engineering, Optical and Magnetic Materials, Materials Science, Mechanical	University of Oxford, Science and Technology Facilities Council, Oxford University Hospitals and Diamond Light Source Ltd.

	Engineering, Alloys, Polymers and Coatings. **IT** - Artificial Intelligence, Copter Graphics, Information Systems, Hardware Architecture, Computer Science Applications. **Life Sciences** - Agricultural, Animal Science, Biochemistry, Genetics and Molecular Biology, Biophysics, Biotechnology, Cell Biology, Ecology, Endocrinology, Genetics, Pharmaceutical Science and Pharmacology, Physiology and Structural Biology.	
Sheffield City Region	**Clinical Sciences** - Behavioural Neuroscience, Cardiovascular, Dentistry, Immunology, Nursing and Psychology. **Engineering** - Biomaterials and Biomedical Engineering, Construction, Civil Engineering, Electrical and Electronic Engineering, Materials Chemistry and Materials Science, Mechanical Engineering, Polymer Science and Coatings. **Environmental Sciences** - Ecology, Environmental Science, Chemistry and Engineering, Conservation, Renewable Energy and Water Science. **IT** - Artificial Intelligence, Computational Theory, Computer Science Applications, Vision and Pattern Recognition, Information Systems and Signal Processing. **Life Sciences** - Agricultural Science, Animal Sciences, Biochemistry, Genetics and Molecular Biology, Biotechnology, cancer Research, Cell Biology, Ecology, Endocrinology, Food Science, Pharmaceutical Science and Pharmacology. **Mathematics & Physics** - Astronomy and Condensed Matter Physics. **Social Sciences** - Education, Planning, Law, Information Systems, Political Science, Social Sciences and Urban Studies.	University of Sheffield, Sheffield Hallam University and Sheffield Teaching Hospitals NHS Foundation Trust.
Solent	**Clinical Sciences** - Biochemistry, Molecular Biology and Genetics, Cardiovascular, Cognitive Psychology, Immunology, Neuroscience, Nursing, Sociology and Virology. **Engineering** - Biomaterials, Biomedical Engineering, Composites, Electrical and Electronic Engineering, Manufacturing, Materials Science, Mechanical Engineering, Polymer Science and Coatings. **IT** - Artificial Intelligence, Computational Theory, Computer Science Applications, Hardware, Information Systems, Signal Processing.	University of Portsmouth, University of Southampton and the Southern Health NHS Foundation Trust.
South East	**Business & Economics** - International Management, Econometrics, Management of Technology Innovation. **Clinical Sciences** - Clinical Psychology, Cognitive Psychology, Neuroscience and Psychology. **IT** - Artificial Intelligence, Computer Science Applications, Information Systems, Computational Theory. **Life Sciences** - Agricultural, Biochemistry, Genetics	University of Kent, Anglia Ruskin University, Canterbury Christchurch University, University of Essex and the Sussex Partnership NHS Foundation

	and Molecular Biology, Pharmaceutical Science, Biotechnology, Ecology and Physiology. **Social Science** - Cultural Studies, Education, Planning, History, Law, Literature, Political Science, Social Sciences and Sociology, and Transport.	Trust.
South East Midlands	**Environmental Science** - Water science, Pollution, Policy, Environmental Science, Engineering and Chemistry, Energy and Ecology. **Social Sciences** - Communication, Cultural Studies, Education, Planning, Linguistics, Safety, Social Sciences, Sociology, Political Science and Performing Arts.	Cranfield University, Natural Environment Research Council, Open University, University of Bedfordshire and Landmark Consulting.
Stoke on Trent and Staffordshire	With the exception of **Geosciences**, no single stand-out research domain. Further analysis does indicate local strengths in Psychology, Neurology, Planetary Science, Astronomy, Molecular Biology and Biochemistry, and Social Sciences.	Keele University and Staffordshire University.
Swindon and Wiltshire	Low overall output of publications in this area, which is not unsurprising given it does not have a university.	Some publications in diverse fields from the Defence Science and Technology Laboratory, Public Health England and local NHS Trusts.
Tees Valley	Low overall output pf publications with no one research domain standing out.	A part of Durham University is in the LEP area, which together with Teesside University, Middlesbrough, generate the bulk of the publications.
Thames Valley Berkshire	**Clinical Sciences** - Cardiovascular, Immunology, Microbiology, Neuroscience, Parasitology, Psychology and Virology. **Life Sciences** - Agricultural Science, Cops, Animal Science, Biochemistry, Molecular Biology and Genetics, Cell Biology, Ecology, Food Science, Pharmaceutical Science, Pharmacology and Toxicology.	University of Reading and Imperial College (Berkshire Campus).
The Marches	Levels of activity are below the threshold for inclusion.	
West of England	**Clinical Sciences** - Microbiology, Cardiovascular, Dentistry, Immunology, Neuroscience, Parasitology, Psychology, Veterinary. **Life Sciences** - Agricultural, Animal Science, Aquatic Science, Biochemistry, Molecular Biology and Genetics, Biophysics, Biotechnology, Cell Biology, Drug Discovery, Ecology, Endocrinology, Food Science, Pharmacology, Physiology, Structural Biology and Toxicology.	University of Bristol, University of the West of England, North Bristol NHS Trust, University of Bath, University Hospitals Bristol NHS Foundation Trust and the Bristol Robotics Laboratory.

Worcestershire	Levels of activity are below the threshold for inclusion.	
York and North Yorkshire	**Clinical Sciences** - Behavioural Neuroscience, Biochemistry, Genetics and Molecular Biology, Developmental and Educational Psychology, Neuroscience and Psychology. **Life Sciences** - Ageing, Agricultural Science, Animal Science, Biochemistry, Genetics and Molecular Biology, Drug Discovery, Ecology, Food Science, Pharmaceutical Science and Pharmacology, Structural Biology and Toxicology. **Social Sciences** - Archaeology, Cultural Studies, Education, Linguistics, Law, Philosophy, Political Science, Sociology and Performing Arts.	University of York and York St John University.

Publications in the 'Great Technologies'

4.88 Figure 4.18 shows a mapping of publications to the 8 'Great Technologies'. It should be stressed that the mapping only covers 10.9% of the total 145,341 publications we analysed but we feel it is, nevertheless, a reasonable indicator of local specialisation across the Technologies.

Figure 4.18: Mapping of Publications in LEP areas to the 8 Great Technologies

Colours indicate quartile range of LEP areas as defined by the key. Where London is shaded in green, this indicate that the number of publications in London is significantly more than in any other LEP area and was, therefore, analysed separately to provide better definition of the relative levels of publications across the remaining LEP areas.

4.89 Table 4.16 lists, for each of the Great Technologies, the LEP areas that fall in to the top quartile of impact per organisation.

Table 4.16: LEP area publication impact in the Great Technologies

Great Technology	No. of publications mapped	LEP area in top quartile of impact per organisation
Advanced Materials	5,760	Coventry & Warwickshire Greater Manchester Leeds York and North Yorkshire
Agri-science	3,354	Leeds City Region Cornwall & Isles of Scilly
Big Data	2,897	Coventry & Warwickshire Solent
Energy Storage	1,316	Leeds City Region Greater Manchester
Regenerative Medicine	78	Whilst Leeds and Greater Manchester fell in to the top quartile of impact per organisation, sample size too low to derive any realistic inferences.
Robotics & Autonomous Systems	944	Enterprise M3
Satellites	293	Oxfordshire Liverpool City Region Greater Manchester Enterprise M3 Derby, Derbyshire, Nottingham and Nottinghamshire Coventry & Warwickshire
Synthetic Biology	1,128	Coventry & Warwickshire

Publications and Innovate UK's priority Areas

4.90 Figure 4.19 maps publications against Innovate UK's priority areas for investment. The mapping covers 44.5% of the total number of publications in our analysis. There is a difference in the number of publications covered in 'Advanced Materials' in the 8 Great Technologies and Innovate UK Priorities (of 1128 publications) due to the inclusion of biomedical engineering and bioengineering categories in the Innovate UK classification. Journal mapping was carried out by matching a selection of typical journals in those fields by journal name, cross-referencing back to our own databases, to create a 'look-up' table. This 'look-up' table was used to assign a journal to a particular theme. If there was ambiguity over the subject matter

of a publication it was removed from the analysis. Following this procedure results in lower coverage but, we would argue, produces a better-defined analysis for the purposes of this report. Relative coverage is indicated in each figure. It needs to be stressed that the exercise both summarises data for LEP areas and not for individual organisations and reports outputs in terms of quartile ranking as opposed to absolute values.

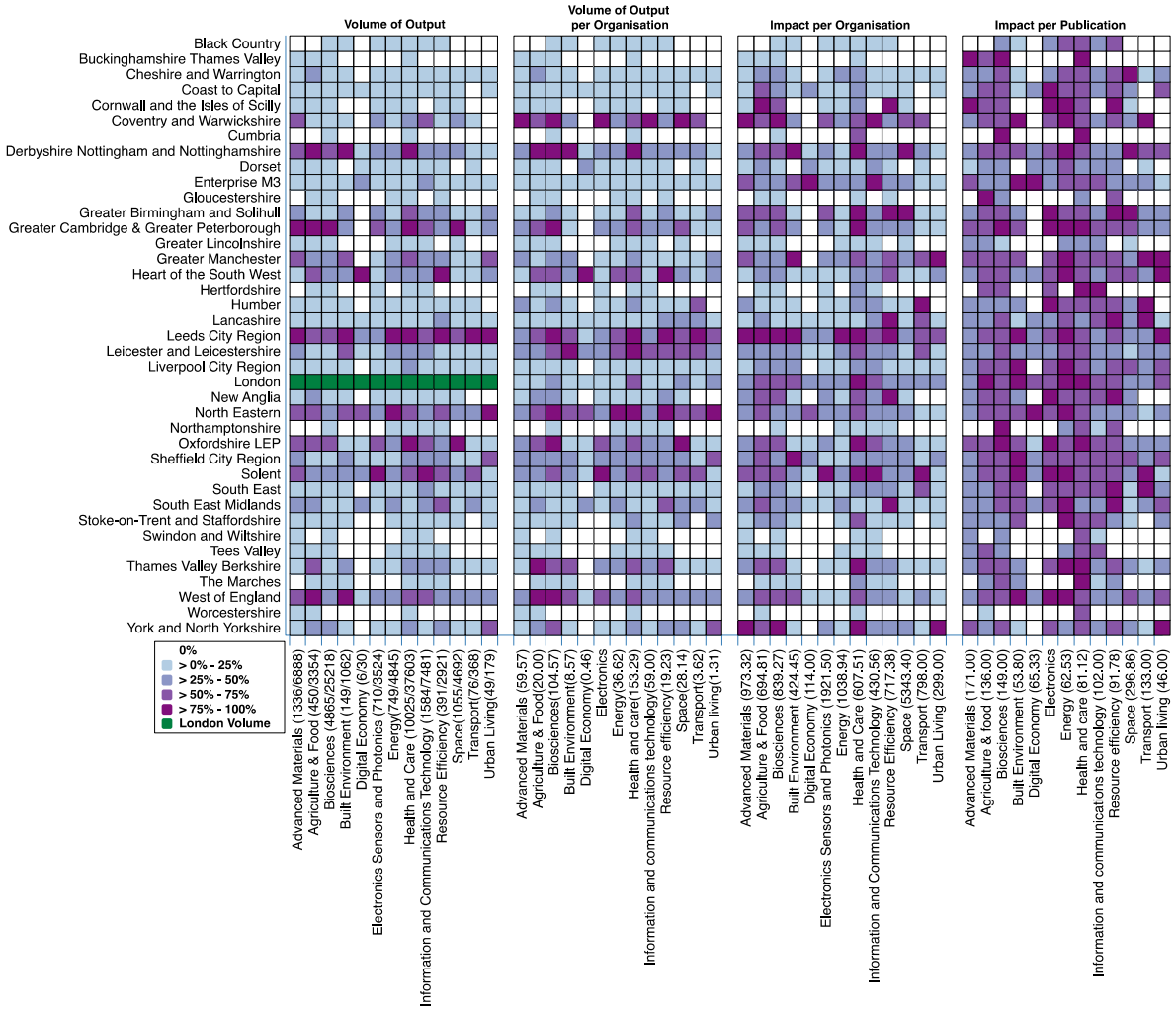


Figure 4.19: Mapping of LEP Publications to the priorities of Innovate UK

Colours indicate quartile ranges of LEP areas as defined by the key. Where London is shaded in green, this indicates that the number of publications in London is significantly more than in any other LEP area and was, therefore, analysed separately to provide better definition of the relative levels of publications across the remaining LEP areas.

4.91 Table 4.17 lists the LEP areas which fall within the top quartile of impact per organisation in relation to Innovate UK's Priority Areas.

Table 4.17: LEP area publication impact in Innovate UK Priority Areas

Innovate UK Priority Area	No. of publications mapped	LEP area in top quartile of impact per organisation
Advanced Materials	6,888	Leeds City Region York and North Yorkshire Coventry & Warwickshire
Agriculture & Food	3,354	Leeds City Region Cornwall & Isles of Scilly
Biosciences	25,218	York and North Yorkshire Leeds City Region Coventry and Warwickshire
Built Environment	1,062	Sheffield City Region Leeds City Region Greater Manchester Derby, Derbyshire, Nottingham and Nottinghamshire
Digital Economy	30	Enterprise M3 fell in to the top quartile of impact per organisation but sample size too low to derive any realistic inferences.
Electronics, Sensors &	3,524	Enterprise M3
Energy	4,845	Leeds City Region.
Health & Care	37,603	York and North Yorkshire Thames Valley Berkshire Solent Oxfordshire London Leeds City Region Greater Cambridge and Greater Peterborough Greater Birmingham and Solihull Derby, Derbyshire, Nottingham and Nottinghamshire
ICT	7,481	Solent Enterprise M3 Coventry and Warwickshire
Resource Efficiency	2,921	South East Midlands North Eastern London Leeds City Region Greater Birmingham and Solihull Coventry and Warwickshire
Space	4,692	Greater Birmingham Derby, Derbyshire, Nottingham and Nottinghamshire
Transport	368	Solent and Humber fell in to the top quartile of impact per organisation but sample size too low to derive any realistic inferences.
Urban Living	179	York and North Yorkshire and Greater Manchester fell in to the top quartile of impact per organisation but sample size too low to derive any realistic inferences.

Publications and Industrial Strategy Sectors

4.92 Figure 4.20 maps publications against the 11 Industrial Strategy sectors. The mapping covers 55.2% of the total number of publications in our analysis. Table 4.18 lists the LEP areas that fall in to the top quartile of impact per organisation in publications relating to the Industrial Strategy sectors.

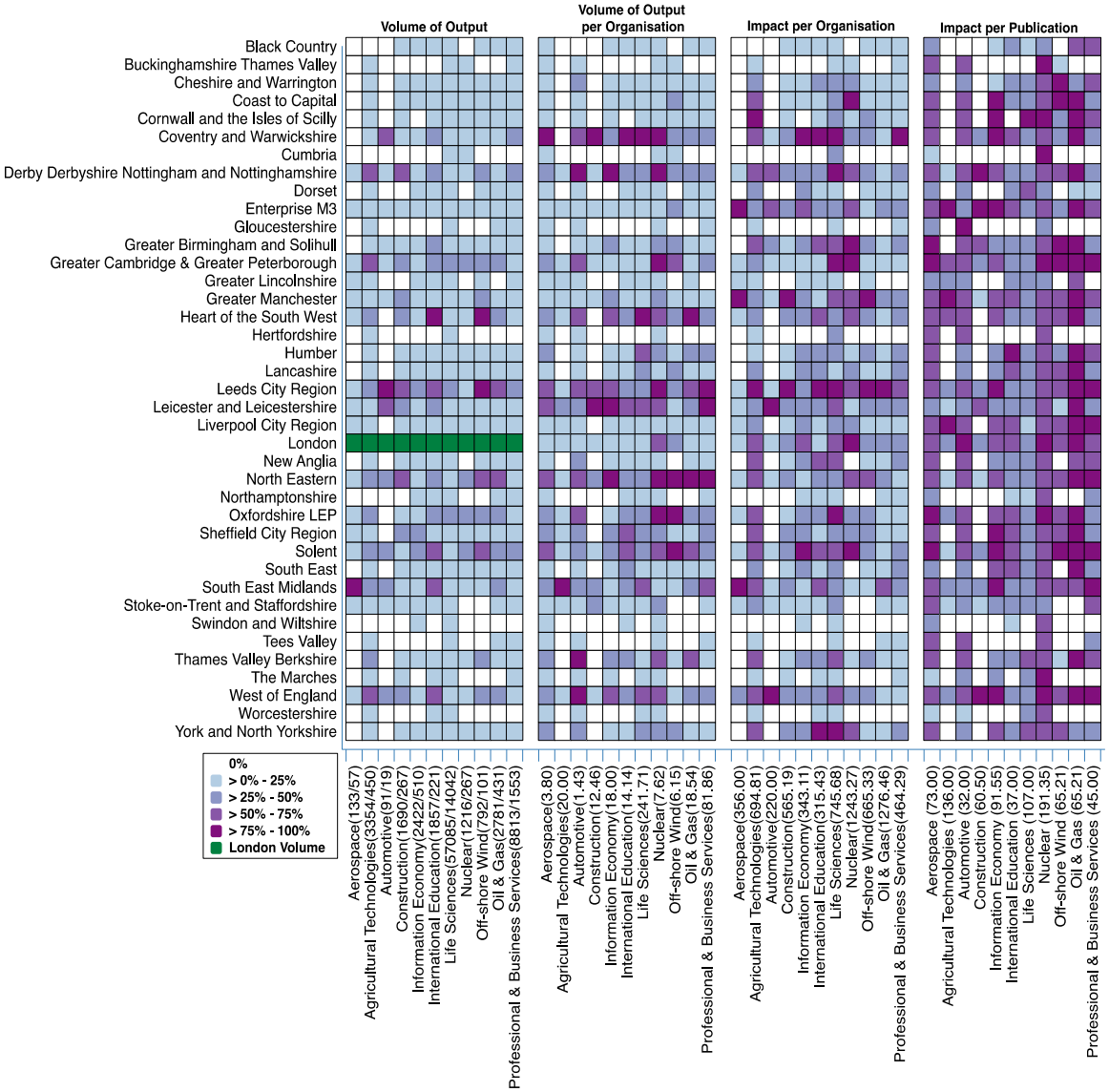


Figure 4.20: Mapping of LEP area publications to the UK Industrial Strategy Sectors

Colours indicate the quartile ranges of the LEP area as defined in the key. Where London is shaded in green, this indicates that the number of publications in London is significantly more than in any other LEP area and was, therefore, analysed separately to provide a better definition of the relative levels of publications across the remaining LEP areas.

Table 4.18: LEP area publication impact in Industrial Strategy sectors

Industrial Strategy Sector	No. of publications mapped	LEP area in top quartile of impact per organisation
Aerospace	133	South East Midlands fell in to the top quartile of impact per organisation but sample size is too low to derive any realistic inferences.
Agricultural Technologies	3,354	Leeds City Region Cornwall and Isles of Scilly.
Automotive	91	West of England and Leicester and Leicestershire fell in to the top quartile of impact per organisation but sample size too low to derive any realistic inferences.
Construction	1,690	Leeds City Region Greater Manchester
Information Economy	2,422	Solent Coventry and Warwickshire.
International Education	1,857	York and North Yorkshire Leeds City Region Coventry and Warwickshire.
Life Sciences	57,085	York and North Yorkshire Oxfordshire Leeds City Region Greater Cambridge and Greater Peterborough Derby, Derbyshire, Nottingham and Nottinghamshire Coventry and Warwickshire
Nuclear	1,216	Solent London Greater Cambridge and Greater Peterborough Greater Birmingham and Solihull Coast to Capital
Off-shore Wind	792	Leeds City Region Greater Manchester
Oil & Gas	2,781	Leeds City Region
Professional & Business Services	8,813	Coventry and Warwickshire.

Publications and Impact

4.93 Appendix D4 provides more detailed analysis of publications using a combined score measure for volume of publications and per organisation, and impact per organisation and per publication, for all subject domains, Great 8 technologies, Innovate priority areas, and Industrial Strategy sectors.

Intellectual property protection: patents

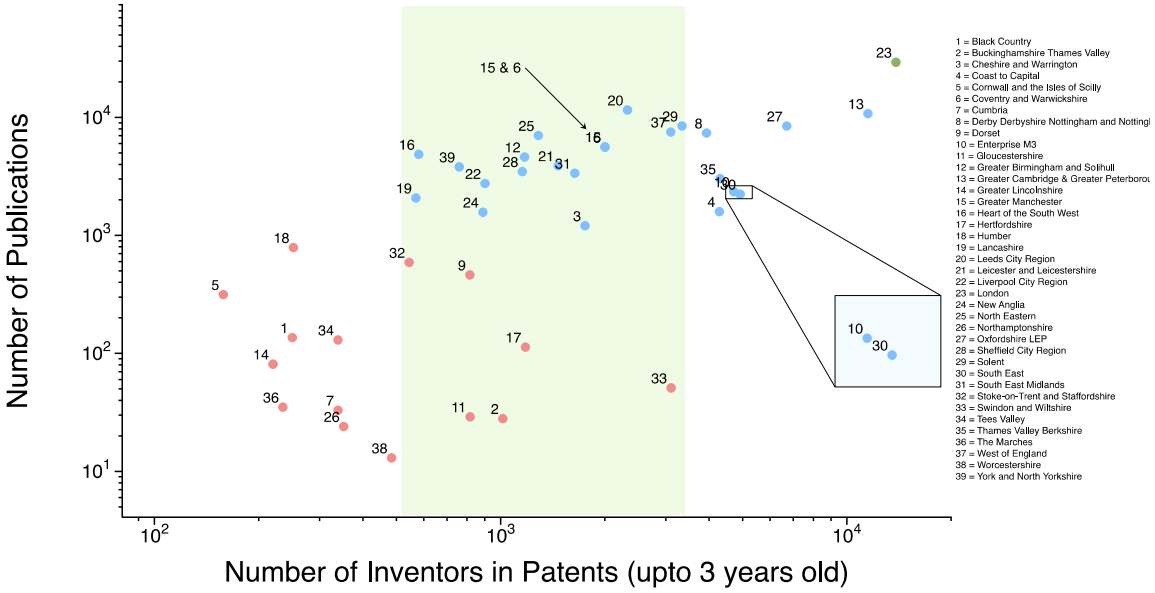
4.94 We compiled a database of 120 million documents covering 12 million patents, of which 39% of inventors have a location assigned to them. This proportion may seem low but the limitation arises from the data sources in which the original information is sometimes entered either incorrectly or incompletely. To overcome the problem of patents being registered at a single office that may or may not be the place where the invention was made, we have focused on patents with inventor addresses.

4.95 A plot of the numbers of publications versus young GB patents (i.e. those patents that are up to and including three years old) shows the same grouping of LEP areas as found previously (Figure 4.13). LEP areas with research intensive universities tend to have greater numbers of inventors (Group 2) than those without (Group 1). However, the cluster analysis also shows that there is a notable cohort of Group 1 LEP areas that are exhibiting patenting rates that are consistent with many Group 2 LEP areas [Figure 4.21, shaded area]. This pattern suggests that the extent of innovation in these LEP areas is not entirely dependent on the presence of publicly-funded HEIs. The LEP areas in question are:

- Buckinghamshire and Thames Valley (London city-region);
- Dorset (third-tier);
- Gloucestershire (urban-rural);
- Hertfordshire (London city-region);
- Stoke-on-Trent and Staffordshire (third-tier); and
- Swindon and Wiltshire (third-tier).

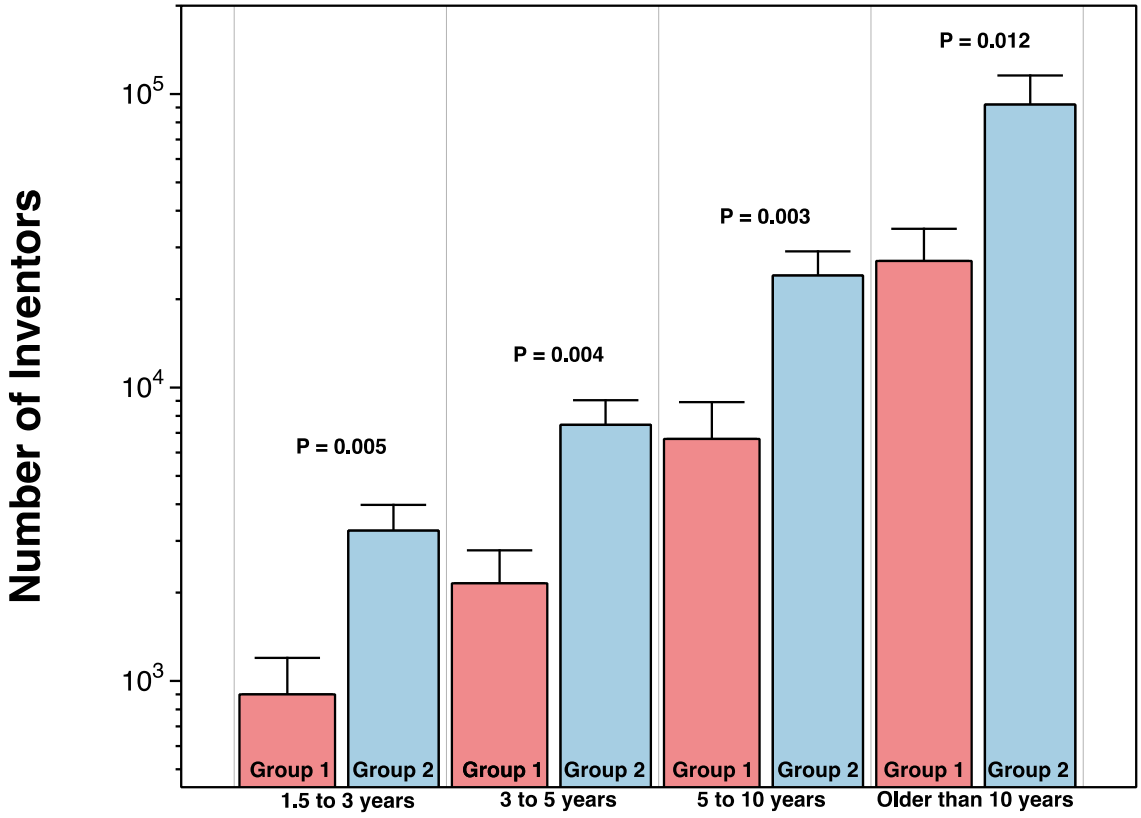
4.96 Whilst Universities are sites of knowledge discovery, they are not the only source of patenting and therefore inventors. In general, across the LEP areas, HEIs are not exhibiting patenting behaviours that would indicate that they are protecting their inventions to any greater extent than other organisations - with the exception of those LEP areas to the right of the green shaded area in Figure 4.21. This would tend to indicate that despite the many years of support to protect and commercialise technology and knowhow, this may not have been happening at a rate commensurate with the investment received through programmes such as HEIF and potentially highlights two-tiers in LEP areas with respect to how knowledge and innovation is best secured.

Figure 4.21: Comparison of publication output versus patenting in the English LEP areas



4.97 Another interesting trend is the level of patenting (as indicated by the number of inventors patenting) over time in the LEP area groups (Figure 4.22). It is tempting to compare the rate of patenting across the LEP areas over the different time periods but this is problematic because, between the time frames (1.5 to 3 years, 3 to 5 years and so on), national patent applications may be filed in a varying number of territories but still relate to the same invention. Divisional and continuation applications would also inflate the values in years 3 to 5. Consequently, patent counts post-3 years could be increased. Moreover, at the end of the three year period, or just prior to it, it may be decided that there is no utility in maintaining a patent (a tactic often used by small companies that are not cash rich and public sector organisations that have to monitor the use of public sector investment) and therefore dropping it to save on expenditure. This means that a direct comparison between years 1.3 to 3 and 3 to 5 is particularly problematic.

Figure 4.22: Comparison of Number of Inventors versus Age of Patents



4.98 The flow diagram in Figure 4.23 attempts to show overall changes in the relative rank position of a LEP area, based on inventor numbers, across the four different time periods. It needs to be interpreted carefully. It shows, for example, that the Greater Cambridge and Greater Peterborough LEP area (number 13 in the figure) consistently heads the rankings over the different time periods. It does not indicate the actual number of inventors in the LEP area, only that the number in that area is greater than in all the other LEP areas. Similarly, where a LEP area falls in rank position (as indicated in the Figure by a red line joining across two sequential time periods) it could be due to a number of factors, including: more accurate or inaccurate recording of addressing information on filed patents; that other LEP areas have improved more; or that there are lower levels of patenting within the area in that period of the data analysis. The flow chart does not show the progress of individual patents over time but is counting instead the number of inventors listed on patents within the indicated age ranges.

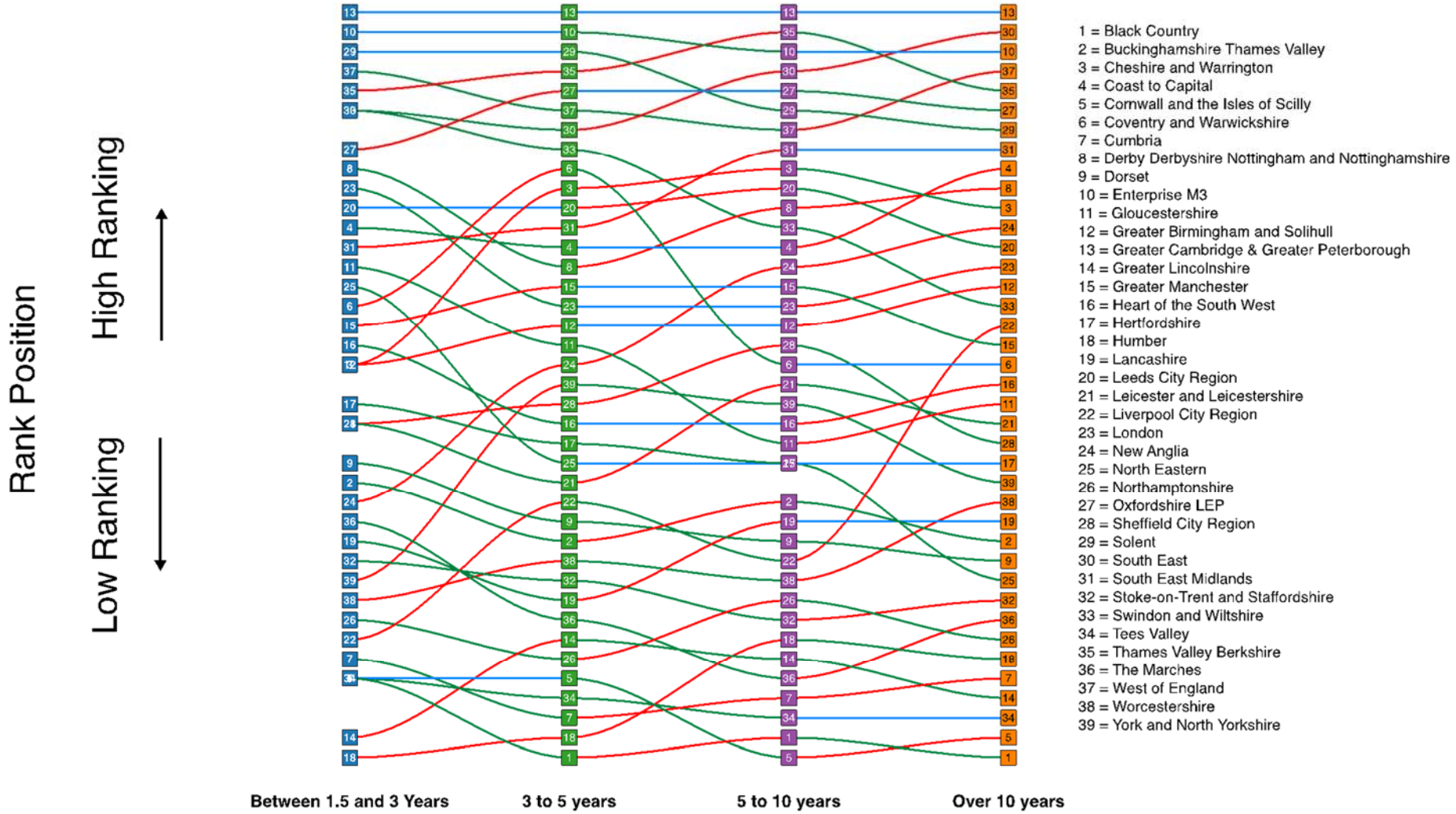


Figure 4.23: Rankings of LEP areas by inventor numbers across patenting time periods

Figure 4.23 Explanatory notes
Each square represents a LEP area with the number inside it referring to the key of LEP area names. The relative position of the LEP area provides its rank order position in terms of the number of inventors recorded on patents in the different time periods, with the highest rank position at the top of the columns. Greater Cambridge & Greater Peterborough LEP area (number 13) is ranked in first place across all time periods. Connecting lines between squares indicate the relative change in rank order of a LEP area across the different time periods. For example, Greater Cambridge and Greater Peterborough LEP area (number 13) shows no change (a connecting blue line) across all time periods - as indicated on the Figure by a connecting blue line. Reading from the right to the left in the Figure, a red connecting line indicates a decline in the number ranking of recorded inventors from older to more recent time periods and a green line indicates an increase. Liverpool City Region LEP area (number 22), for example, appears to show a reduction in the ranking of inventor numbers on patents for those greater than 10 years old to those 5 to 10 years old (a red line), an increase in ranking numbers of to those that are 3 to 5 years old (green line) and a subsequent fall in ranking to those that are between 1.5 and 3 years old (red line).

4.99 LEP areas in Eastern England, the South East and South West - Greater Cambridge and Greater Peterborough, Enterprise M3, Solent, South East, Oxfordshire and Thames Valley Berkshire and West of England - consistently top the rankings in all the patenting time periods. In the most recent period, 1.5 to 3 years, this group has been joined by Swindon and Wiltshire LEP area, which has moved to 6th equal in the ranking from 16th place ranking for the 'over 10 years' time period. Inventors are not evenly distributed across the country but this is not to argue that there are no inventive people in all LEP areas. However, those who patent, and the decision to patent, will be based on the availability of finance and the policy/appetite to patent an invention.

Area of Patenting Activity

4.100 Patents are classified by the International Patent Classification (IPC) coding system, which is a hierarchical alpha-numeric system comprising 8 main top level domains, Sections A-H (although there is a recently introduced Y class that is currently not overly populated). The distribution of inventors - assigned to LEP areas by their address - and top level domain is shown in Fig. 4.21. Patents are assigned to LEP areas if the inventor's address is in a LEP boundary. Therefore, rather than counting the numbers of patents, we are counting and locating the inventors in the 39 LEP areas. In doing this, the same caveats apply as previously described for patents, in that it may be that the inventor's address is the address of his or her employer, who may well have the same patenting address as the patent agent. We, nevertheless, would argue that the exercise still provides a reasonable indication of the density and distribution of inventors across each of the LEP areas.

4.101 As Figure 4.24 shows, London leads, with Greater Cambridge & Greater Peterborough, South East, Oxfordshire, Leeds City Region, Greater Manchester, Greater Birmingham & Solihull, Gloucestershire, Enterprise M3, Derby, Derbyshire, Nottingham & Nottinghamshire and Coventry & Warwickshire LEP areas all showing the highest numbers of inventors. However, when one reviews the most recent patents activity (Fig 4.23, right panel), the picture is somewhat different. Over time, the levels of patenting across the LEP areas vary because of the combination of activities of the public and private sectors. Table 4.19 summarises

this view of the data by Patent Section and the top quartile LEP areas by inventor numbers for these two time spans.

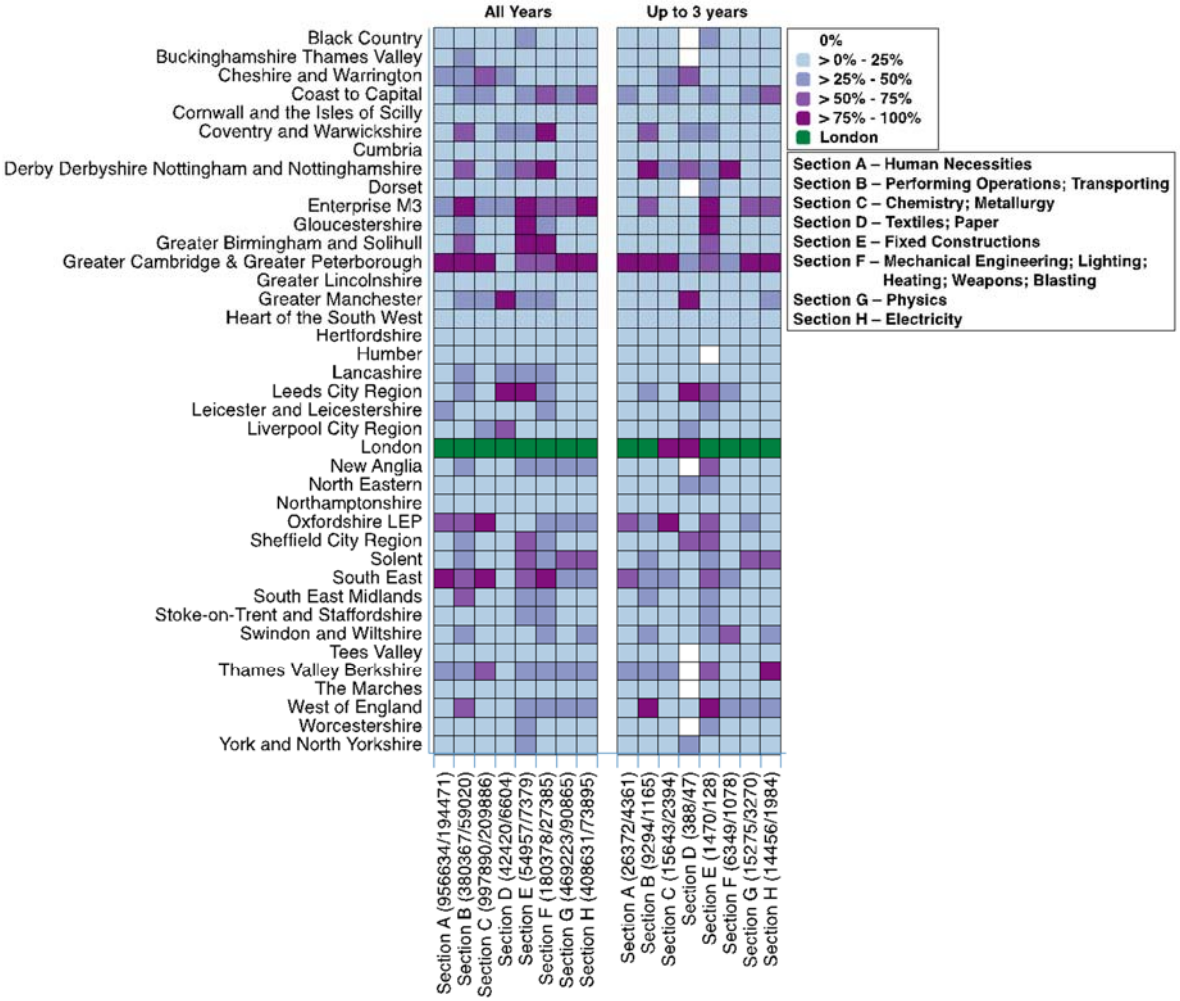


Figure 4.24: Distribution of Inventors by IPC code and LEP area in England

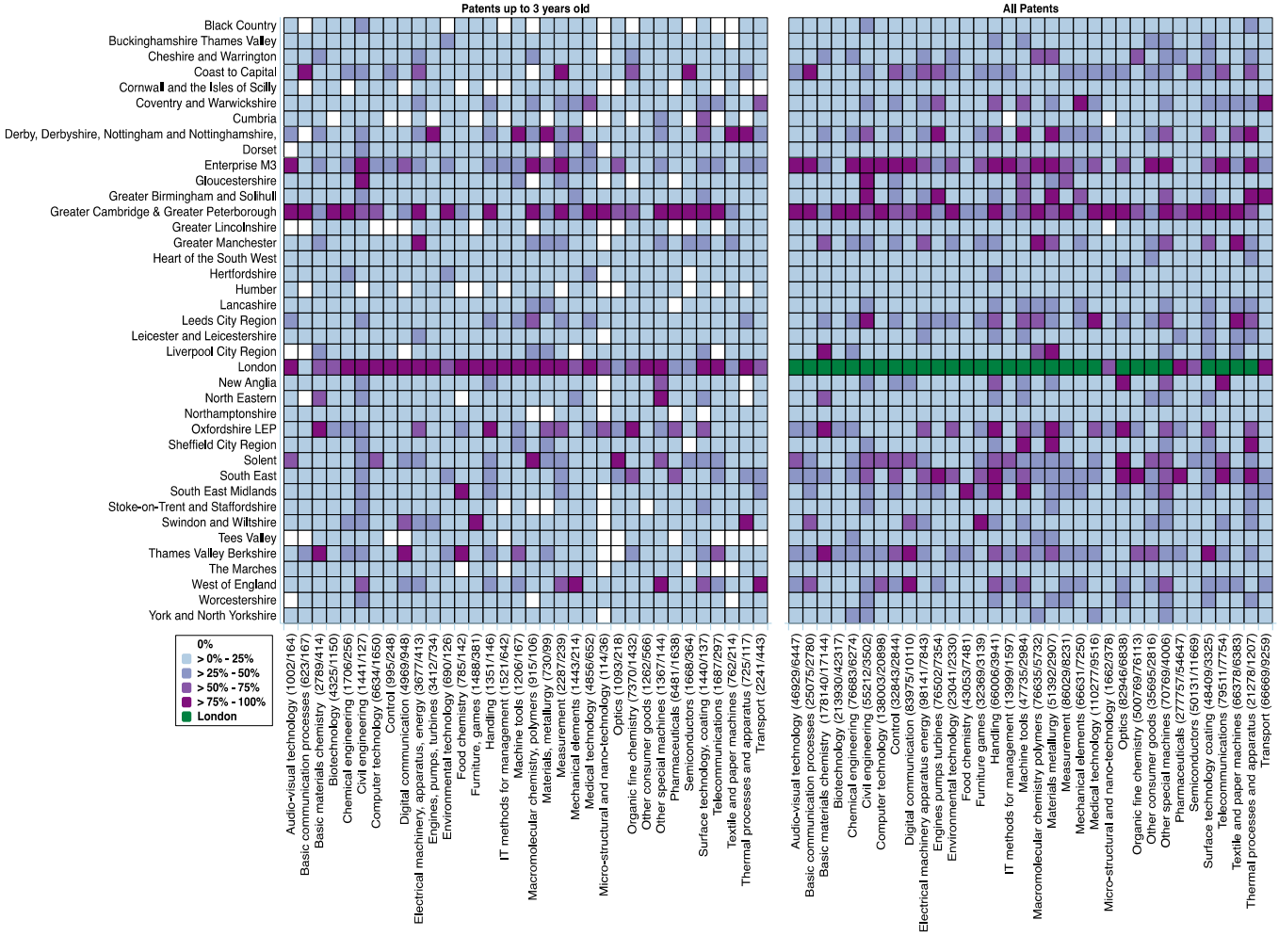
The two panels are all GB patents with an inventor address assigned to a LEP area for all patent ages (left panel) and those that are less than or equal to 3 years old (right panel) as of end December 2014. The two numbers in brackets in the x-axis label below the panels are, respectively, the total number of inventors and the highest value in the section in question. Colours indicate quartile ranges of LEP areas defined by the key. Where London is shaded in green, this indicates that the number of inventors in London is significantly more than in any other LEP area and was, therefore, analysed separately to provide better definition of the relative numbers of inventors in the remaining LEP areas.

Table 4.19: Distribution of Inventors across LEPs by Patent Section

Patent Section	All Patents	1.5 to 3 years old
A HUMAN NECESSITIES	• Greater Cambridge & Greater Peterborough • South East • London	• Greater Cambridge & Greater Peterborough • London
B PERFORMING OPERATIONS; TRANSPORTING	• Greater Cambridge & Greater Peterborough • London • Enterprise M3	• Derbyshire, Nottingham & Nottinghamshire • London • Greater Cambridge & Greater Peterborough • West of England
C CHEMISTRY; METALLURGY	• Greater Cambridge & Greater Peterborough • South East • Oxfordshire • London	• Oxfordshire • London • Greater Cambridge & Greater Peterborough
D TEXTILES; PAPER	• Leeds City Region • London • Greater Manchester	• Leeds City Region • London • Greater Manchester
E FIXED CONSTRUCTIONS	• London • Leeds City Region • Greater Birmingham & Solihull • Gloucestershire • Enterprise M3	• London • Leeds City Region • Gloucestershire • Enterprise M3 • West of England
F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING	• Coventry & Warwickshire • Derbyshire, Nottingham & Nottinghamshire • Greater Birmingham & Solihull • South East • London	• Derbyshire, Nottingham & Nottinghamshire • London
G PHYSICS	• Greater Cambridge & Greater Peterborough • London	• Greater Cambridge & Greater Peterborough • London
H ELECTRICITY	• Greater Cambridge & Greater Peterborough • Enterprise M3 • London	• Greater Cambridge & Greater Peterborough • London • Thames Valley Berkshire

4.102 Figure 4.25 shows inventors related to patenting in the 8 Great Technologies (assigned by IPC Code), plus a further two identified separately by the Government (*Eight Great Technologies, UK Intellectual Property Office*, October 2014 - see Figure 4.24), and a view of inventors' numbers associated with patents that are typical of key industrial sectors defined by the European Patent Office (Figure 4.25).

Figure 4.25: Comparison of numbers of inventors on patents across various technology areas in LEP areas



The two panels show all GB patents with inventor addresses assigned to a LEP area for both all patent ages (right-hand panel) and those that are less than or equal to 3 years old (left-hand panel) as of the end of December 2014. The numbers in brackets in the x-axis label alongside the panels are, respectively, the total number of inventors and the highest value in the section in question. Colours indicate quartile range of the LEP areas as defined by the key. Where London is shaded in green, this indicates that the number of inventors in London is significantly more than in any other LEP area and was, therefore, analysed separately to provide better definition of the relative levels of inventors across the remaining LEP areas.

4.103 It is noteworthy that, whatever the method of analysis of the location of inventors by their addresses on patents, there appears to be a paucity of inventors in the northern city regions of England, with the possible exception of Greater Manchester, in comparison with other LEP areas, particularly those in the South East and South West.

Knowledge exchange/ collaboration - interactions between Higher Education Institutions and business and the wider community: HE Business and Community Interaction Survey (HE-BCI)

4.104 We use data from the Higher Education Business and Community Interaction Survey (HE-BCI) administered by the Higher Education Statistics Agency (HESA) for one of the headline indicators for 'knowledge assets'. HE-BCI measures the volume and direction of interactions between UK Higher Education Institutions and business and the wider community. It collects data on both the infrastructure, capacity and strategy of HEIs and 'third stream activity' – the activities specifically concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside HE.

4.105 Higher Education Institutions in England reported some £2.8 billion in annual average income for business and community interaction activities between 2010/11 and 2012/13 (Table 4.20). Contract research was the largest single category with an annual average figure of £967.4 million (35% of the total), followed by collaborative research (both cash and 'in-kind': £668.3 million, 24% of the total), continuing professional development (£359.1 million, 13% of the total) and consultancy (£314.7 million, 11% of the total).

4.106 For four of the income categories - contract research, continuing professional development (CPD) for businesses and other organisations, consultancy and facilities and equipment related services – data have been broken down by source: large businesses, public and third sector and small and medium sized firms (SMEs). For three of the categories – contract research, CPD and consultancy – the public and third sector accounts for just under a third of the income (Table 4.20). Large businesses account for between 21% (consultancy) and 32% (contract research). The importance of facilities and equipment related services for SMEs stands out – with over a third (36%) of this category of income coming from SMEs compared, for example, with just 3% of contract research.

Table 4.20: Higher Education Business and Community Interaction in England Annual Average Income by Category, 2010/11 – 2012/13

Income category	Income (£000s)	% total	Source £000s (% share)			
			Large businesses	Public and third sector	SMEs	Total
Contract Research	967,439	34.5	309,580 (32.0)	628,835 (65.0)	29,023 (3.0)	(100.0)
Collaborative Research	668,294	23.8	-	-	-	-
Continuing Professional Development (CPD) [for businesses and other organisations]	359,124	12.8	107,737 (30.0)	233,431 (65.0)	17,956 (5.0)	(100.0)
Consultancy	314,666	11.2	66,080 (21.0)	204,533 (65.0)	44,053 (14.0)	(100.0)
CPD and Continuing Education [for individuals]	183,699	6.6	-	-	-	-
Regeneration and development programmes	129,615	4.6	-	-	-	-
Facilities and equipment related services	117,273	4.2	37,527 (32.0)	37,527 (32.0)	42,218 (36.0)	(100.0)
Intellectual property	63,452	2.3	-	-	-	-
Grand Total	2,803,563	100.0	-	-	-	-

Source: HE-BCI

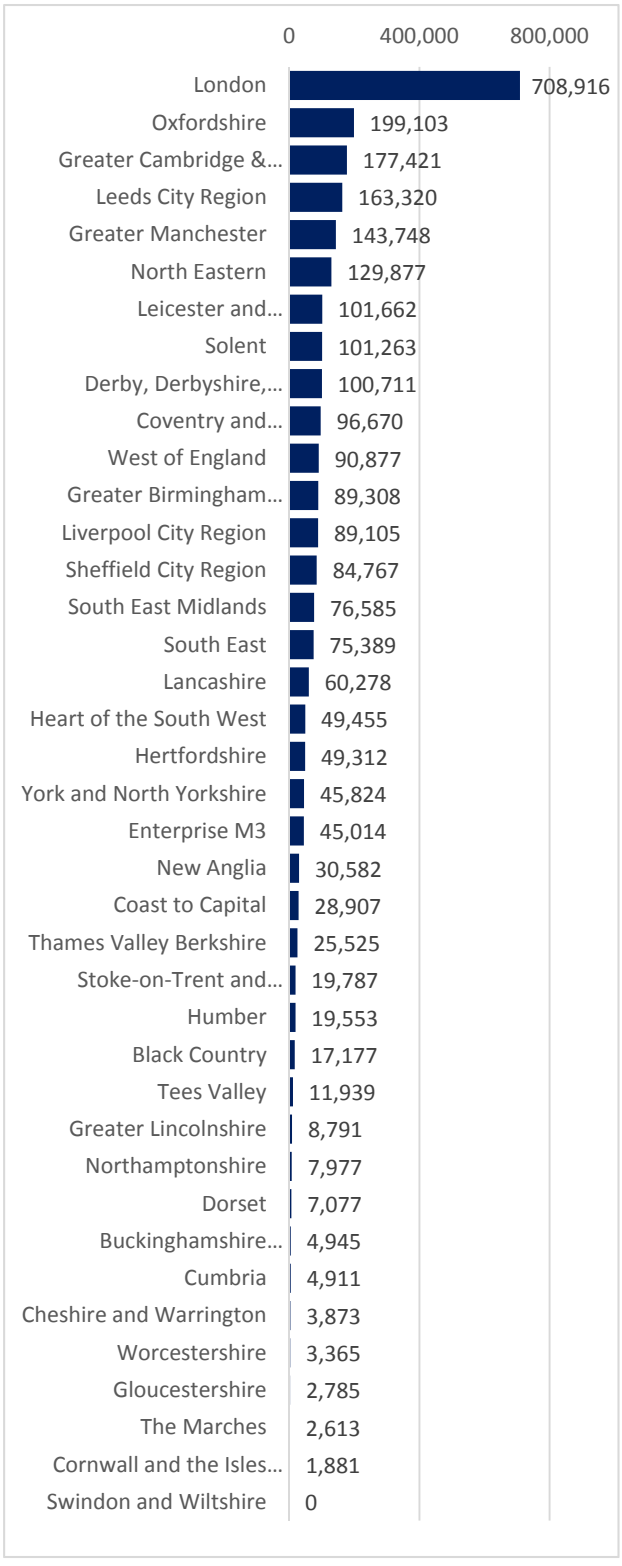
Total HE-BCI income

4.107 Given the concentration of HEIs in London, it is unsurprising that the capital reported the highest total income - an annual average of £708.9 million in real terms for the three years 2010/11 to 2012/13, a quarter of the £2.8 billion total for England. And HEIs in London and in 4 other LEP areas - Oxfordshire, Greater Cambridge & Greater Peterborough, Leeds City Region and Greater Manchester - together accounted for half of the total (Figure 4.26a).

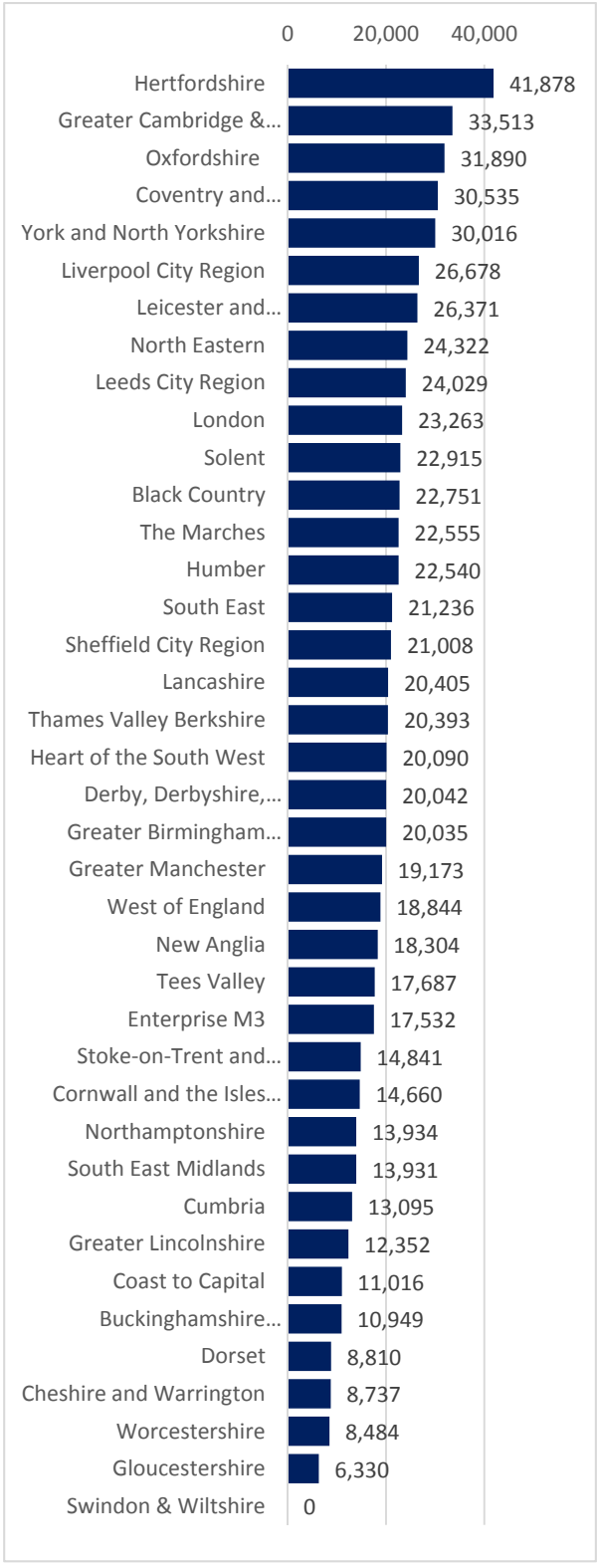
4.108 Allowing for institutional size - measured by numbers of full-time equivalent (FTE) academic staff – the ranking changes, in some cases, quite significantly (Figure 4.26b). The capital, London, slips down while Hertfordshire in the London city-region moves into first place. Some of the LEP areas in the core second-tier city-regions also slip down the ranking, notably Greater Manchester, Derby, Derbyshire, Nottingham and Nottinghamshire and West of England. Moving in the opposite direction are some of the smaller, predominantly rural LEP areas - notably The Marches, York and North Yorkshire and Cornwall and the Isles of Scilly. HEIs in these LEP areas, it could be argued, are interacting with business and the community 'above their weight'.

Figure 4.26: HE-BCI grand total - income in HEIs by LEP area, 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s



(b) £s per HE academic staff FTE



Source: HE-BCI

Contract research income

4.109 London HEIs unsurprisingly reported the largest single amounts in all of the income categories but one - the relatively small 'regeneration and development' category (see below). In terms of the largest category, contract research, HEIs in London reported an average of £281 million in real terms for the three years 2010/11 to 2012/13 - 29% of the £967.4 million total for England. HEIs in London and in just two other LEP areas - Oxfordshire and Leeds City Region - together accounted for half of the total (Figure 4.27a). Adding the next 8 LEPs - Greater Manchester, North Eastern, West of England, Sheffield City Region, Greater Birmingham and Solihull, Greater Cambridge & Greater Peterborough, Coventry and Warwickshire and Derby, Derbyshire, Nottingham and Nottinghamshire brings the share to four fifths of the total.

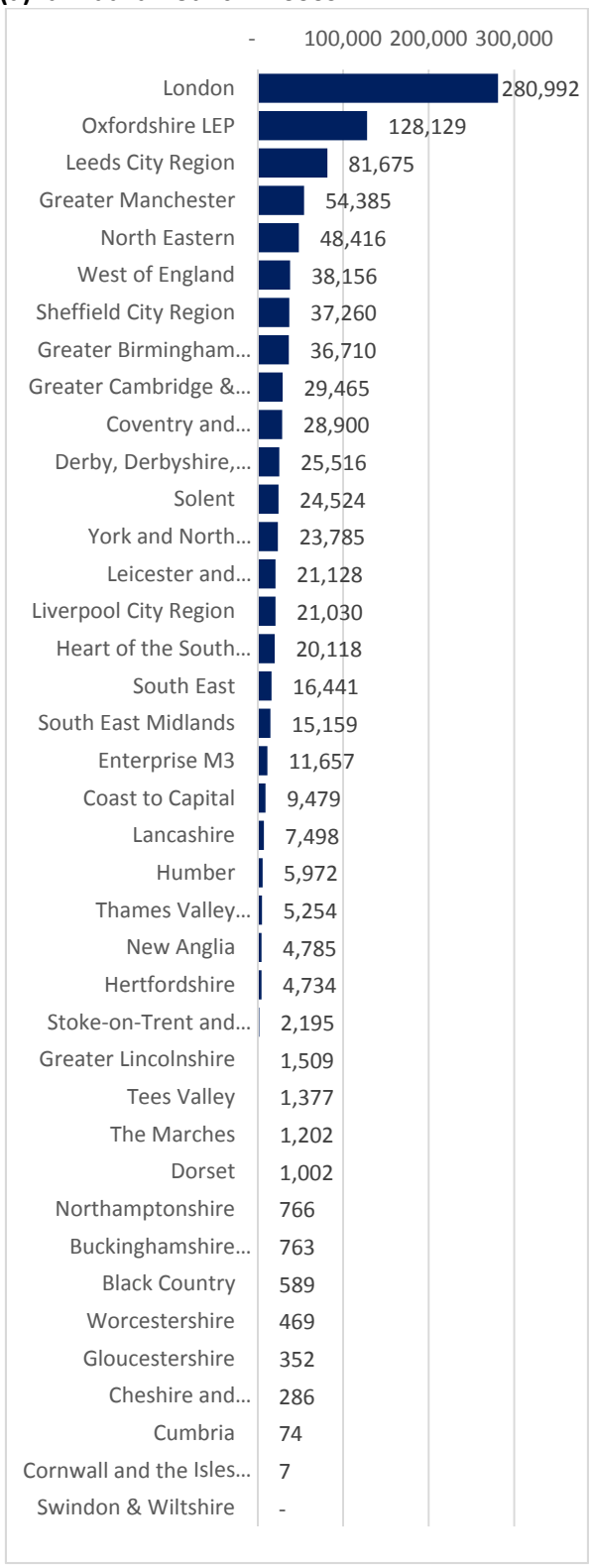
4.110 Allowing for institutional size – measured by numbers of full-time equivalent - academic staff - London slips down the ranking (Figure 4.27b). Rural Oxfordshire moves into first place and second-tier Leeds City Region stays third. Rural York and North Yorkshire moves into second place and others moving significantly up the rankings are rural The Marches and third-tier Heart of the South West and Humber.

4.111 Figure 4.28 shows the distribution of total contract research income by source and LEP area. There is significant variation. Rrual Cornwall and the Isles of Scilly, with its relatively small HEI presence, reported the lowest amount of contract research income and all of this was from the public and third sector. HEIs in each of Buckinghamshire Thames Valley and the Black Country LEP areas reported just 1% of contract research income from large businesses compared with the 79% figure in the South East Midlands (nearly two and a half times the share for England as a whole). The lowest share accounted for by the public and third sector was 29% in Greater Cambridge and Greater Peterborough. The highest shares accounted for by SMEs were in The Marches (19%), Tees Valley (12%), Stoke on Trent and Staffordshire (11%) and Liverpool City Region (10%).

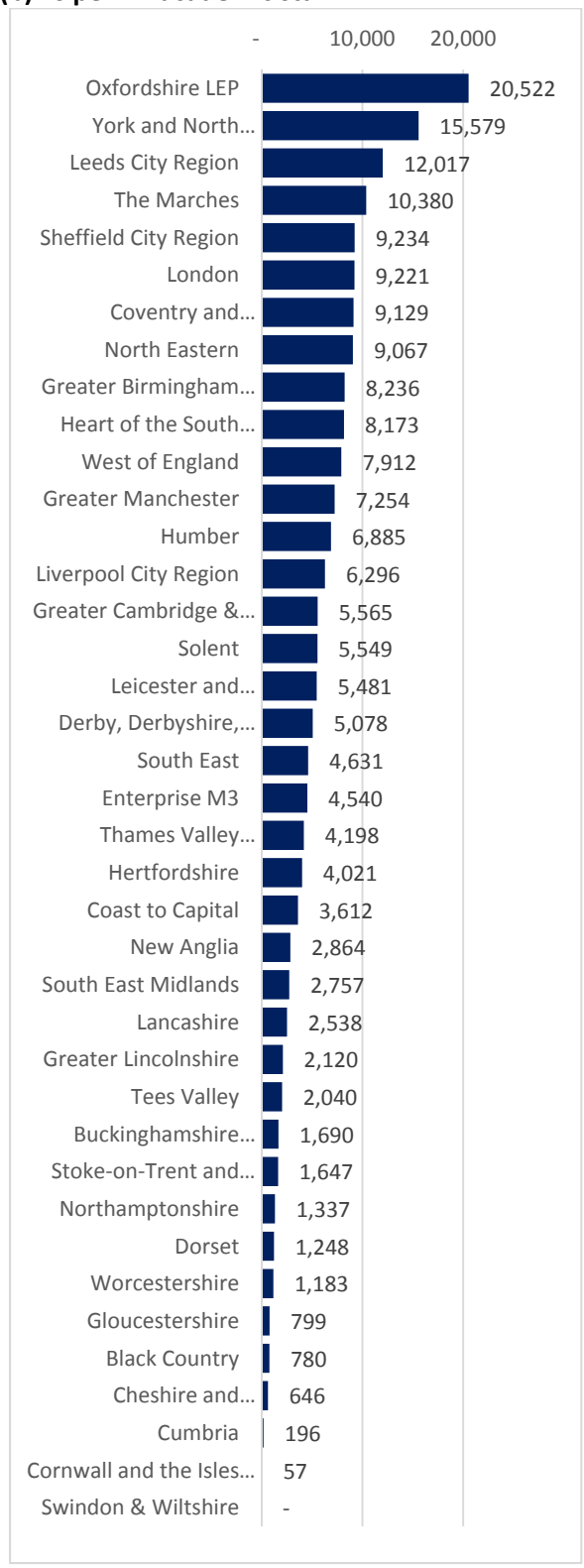
4.112 Given its relative size, London's split was unsurprisingly fairly close to the England average. But there was still some variation across the other seven LEP areas with consultancy income above £30 million. Income from large businesses ranged from 18% of the total (in Greater Birmingham and Solihull) to 38% (in Greater Manchester). For public and third sector, it ranged from 59% (Sheffield City Region) to 79% (in Leeds City Region). Income from SMEs ranged between 1% and 4%.

Figure 4.27: Contract research income in HEIs by LEP area, 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s

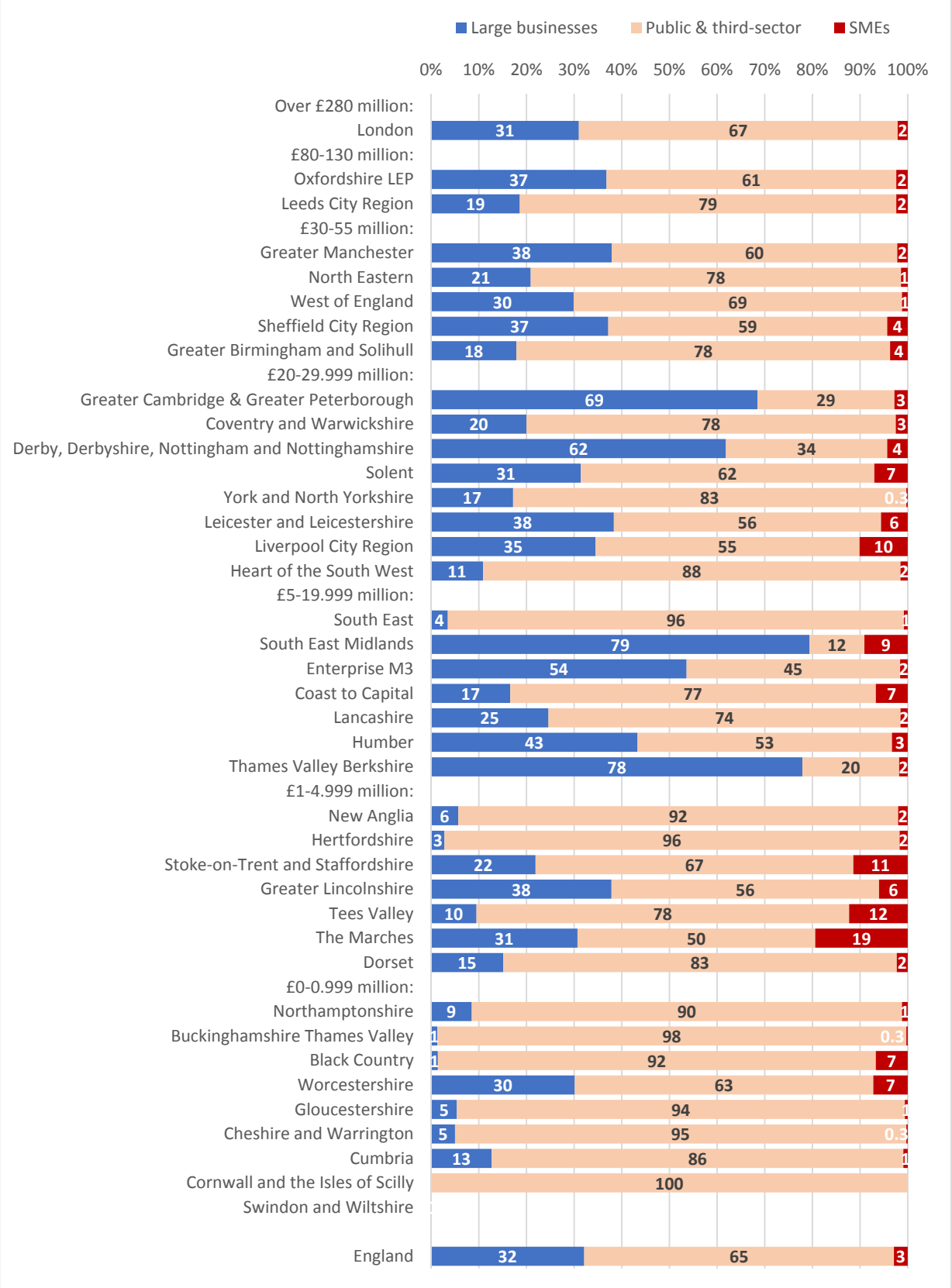


(b) £s per HE academic staff FTE



Source: HE-BCI

Figure 4.28: Contract Research – annual average 2010/11-2012/13 – % split in income: 'large businesses', 'public & third sector' and SMEs, ranked in descending order of income



Source: HE-BCI; Note: Figures may not sum due to rounding

Collaborative research income

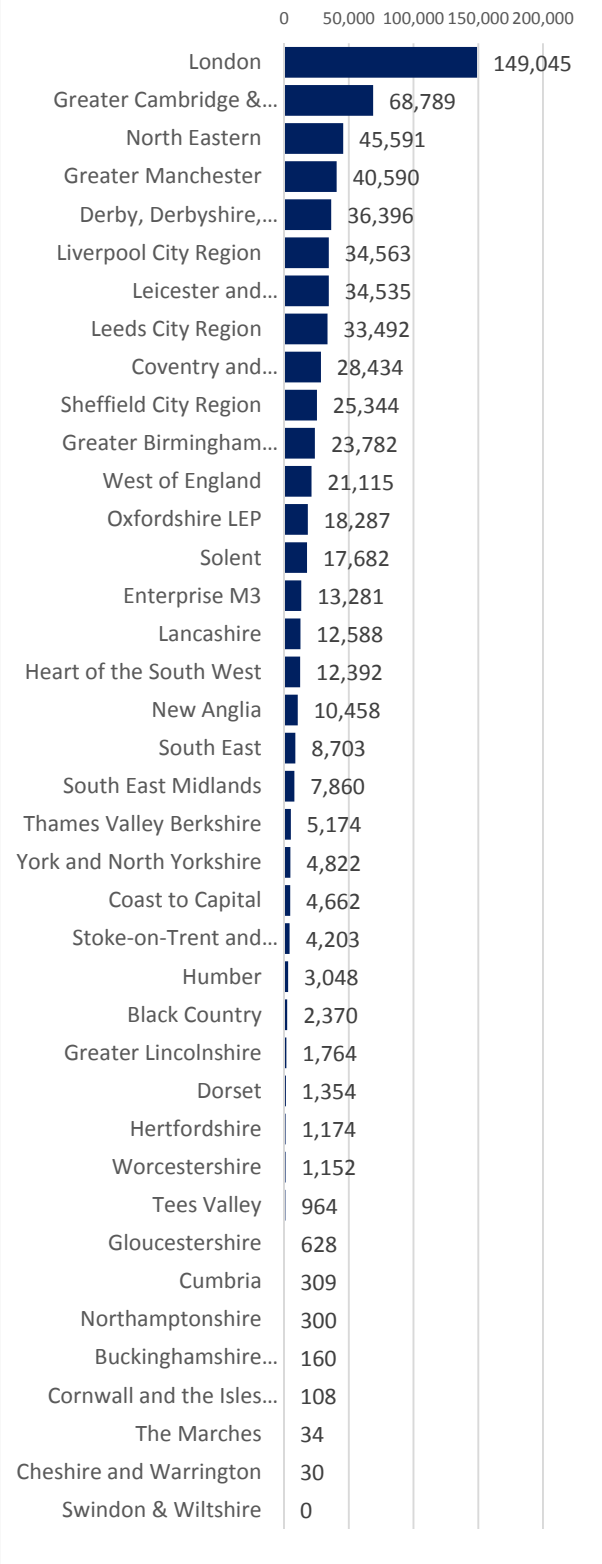
4.113 Collaborative research was the second largest reported source of income in the HE-BCI with an annual average for the three years 2010/11 to 2012/13 of some £668 million in real terms. It should be noted that the figure includes both cash and in-kind contributions. Figure 4.29a shows the distribution of this figure across the LEP areas.

4.114 London HEIs reported £149 million, 22% of the total. Greater Cambridge and Greater Peterborough comes next with under half that figure, some £68.8 million (10% of the total). HEIs in these two LEP areas plus North Eastern, Greater Manchester and Derby, Derbyshire, Nottingham and Nottinghamshire accounted for half the total. Adding another seven - Liverpool City Region, Leicester and Leicestershire, Leeds City Region, Coventry and Warwickshire, Sheffield City Region, Greater Birmingham and Solihull and West of England – accounted for four fifths of the total.

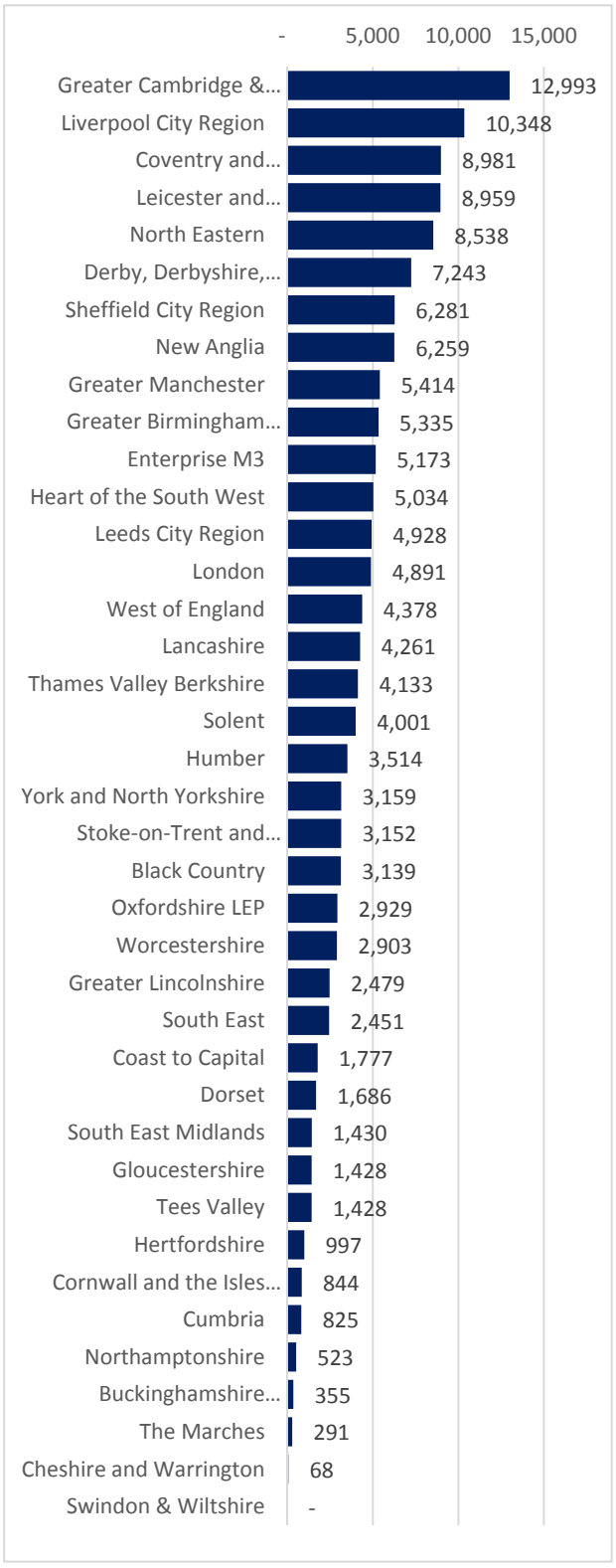
4.115 When adjusted for numbers of academic staff, London again slips down the ranking and by more places than for contract research income (Figure 4.29b). The northern and Midlands LEP areas move up, notably Liverpool City Region, Coventry and Warwickshire, Leicester and Leicestershire, Sheffield City Region, Humber, Black Country and Worcestershire. Others that move up the ranking when size is taken into account are New Anglia in eastern England, Enterprise M3 in the south east and Heart of the South West in the south west.

Figure 4.29: Collaborative research income in HEIs by LEP area 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s



(b) £s per HE academic staff FTE



Source: HE-BCI

Continuing professional development income (for businesses and other organisations)

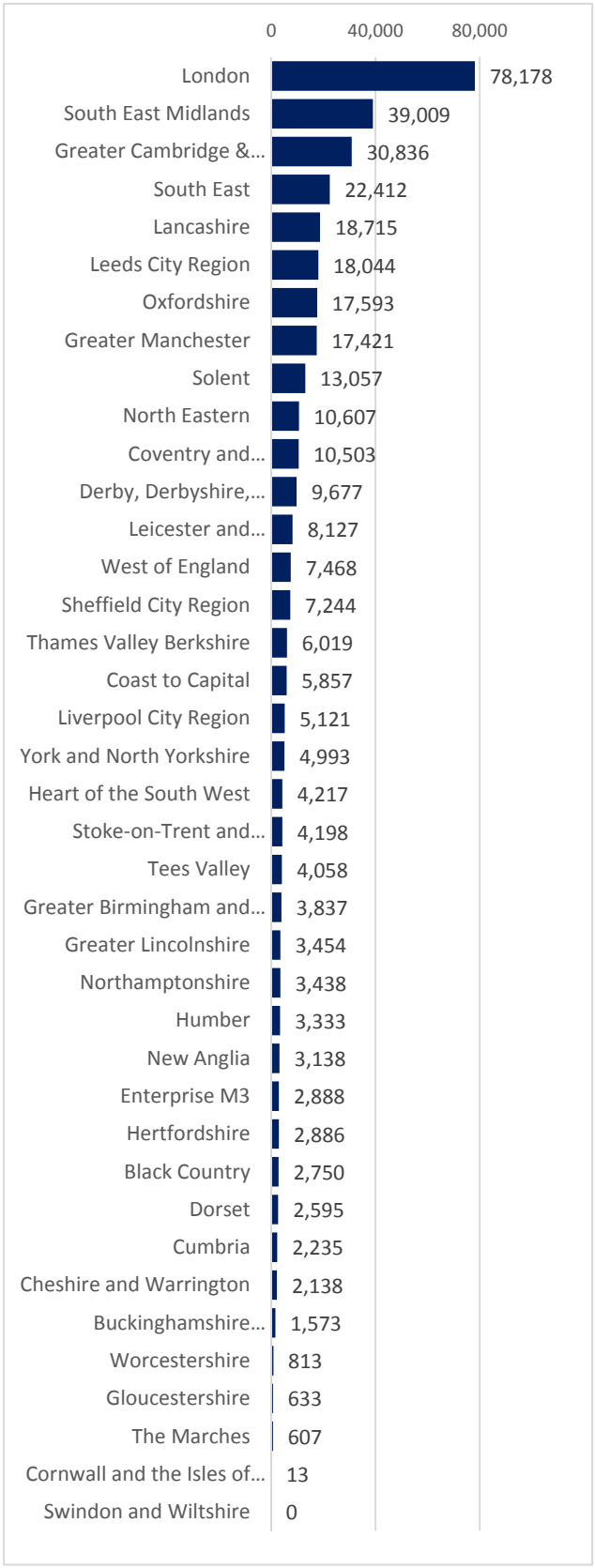
4.116 London leads again in terms of total income from continuing professional development (CPD) for businesses and other organisations: £78 million, 22% of the total (Figure 4.30a). With London, HEIs in 4 other LEP areas - South East Midlands, Greater Cambridge and Greater Peterborough, South East and Lancashire – together had just over half of the total (53%).

4.117 In relation to numbers of academic staff, HEIs in South East Midlands head the ranking, followed by Lancashire, South East, Tees Valley and Northamptonshire (Figure 4.30b).

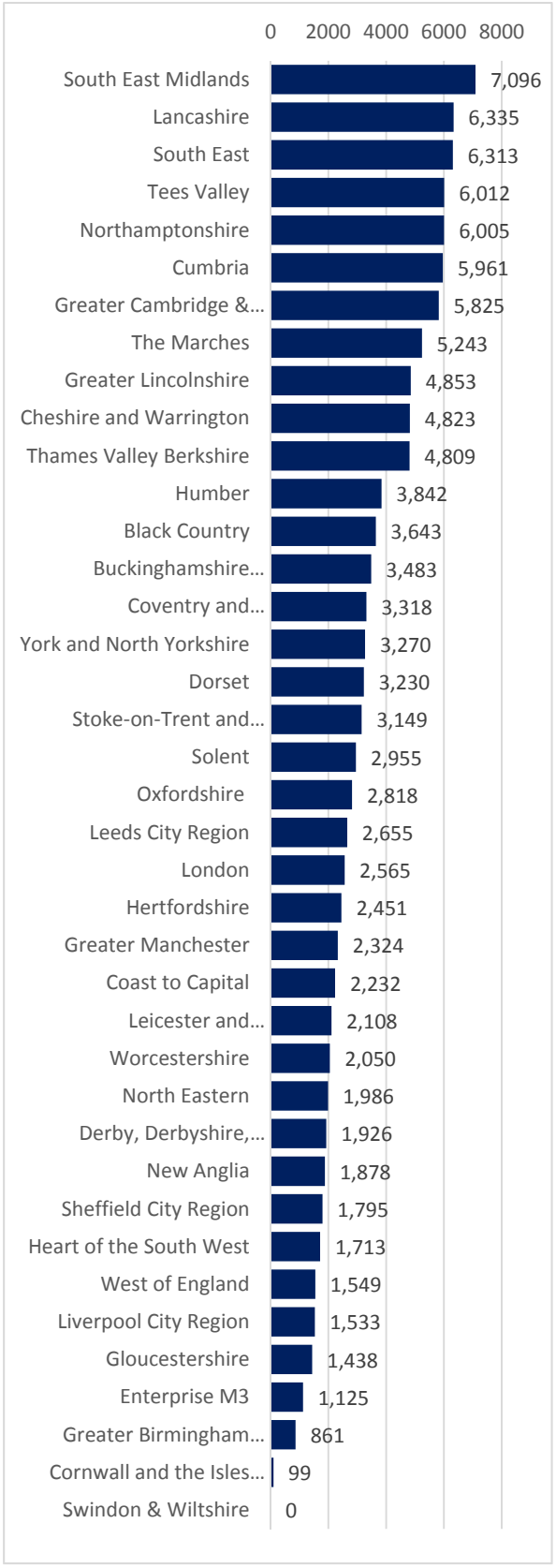
4.118 Figure 4.31 shows the distribution of this category of CPD income by source and LEP area. Again there is significant variation. The share accounted for by large businesses in England as a whole was 30%. The corresponding figure ranges from zero in third-tier Northamptonshire and New Anglia, rural Cumbria and Cornwall and the Isles of Scilly to 83% in Thames Valley Berkshire in the London city-region. The public and third sector accounted for 65% of the total in England. The equivalent share ranged from just 7% in rural The Marches to 100% in third-tier New Anglia and 99% in HEIs in third-tier Northamptonshire and rural Cumbria.

Figure 4.30: CPD income in HEIs by LEP areas 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s

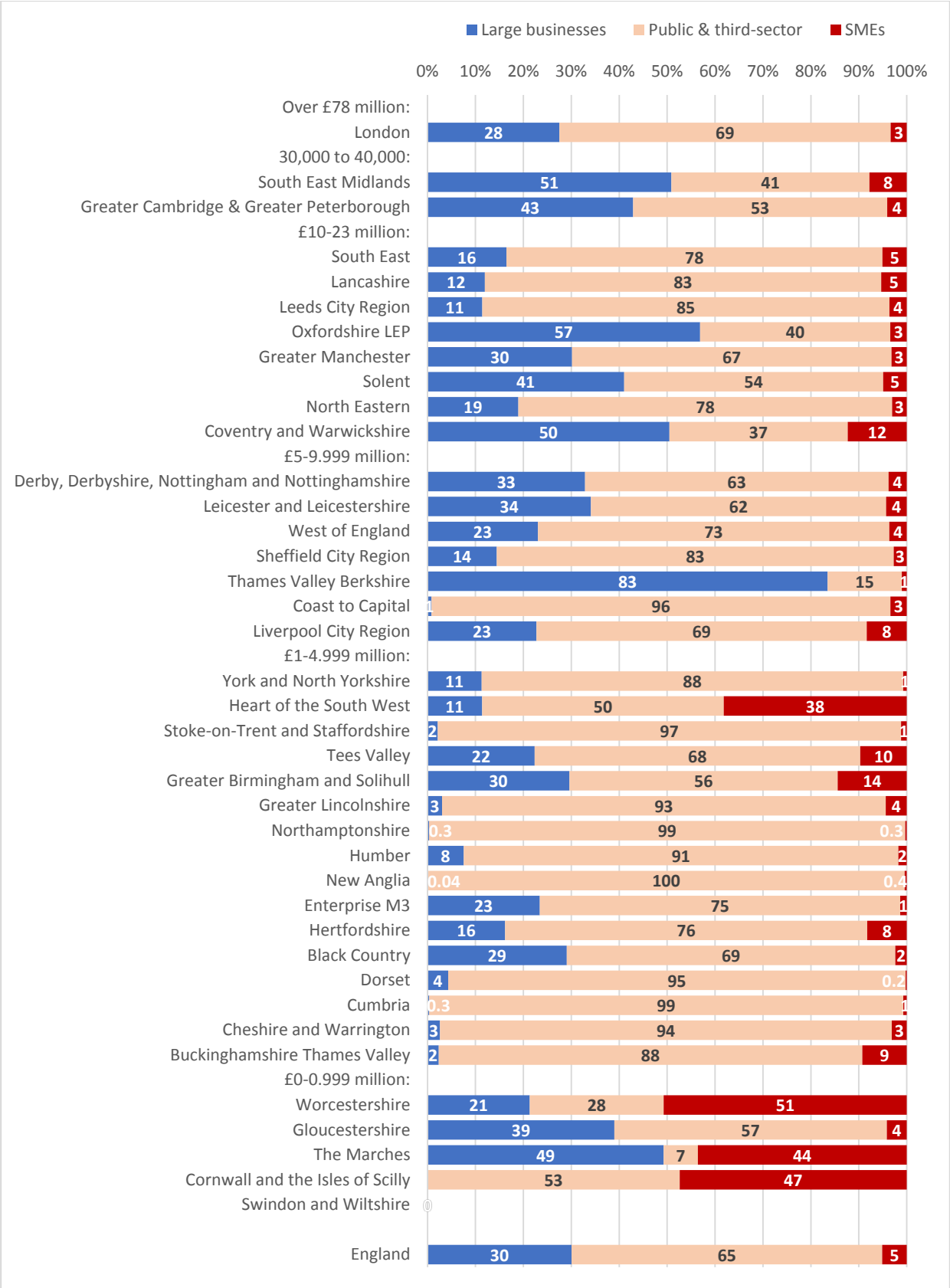


(b) £s per HE academic staff FTE



Source: HE-BCI

Figure 4.31: CPD – annual average 2010/11-2012/13 – % split in income: 'large businesses', 'public & third sector' and SMEs, ranked in descending order of income



Source: HE-BCI; Note: Figures may not sum due to rounding

Consultancy income

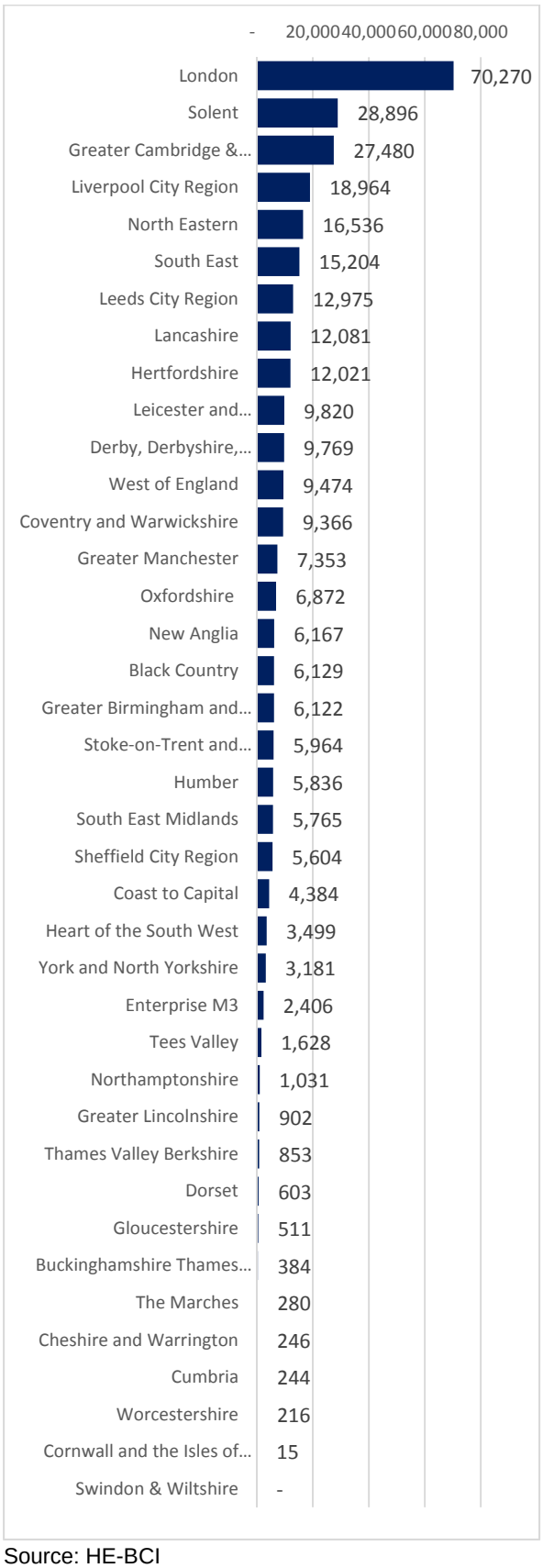
4.119 For the three years, 2010/11 to 2012/13, the HE-BCI data show in real terms an annual average of some £315 million in consultancy income generated by English HEIs. Figure 4.32a shows the distribution of this figure across the LEP areas. In absolute terms, consultancy income is once again dominated by London, which generated £70 million or 22% of the total. Next come third-tier Solent and Greater Cambridge & Greater Peterborough with figures of £29 million and £27 million, each with approximately 9% of the total. These three LEP areas plus second-tier Liverpool City Region and North Eastern account for half of the total. These five LEP areas plus South East, Leeds City Region, Lancashire, Hertfordshire, Leicester and Leicestershire, Derby, Derbyshire, Nottingham and Nottinghamshire, West of England, and Coventry and Warwickshire together accounted for four fifths of the total.

4.120 The ranking again changes, in some cases quite substantially, when the relative size of institutions is taken into account, see Figure 4.32b. LEP areas that shift up the rankings include Hertfordshire and New Anglia in eastern England, Tees Valley, Humber and York and North Yorkshire in the north and the Black Country, Stoke-on-Trent and Staffordshire, The Marches and Northamptonshire in the midlands.

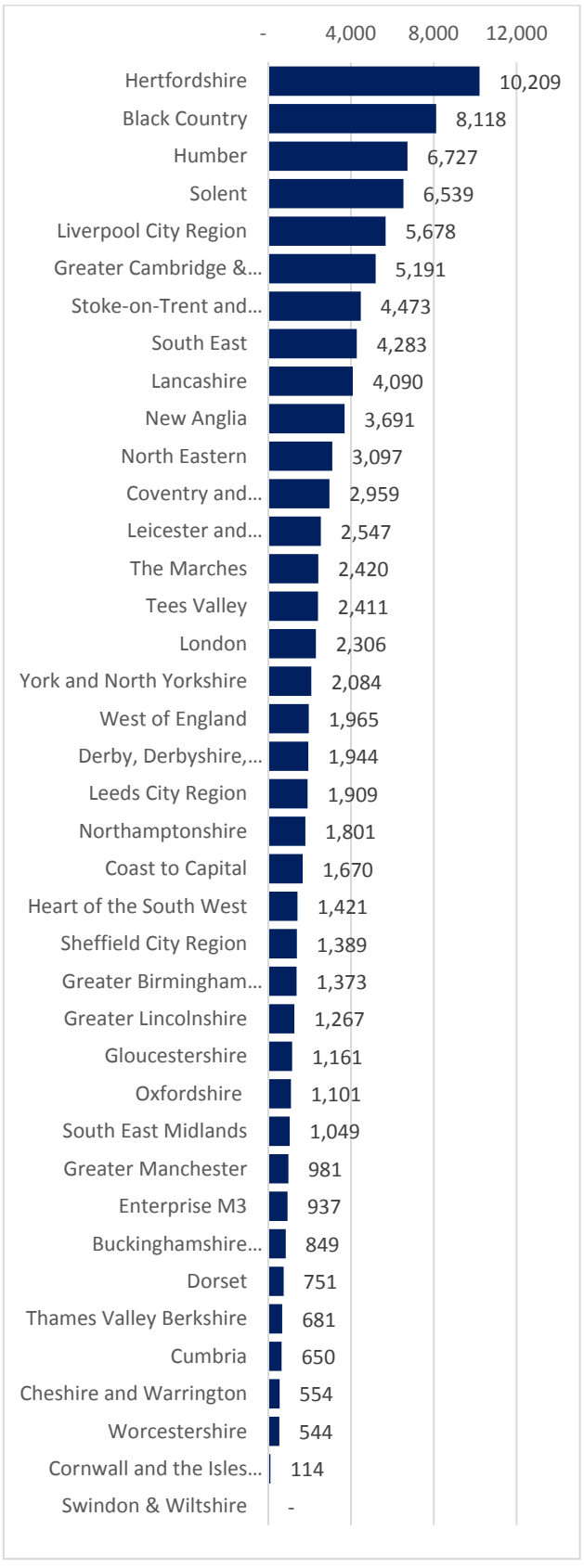
4.121 Figure 4.33 shows the distribution of total consultancy income by source and LEP area. The share accounted for by large businesses in England as a whole was 21%. The corresponding figure ranges from just 1% for HEIs in rural Cumbria to 56% in Greater Manchester. The public and third sector accounted for 65% of the total in England. The equivalent share ranged from 10% in rural The Marches to 99% in rural Cumbria.

Figure 4.32: Consultancy income in HEIs by LEP area 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s

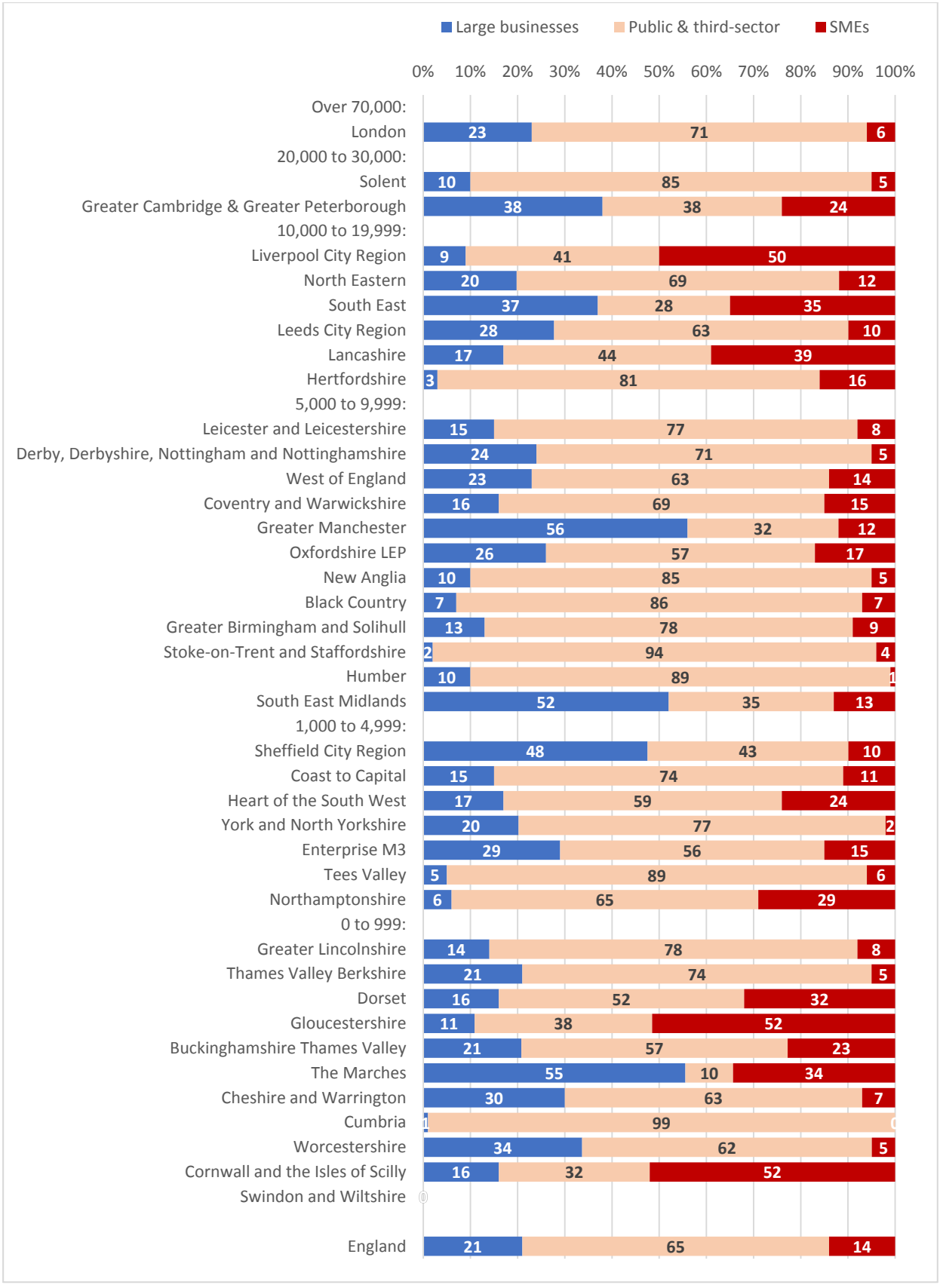


(b) £s per HE academic staff FTE



Source: HE-BCI

Figure 4.33: Consultancy Income – annual average 2010/11-2012/13 – % split in income: 'large businesses', 'public & third sector' and SMEs, ranked in descending order of income



Source: HE-BCI; Note: Figures may not sum due to rounding

Continuing professional development income and continuing education income (for individuals)

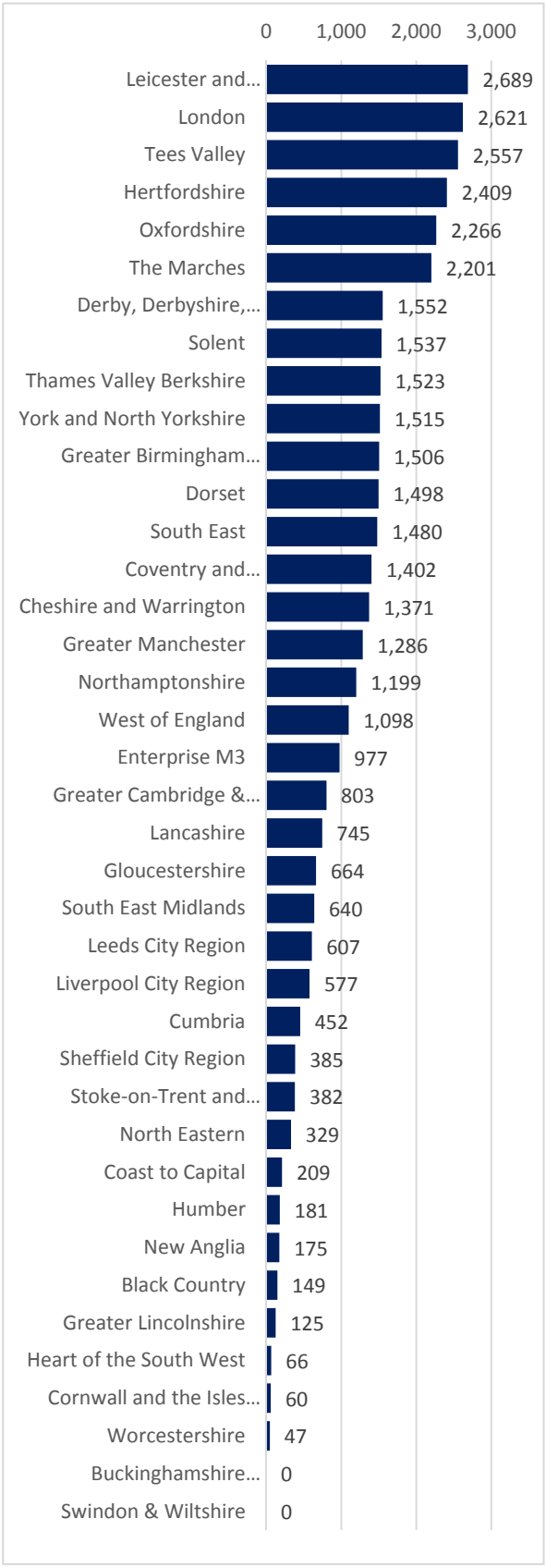
4.122 For the three years, 2010/11 to 2012/13, the HE-BCI data show in real terms an annual average of some £184 million in continuing professional development (CPD) and continuing education (CE) income for individuals generated by English HEIs. Figure 4.34a shows the distribution of this figure across the LEP areas. HEIs in London generated £79.9 million or 43.5% of the total, the city's largest share of all of eight income categories. HEIs in the Oxfordshire, Leicester and Leicestershire and Greater Manchester LEP areas together with London accounted for 62% of the total.

4.123 When the relative size of institutions is taken into account, the LEP areas that shift up the rankings include Hertfordshire in the London city-region, third-tier Tees Valley, in the north and rural The Marches in the midlands.

Figure 4.34: CPD and CE income in HEIs by LEP, 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s

(b) £s per HE academic staff FTE



Source: HE-BCI

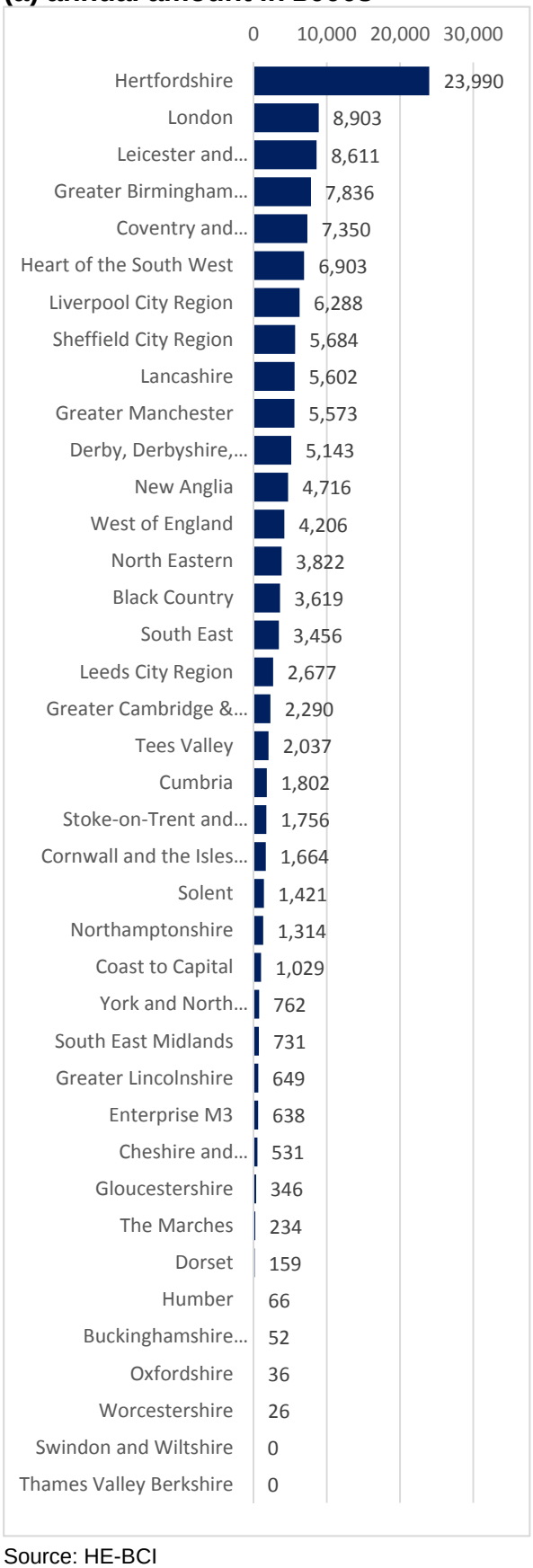
Regeneration and development programmes

4.124 Regeneration and development programmes provided English HEIs in total an annual average of some £130 million over the years, 2010/11 to 2012/13. Figure 4.35a shows the distribution of this figure across the LEP areas. London is replaced in lead place by Hertfordshire, which reported annual average income of just under £24 million from these programmes over the three years, nearly 19% of the total. HEIs in the LEP areas with the six next largest reported incomes - London, Leicester and Leicestershire, Greater Birmingham and Solihull, Coventry and Warwickshire, Heart of the South West and Liverpool City Region – together provided another £46 million or 29% of the total.

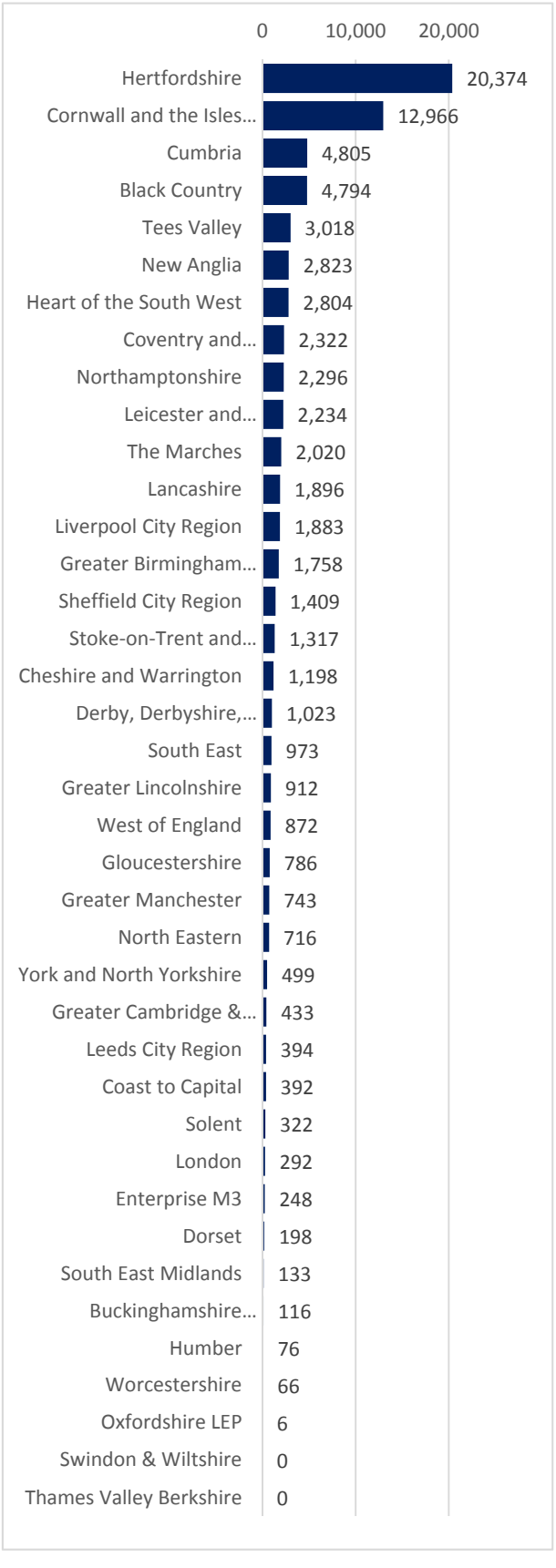
4.125 When the relative size of institutions is taken into account, the LEP areas that shift up the rankings include rural Cumbria and third-tier Tees Valley in the north, the second-tier Black Country in the midlands, third-tier New Anglia in eastern England and, notably, rural Cornwall and the Isles of Scilly in the south west (Figure 4.35b). Regeneration and development programmes accounted for 88% of the area's annual average HE-BCI income reported by its HEIs over the three year period.

Figure 4.35: Regeneration and development programmes income in HEIs by LEP area, 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s



(b) £s per HE academic staff FTE



Source: HE-BCI

Facilities and equipment related services

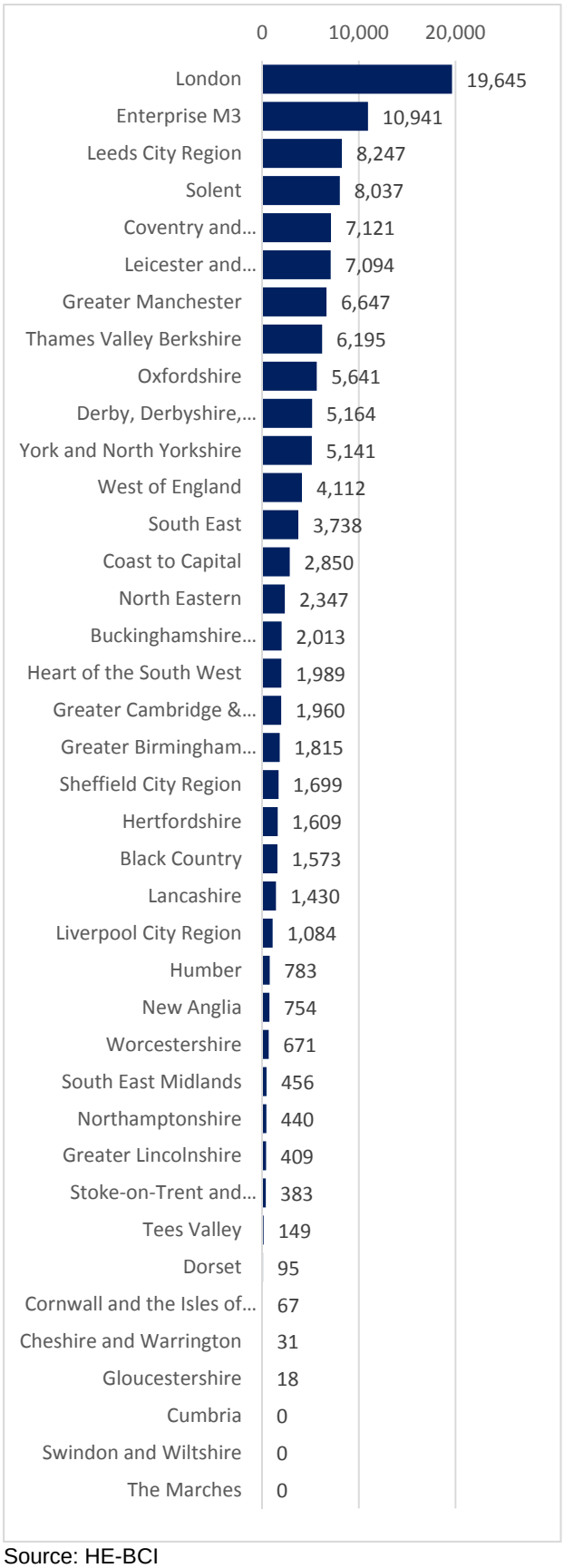
4.126 For the three years, 2010/11 to 2012/13, the HE-BCI data show in real terms an annual average of some £117 million in income generated by English HEIs from the provision of equipment and related services. Figure 4.36a shows the distribution of this figure across the LEP areas. HEIs in London reported 17% of this figure, just under £20 million. HEIs in the next six LEP areas in the rankings in this income category - Enterprise M3, Leeds City Region, Solent, Coventry and Warwickshire, Leicester and Leicestershire and Greater Manchester – together reported annual average income of some £48 million, 41% of the total.

4.127 The LEP areas that shift up the rankings when relative size is taken into account include York and North Yorkshire in the north, the Black Country in the midlands and Buckinghamshire Thames Valley in the south east (Figure 4.36b).

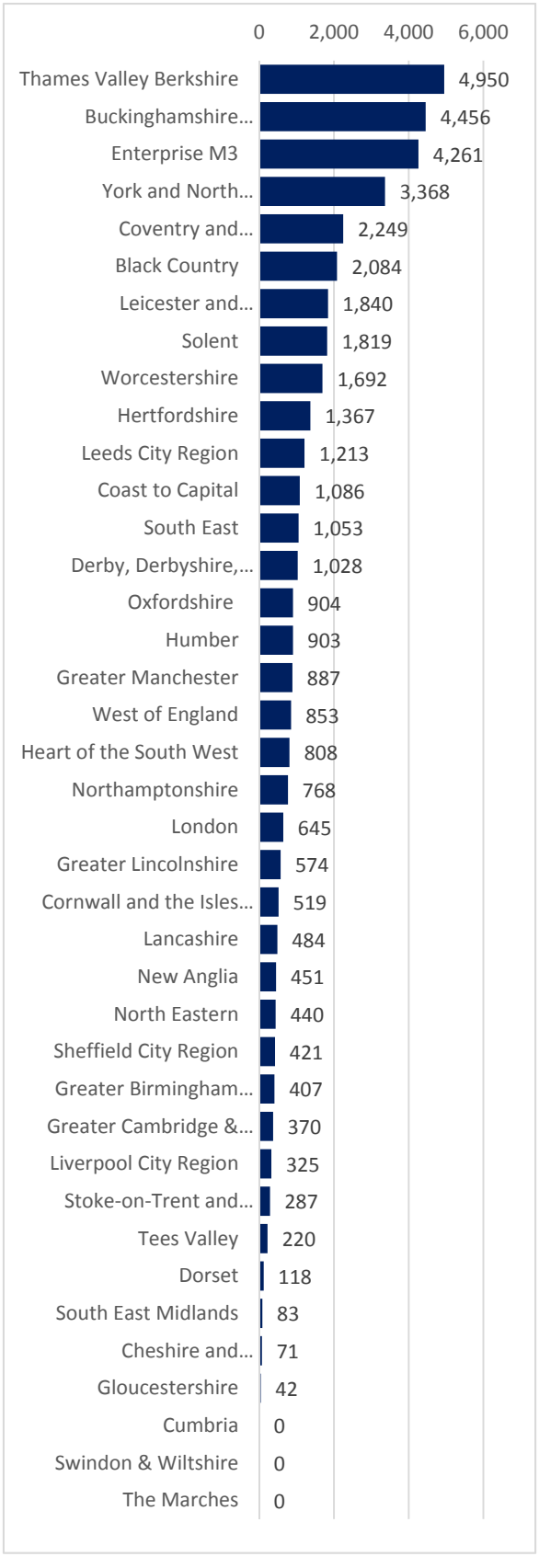
4.128 The relative importance for SMEs of hiring facilities and equipment from HEIs is indicated in Figure 4.37. The share of this income category accounted for by SMEs in England as a whole was 36%. The corresponding figure ranges from zero for HEIs in the New Anglia LEP area to 96% for HEIs in each of Buckinghamshire Thames Valley and Cornwall and the Isles of Scilly LEP areas. There was similar - if slightly less marked - variation in the other sources of income. Large business and the public and third sector each accounted for 32% of the England total. The figures for the former ranged from zero in each of Buckinghamshire Thames Valley and Cornwall and the Isles of Scilly LEP areas to 75% in Northamptonshire. The share of the public and third sector ranged from just 4% and 5% in Buckinghamshire Thames Valley and Cornwall and the Isles of Scilly, respectively to 85% in the Gloucestershire LEP area.

Figure 4.36: Facilities and equipment related services - income in HEIs by LEP area - 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s

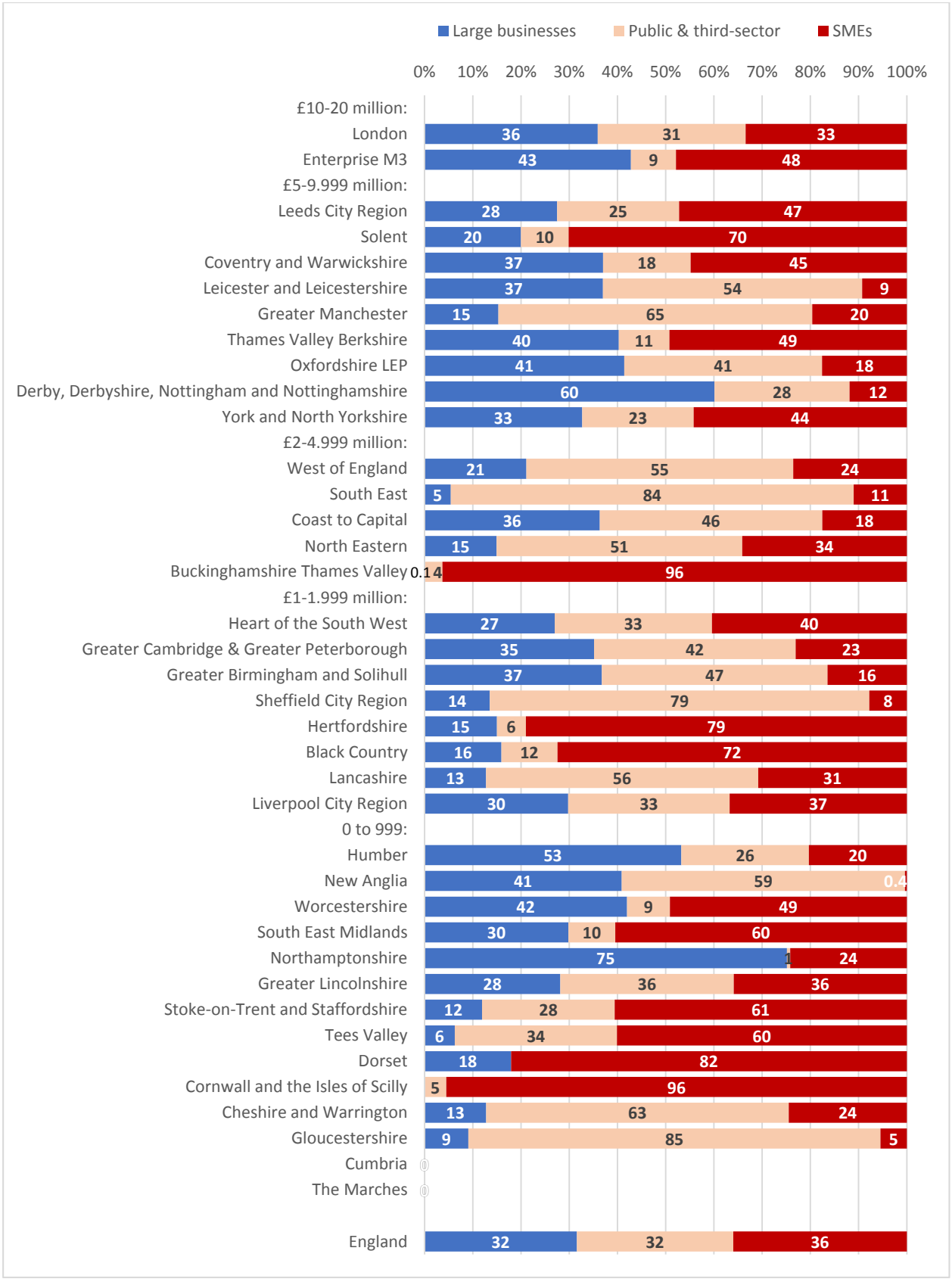


(b) £s per HE academic staff FTE



Source: HE-BCI

Figure 4.37: Facilities and equipment related services – annual average 2010/11-2012/13 - % split in income: 'large businesses', 'public & third sector' and SMEs, ranked in descending order of income



Source: HE-BCI; Note: Figures may not sum due to rounding

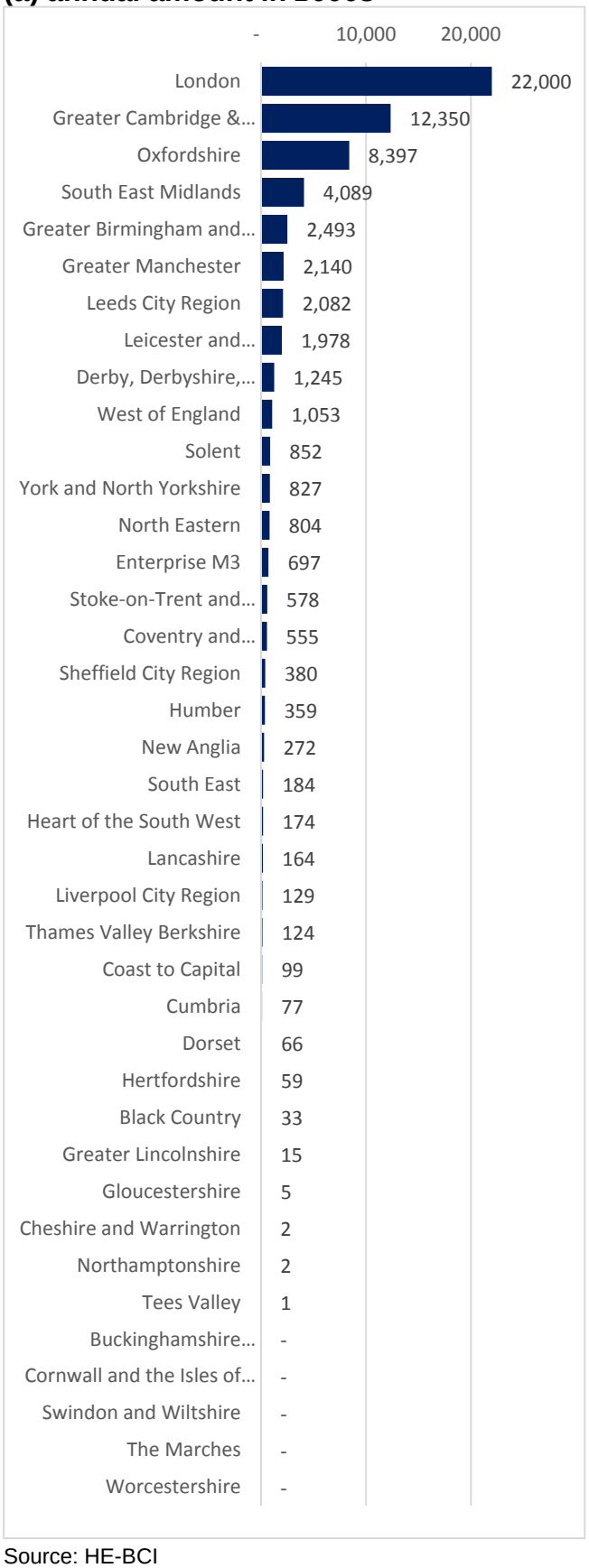
Intellectual property

4.129 Intellectual property (IP) was the smallest income category in the HE-BCI survey – some £63.5 million annual average for the years 2010/11 to 2012/13, just 2% of the total. It, nevertheless, is clearly especially important as an indicator of innovation. Figure 4.38a shows the distribution of income from IP across LEP areas. It was highly concentrated, with nearly three quarters (74%) of the annual average total (£47 million) accounted for by HEIs in just four LEP areas - London, Greater Cambridge & Greater Peterborough, Oxfordshire and South East Midlands.

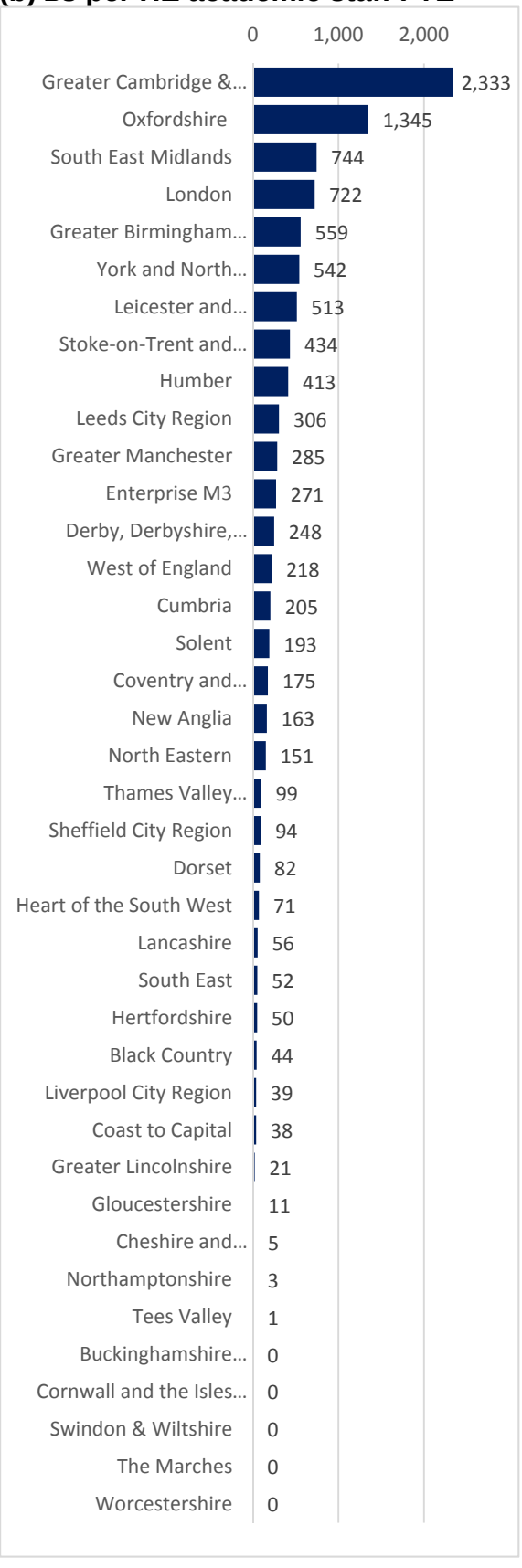
4.130 Allowing for institutional size only reshuffles the ordering of these four LEP areas in the rankings with Greater Cambridge and Greater Peterborough displacing the capital, London, at the top (Figure 4.38b).

Figure 4.38: Intellectual Property - income in HEIs by LEP area, 3 year average in real terms values, 2010/11-2012/13

(a) annual amount in £000s



(b) £s per HE academic staff FTE



Source: HE-BCI

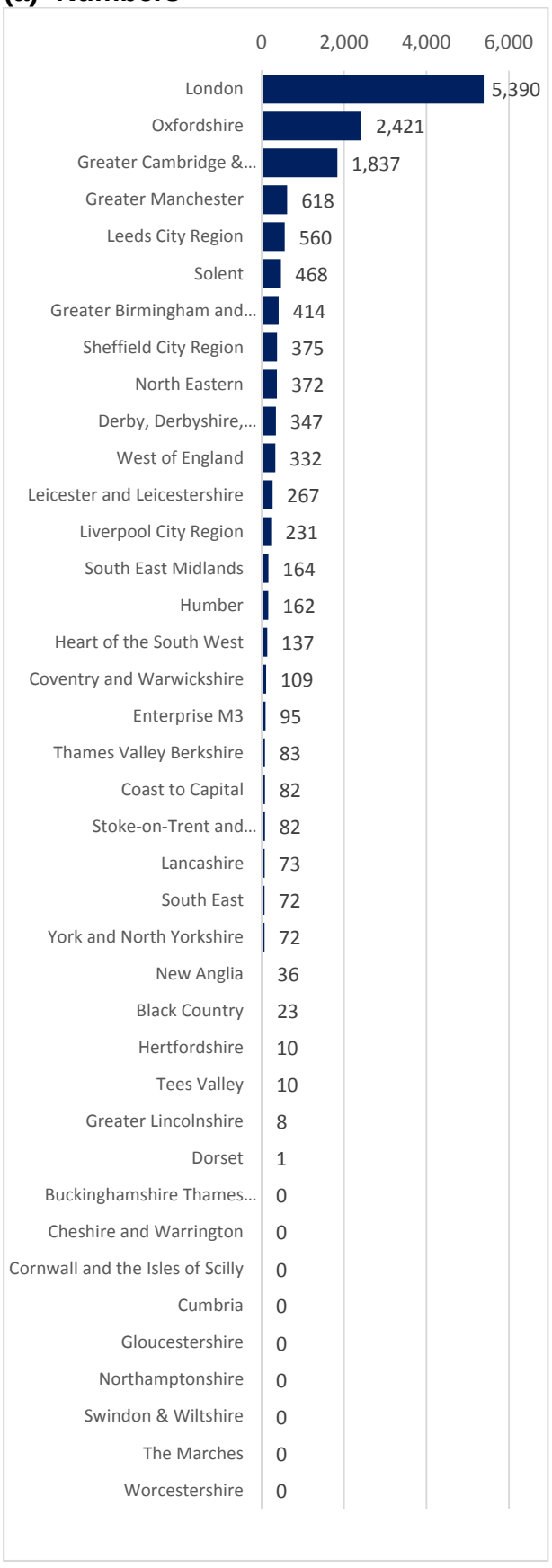
Patents

4.131 HE-BCI also provides information on the number of active patents held by HEIs. This figure will be included in the patents analysis above but it does give an idea of the contribution that HEIs made to patenting activity in the 2010/11 period. There were just under 15,000 active patents reported by HEIs in this period, distributed across LEP areas as shown in Figure 4.39a. Nearly two thirds of these were in three LEP areas: London, Oxfordshire and Greater Cambridge and Greater Peterborough, mirroring the ranking in terms of IP income. Adding another nine LEP areas in descending order of total number of patents - Greater Manchester, Leeds City Region, Solent, Greater Birmingham and Solihull, Sheffield City Region, North Eastern, Derby, Derbyshire, Nottingham and Nottinghamshire, West of England and Leicester and Leicestershire – brings the figure to 90 percent.

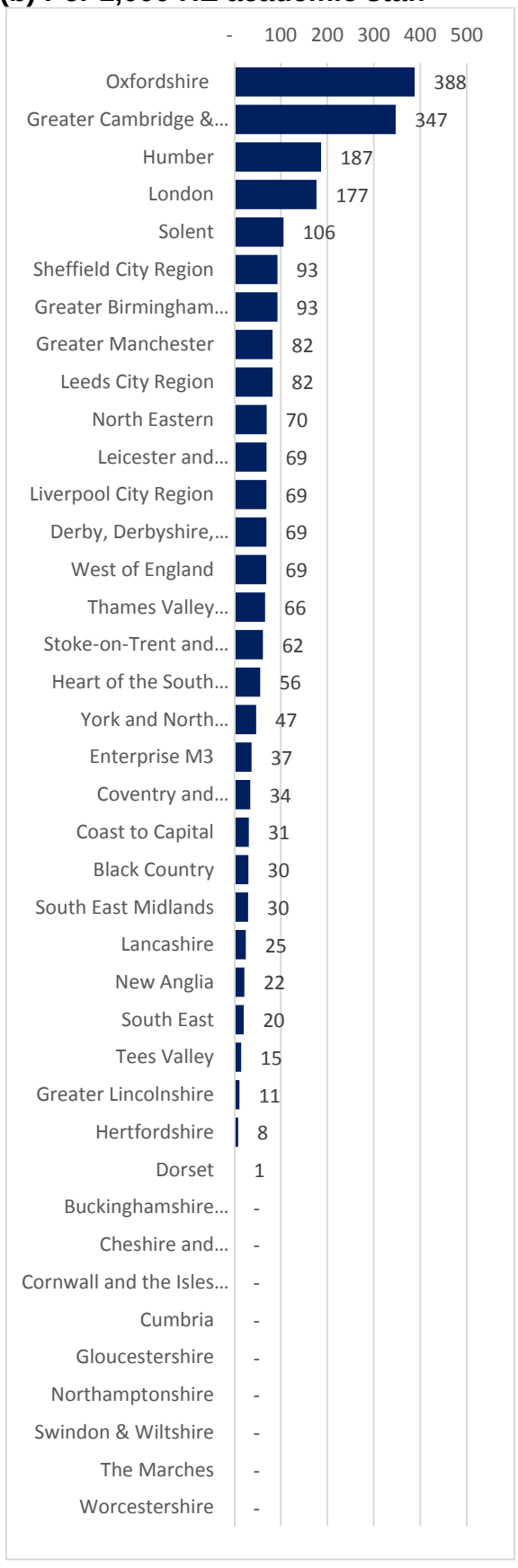
4.132 Allowing for institutional size does not dramatically change the rankings with the notable exception of the Humber LEP area, which now ranks third as against 22nd in terms of its absolute number of patents (Figure 4.39b). Other LEP areas moving up the rankings are Thames Valley Berkshire, Stoke on Trent and Staffordshire, York and North Yorkshire and South East Midlands.

Figure 4.39: Count of active patents by LEP area, 2012/13

(a) Numbers



(b) Per 1,000 HE academic staff



Source: HE-BCI

Knowledge assets: 'science and technology' intermediary institutions

4.133 We have mapped, through an internet and LEP documentation search, the presence of key 'science and technology' intermediary organisations to give an idea of the innovation infrastructure in LEP areas. The organisations comprise Higher Education Institutions (HEfCE listing), public sector research establishments, science parks (members of UK Science Parks Association), Research and Technology Organisations (members of the Association for Independent Research and Technology Organisations), Enterprise Zones and Catapult Centres.

4.134 The mapping is attached in Appendix D5.

4.135 Whilst not claiming to be comprehensive, the mapping does show the variation across LEP areas. London – and the LEP areas in the wider London city-region - as in most of the indicators we looked at, stand out. At the centre is London with 39 HEIs, 15 science parks, 3 Catapult Centres, the National Physical Laboratory and the Royal Docks Enterprise Zone. Rural Oxfordshire follows closely, with 2 HEIs, the Satellite Applications Catapult, 8 science parks, the Rutherford Appleton laboratory and the Science Vale Enterprise Zone. Third-tier Greater Cambridge and Greater Peterborough also has 2 HEIs, 12 science parks, the Babraham Institute and the Enterprise Zone at Alconbury Enterprise Campus.

4.136 The LEP areas in the second-tier city-regions in the north and midlands with their strong HEI presence also feature with a broad spread of intermediary organisations across all categories. In the South West, the West of England also has a strong base with 3 HEIs, a High Value Manufacturing Catapult, 2 science parks, the National Composites Centre, Bristol Robotics Laboratory and the Bristol Temple Quarter Enterprise Zone.

4.137 The predominantly rural LEP areas, unsurprisingly, have smaller numbers of intermediary organisations but, for their size, have some specialist strengths. Cornwall and the Isles of Scilly, for example, has Falmouth University and the University of Exeter Cornwall campuses that host the University of Exeter Medical School in Cornwall and the European Centre for Environment & Human Health, 3 Enterprise Zones and the Newquay Aerohub Enterprise Zone. The Marches LEP area has the specialist agricultural university, Harper Adams and the Hereford Enterprise Zone. New Anglia's agri-tech and life sciences specialisms are embodied in its 6 Scientific Research Institutes (the Pirbright Institute, the Genome Analysis Centre, the Institute of Food Research, the John Innes Centre, the Centre for Environment, Fisheries and Aquaculture Science, Weymouth and the Norwich Research Park.

4.4 Structures and Incentives

4.138 This element of the framework attempts to capture 'the institutions and interconnections that determine how effectively the actors in the system work together to generate outcomes'. We have selected three indicators, two measuring industrial sector and specialisation and one mapping LEP governance structures and networks relating to innovation strategy:

Industrial structure and specialisation:
- Industrial Strategy sectors - locational quotients (BBSD/IDBR data)
- Key 'science and technology sectors' - employment in and locational quotients (ONS definitions; BRES data)

LEP governance structures and networks:
- LEP consultation
- LEP documentation

Structures and Incentives: Industrial Strategy sectors

4.139 We repeat here the research on the localisation of industrial activity across LEP areas carried out by the Enterprise Research Centre (ERC) at the University of Warwick for BIS and heavily cited in Sir Andrew Witty's review of universities and growth (Witty, 2013).

4.140 The research provides a detailed map of the comparative strengths of LEP areas in the Industrial Strategy sectors using location quotients (LQs) calculated from data from ONS' Business Structure Database (BSD) itself compiled using the Inter-departmental Business Register (IDBR) as a proxy for 'clustering'. We reproduce here, the findings of ERC's LQ analysis for 10 of the 11 Industrial Strategy sectors. The data are for 2012.

Industrial Strategy sectors: agriculture and energy

4.141 Table 4.21 shows the comparative strengths in the agricultural and energy sectors. It is no surprise that the comparative advantage in the agri-tech sector lies in the LEP areas in rural areas notably The Marches, Greater Lincolnshire and New Anglia with LQs above 3 and Cornwall & Isles of Scilly, Cumbria, Heart of the South West, York, North Yorkshire & East Riding, Greater Cambridge & Greater Peterborough, Humber and Worcestershire, all with LQs between 2 and 3.

4.142 For oil and gas, Humber, Tees Valley and Greater Lincolnshire stand out. In Cumbria, the dominance of the Sellafield nuclear complex in the local economy is clear, registering an LQ of 18. Other LEP areas with relative strengths in the nuclear sector, albeit nowhere near the over-representation of Cumbria, include Derby, Derbyshire, Nottingham & Nottinghamshire, Lancashire, Gloucestershire and Cheshire & Warrington.

Table 4.21: Comparative strengths/ potential clusters in agri-tech, oil and gas and nuclear (Location Quotients, 2012)

Agri-tech	Oil and gas	Nuclear	Key	
The Marches (4.7)	Humber (2.8)	Cumbria (18.1)		
Greater Lincolnshire (3.9)	Tees Valley (2.8)	Derby, Derbyshire, Nottingham & Nottinghamshire (5.3)	1.0 – 1.9	
New Anglia (3.3)	Greater Lincolnshire (2.5)	Lancashire (3.1)	2.0 – 3.9	
Cornwall & Isles of Scilly (2.9)	Thames Valley Berkshire (1.9)	Gloucestershire (3.0)	4.0 – 5.9	
Cumbria (2.6)	Cheshire & Warrington (1.4)	Cheshire & Warrington (2.2)	6.0 – 7.9	
Heart of the South West (2.6)	Solent (1.4)	Heart of the South West (1.8)		
York, North Yorkshire & East Riding (2.6)	Enterprise M3 (1.3)	Coast to Capital (1.2)	18.1 – 19.9	
Greater Cambridge & Greater Peterborough (2.5)				
Humber (2.5)				
Worcestershire (2.0)				
Gloucestershire (1.6)				
South East (1.5)				
Swindon & Wiltshire (1.5)				
Oxfordshire (1.4)				
Cheshire & Warrington (1.3)				
Dorset (1.3)				
Lancashire (1.1)				
Stoke-on-Trent & Staffordshire (1.1)				
Coast to Capital (1.0)				
Coventry & Warwickshire (1.0)				
Enterprise M3 (1.0)				
Northamptonshire (1.0)				
Solent (1.0)				

Source: Enterprise Research Centre

Industrial Strategy sectors: manufacturing

4.143 In the three Industrial Strategy manufacturing sectors, the clusters that stand out (with LQs of 2 and above; Table 4.22) are:

Aerospace: Lancashire, West of England, Cheshire & Warrington, Derby, Derbyshire, Nottingham & Nottinghamshire, Heart of the South West, Solent and Gloucestershire

Automotive: Coventry & Warwickshire, Greater Birmingham & Solihull, Swindon & Wiltshire, Cheshire & Warrington, North Eastern, The Marches, Oxfordshire, Worcestershire and Humber

Life Sciences: Hertfordshire, Swindon & Wiltshire, Oxfordshire, Humber and Solent

Table 4.22: Comparative strengths/ potential clusters in Aerospace, Automotive and Life Sciences (Location Quotients, 2012)

Aerospace	Automotive	Life Sciences	Key
Lancashire (6.5)	Coventry & Warwickshire (5.0)	Hertfordshire (2.8)	
West of England (4.0)	Greater Birmingham & Solihull (4.2)	Swindon & Wiltshire (2.3)	1.0 – 1.9
Cheshire & Warrington (3.8)	Swindon & Wiltshire (3.5)	Oxfordshire (2.2)	2.0 – 3.9
Derby, Derbyshire, Nottingham & Nottinghamshire (3.4)	Cheshire & Warrington (3.1)	Humber (2.1)	4.0 – 5.9
Heart of the South West (3.3)	North Eastern (2.9)	Solent (2.0)	6.0 – 7.9
Solent (2.7)	The Marches (2.8)	Cheshire & Warrington (1.9)	
Gloucestershire (2.3)	Oxfordshire (2.3)	Gloucestershire (1.8)	18.1 – 19.9
Greater Cambridge & Greater Peterborough (1.4)	Worcestershire (2.2)	Coast to Capital (1.7)	
Dorset (1.3)	Humber (2.0)	Liverpool City Region (1.7)	
Humber (1.2)	Northamptonshire (1.8)	North Eastern (1.7)	
South East Midlands (1.2)	Black Country (1.6)	Greater Cambridge & Greater Peterborough (1.4)	
	Stoke-on-Trent & Staffordshire (1.6)	Buckinghamshire Thames Valley (1.3)	
	Liverpool City Region (1.5)	Sheffield City Region (1.3)	
	Lancashire (1.4)	Heart of the South West (1.2)	
	Derby, Derbyshire, Nottingham & Nottinghamshire (1.2)	Greater Birmingham & Solihull (1.1)	
	South East Midlands (1.2)	Leeds City Region (1.1)	
		South East (1.1)	
		West of England (1.1)	
		Worcestershire (1.1)	
		Derby, Derbyshire, Nottingham & Nottinghamshire (1.0)	
		Enterprise M3 (1.0)	

Source: Enterprise Research Centre

Industrial Strategy sectors: construction (Location Quotients, 2012)

4.144 The LQ analysis shows no exceptional clustering of this relatively evenly distributed sector, see Table 4.23.

Table 4.23: Comparative strengths/ potential clusters in Construction

Construction
Hertfordshire (1.3) South East (1.3) Black Country (1.2) Cumbria (1.2) Lancashire (1.2) Tees Valley (1.2) Coast to Capital (1.1) Cornwall & Isles of Scilly (1.1) Derby, Derbyshire, Nottingham & Nottinghamshire (1.1) Dorset (1.1) Enterprise M3 (1.1) Gloucestershire (1.1) Greater Lincolnshire (1.1) Heart of the South West (1.1) Humber (1.1) New Anglia (1.1) Sheffield City Region (1.1) Stoke-on-Trent & Staffordshire (1.1) Cheshire & Warrington (1.00) Greater Birmingham & Solihull (1.00) Greater Cambridge & Greater Peterborough (1.0) Greater Manchester (1.00) Leeds City Region (1.00) North Eastern (1.0) Solent (1.0) York, North Yorkshire & East Riding (1.0)

Source: Enterprise Research Centre

Industrial Strategy sectors: services (Location Quotients, 2012)

4.145 Of the 3 Industrial Strategy service sectors, the geographical distribution of the Information Economy sector had the most pronounced clustering with 3 of the LEP areas in the London city-region having LQs between 2 and 4: Thames Valley Berkshire, Enterprise M3 and Buckinghamshire Thames Valley. There were no LEP areas with LQs above 2 in the other two, relatively more evenly distributed service sectors, Education and Professional and Business Services, see Table 4.24.

Table 4.24: Comparative strengths/ potential clusters in Education, Information Economy and Professional and business services (Location Quotients)

Education	Information Economy	Professional and business services	Key
Oxfordshire (1.6) Coventry & Warwickshire (1.3) Greater Birmingham & Solihull (1.3) Gloucestershire (1.2) South East Cornwall & Isles of Scilly (1.1) Dorset (1.1) Greater Cambridge & Greater Peterborough (1.1) Lancashire (1.1) Leeds City Region (1.1) Leicester & Leicestershire (1.1) North Eastern (1.1) Sheffield City Region (1.1) Solent 91.1) Tees Valley (1.1) Black Country (1.0) Buckinghamshire Thames Valley (1.0)	Thames Valley Berkshire (4.0) Enterprise M3 (2.2) Buckinghamshire Thames Valley (2.0) Hertfordshire (1.5) London (1.5) Solent (1.2) Coast to Capital (1.1) Coventry & Warwickshire (1.1) Oxfordshire (1.1) Swindon & Wiltshire (1.1) West of England (1.1) Cheshire & Warrington (1.0) Greater Cambridge & Greater Peterborough (1.0) South East Midlands (1.0)	Hertfordshire (1.5) London (1.5) Cheshire & Warrington (1.3) Thames Valley Berkshire (1.3) Buckinghamshire Thames Valley (1.2) Enterprise M3 (1.2) Oxfordshire (1.2) Greater Cambridge & Greater Peterborough (1.1) South East Midlands (1.1) West of England (1.1) Coast to Capital Coventry & Warwickshire (1.0) Derby, Derbyshire, Nottingham & Nottinghamshire (1.0)	1.0 – 1.9 2.0 – 3.9 4.0 – 5.9 6.0 – 7.9 18.1 – 19.9

Coast to Capital (1.0) Derby, Derbyshire, Nottingham & Nottinghamshire (1.0) Enterprise M3 (1.0) Greater Lincolnshire (1.0) Greater Manchester (1.0) Heart of the South West (1.0) Humber (1.0) Liverpool City Region (1.0) South East Midlands (1.0) Stoke on Trent & Staffordshire (1.0) The Marches (1.0) West of England (1.0) Worcestershire (1.0) York, North Yorkshire and East Riding (1.0)		Greater Birmingham & Solihull (1.0) Greater Manchester (1.0) Leeds City Region (1.0) Leicester & Leicestershire (1.0) Northamptonshire (1.0) Swindon & Wiltshire (1.0)	

Source: Enterprise Research Centre

Structures and Incentives: 'Science and Technology' sectors

'Science and Technology' sectors: ONS classification

4.146 The ONS classification covers most of the Industrial Strategy sectors, the exceptions being agri-tech, nuclear and construction. Unlike other 'Science and Technology sector' classifications, which tend to prioritise science and hi-tech-based manufacturing activities, it also usefully includes 'science and technology-based' services including higher education, research and development, architecture, engineering and professional and business services, see Table 4.25.

Table 4.25: ONS classification of 'Science and Technology' businesses

ONS 5-fold classification of 'Science and Technology' businesses	Constituent parts
Digital Technologies: the manufacture and repair of computers and electronic components; computer services including software development; internet services; and computer consultancy	• Computer and electronic manufacturing (including peripherals) • Digital & computer services
Life Sciences and Healthcare: medical healthcare services (both human and veterinary); medical research and development (including biotechnologies); and manufacture of pharmaceuticals and medical treatment machinery	• Medical (excluding pharmaceutical) & optical equipment manufacturer • Pharmaceutical manufacture • Biotechnology research and development • Healthcare services (including veterinary)
Publishing and Broadcasting: publishing and telecommunications; specialist graphic design and marketing services; the manufacture and repair of communication equipment; and the use of this equipment by means of broadcasting	• Communication Equipment manufacture • Publishing, Marketing & Graphic Design • Audio-visual broadcasting • Telecommunication services by wire, wireless and satellite (including news agency activities)
Other scientific/technological manufacture: precision engineering and the manufacture and repair of equipment for aerospace, defence, automotive, chemical products, engines and machinery (both electrical and non-electrical)	• Manufacture and repair of air and spacecraft • Defence technologies (weapons, ammunition, explosives & military vehicles) • Automotive manufacture (including vehicles, trailers, railroad, shipbuilding) • Chemicals and Chemical Product manufacturing (excluding Pharmaceuticals) • Electrical Machinery manufacture • Non-electrical Machinery manufacture • Precision engineering (watches, clocks, jewellery, non-electrical instruments & appliances)
Other scientific/technological services: knowledge-intensive services including higher education, engineering, architecture, quantity surveying, aerospace transport services, and nonmedical research and development	• Aerospace transport • Architecture, Engineering & Quantity Surveying • Higher education (college, university and post-graduate) • Research and Development on humanities, natural sciences, social sciences and engineering

Source: Harris, 2015

4.147 We focus here on the five broad sub-categories in the classification (Table 4.26). Together they accounted for just over 3 million FTE jobs in England in 2013. Life Sciences and Healthcare is the smallest sub-category with 242,000 FTE jobs (8% of the total) and other scientific/technological services the largest, with 850,000 FTE jobs (28% of the total).

Table 4.26: FTE employment in 5 'science and Technology' sectors, 2013

ONS 5-fold classification of 'Science and Technology' businesses	FTE Employment (England)	%
Digital Technologies	652,800	21.7
Life Sciences and Healthcare	241,600	8.0
Publishing and Broadcasting	635,600	21.1
Other scientific/technological manufacture	631,400	21.0
Other scientific/technological services	849,900	28.2
Total (England)	3,011,300	100.0

Source: Business register and employment survey

Digital Technologies

4.148 Table 4.27 shows the distribution of FTE employment in Digital Technologies across the LEP areas. London has a quarter of employment in the sector. Including London, the eight largest employers together account for 60% of total employment: London, 5 south eastern LEP areas (Thames Valley Berkshire, Enterprise M3, South East, Solent and Coast to Capital) and two LEP areas in the midlands (South East Midlands and Derby, Derbyshire, Nottingham and Nottinghamshire).

Table 4.27: Digital Technologies: FTE employment by LEP area, 2013

LEP area	Region	Classification	FTE	% of England Total
London	London	Capital	160,100	24.5
Thames Valley Berkshire	South East	Lon C-R	48,800	7.5
Enterprise M3	South East	Lon C-R	45,800	7.0
South East	South East (part East of England)	Lon C-R	32,600	5.0
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	27,100	4.2
Solent	South East	3rd Tier	25,600	3.9
Coast to Capital	South East (part London)	Lon C-R	25,200	3.9
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	24,100	3.7
Greater Manchester	North West	2nd Tier	22,700	3.5
Hertfordshire	East of England	Lon C-R	21,700	3.3
Leeds City Region	Yorkshire and Humber	2nd Tier	21,200	3.2
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	20,100	3.1
West of England	South West	2nd Tier	16,400	2.5
Greater Birmingham and	West Midlands	2nd Tier	14,900	2.3

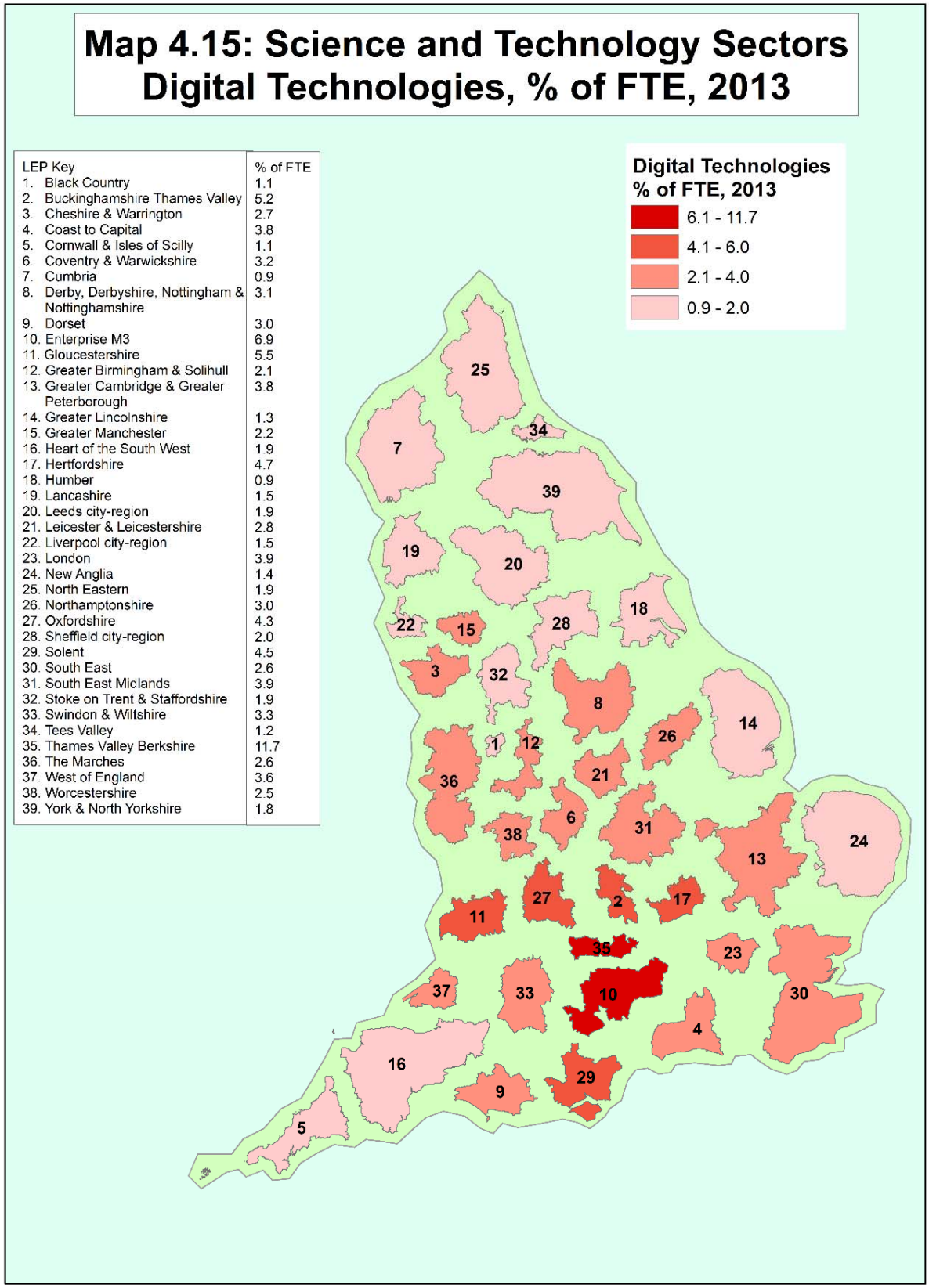
Solihull				
Gloucestershire	South West	Urban-rural	12,800	2.0
Oxfordshire	South East	Rural	12,300	1.9
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	12,300	1.9
North Eastern	North East	2nd Tier	12,000	1.8
Coventry and Warwickshire	West Midlands	3rd Tier	11,100	1.7
Heart of the South West	South West	3rd Tier	11,000	1.7
Leicester and Leicestershire	East Midlands	2nd Tier	10,600	1.6
Cheshire and Warrington	North West	3rd Tier	10,300	1.6
Buckinghamshire Thames Valley	South East	Lon C-R	9,600	1.5
Northamptonshire	East Midlands	3rd Tier	8,300	1.3
Swindon and Wiltshire	South West	3rd Tier	8,100	1.2
Dorset	South West	3rd Tier	7,800	1.2
New Anglia	East of England	3rd Tier	7,700	1.2
Lancashire	North West	3rd Tier	7,600	1.2
Liverpool City Region	North West	2nd Tier	7,200	1.1
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	7,000	1.1
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	7,000	1.1
The Marches	West Midlands	Rural	6,000	0.9
Worcestershire	West Midlands	Urban-rural	4,900	0.8
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	4,600	0.7
Black Country	West Midlands	2nd Tier	4,000	0.6
Humber	Yorkshire and Humber	3rd Tier	2,800	0.4
Tees Valley	North East	3rd Tier	2,500	0.4
Cornwall and Isles of Scilly	South West	Rural	1,900	0.3
Cumbria	North West	Rural	1,600	0.2
England			652,800	100.0

Source: Business Register and Employment Survey

4.149 Map 4.15 shows the sector's share of total FTE employment in the LEP areas. The highest shares are in Thames Valley Berkshire and Enterprise M3 LEP areas and the lowest in the Black Country and Cornwall and the Isles of Scilly.

Map 4.15: Science and Technology Sectors Digital Technologies, % of FTE, 2013

LEP Key	% of FTE
1. Black Country	1.1
2. Buckinghamshire Thames Valley	5.2
3. Cheshire & Warrington	2.7
4. Coast to Capital	3.8
5. Cornwall & Isles of Scilly	1.1
6. Coventry & Warwickshire	3.2
7. Cumbria	0.9
8. Derby, Derbyshire, Nottingham & Nottinghamshire	3.1
9. Dorset	3.0
10. Enterprise M3	6.9
11. Gloucestershire	5.5
12. Greater Birmingham & Solihull	2.1
13. Greater Cambridge & Greater Peterborough	3.8
14. Greater Lincolnshire	1.3
15. Greater Manchester	2.2
16. Heart of the South West	1.9
17. Hertfordshire	4.7
18. Humber	0.9
19. Lancashire	1.5
20. Leeds city-region	1.9
21. Leicester & Leicestershire	2.8
22. Liverpool city-region	1.5
23. London	3.9
24. New Anglia	1.4
25. North Eastern	1.9
26. Northamptonshire	3.0
27. Oxfordshire	4.3
28. Sheffield city-region	2.0
29. Solent	4.5
30. South East	2.6
31. South East Midlands	3.9
32. Stoke on Trent & Staffordshire	1.9
33. Swindon & Wiltshire	3.3
34. Tees Valley	1.2
35. Thames Valley Berkshire	11.7
36. The Marches	2.6
37. West of England	3.6
38. Worcestershire	2.5
39. York & North Yorkshire	1.8



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Data are from the Business Register and Employment Survey (BRES). Sector SIC code definitions are from ONS. Map layout by EIUA.

4.150 Table 4.28 lists the 13 LEP areas in which the sector is relatively over-represented in their employment structures compared with national – with location quotients (LQs) above 1.0.

4.151 Thames Valley Berkshire's and Enterprise M3 in the London city-region stand out with LQs of 3.68 and 2.18, respectively. While the capital, London, has the highest share of employment in the sector, the sector is not as highly over-represented, with an LQ of 1.22.

4.152 LEP areas in which the sector is particularly under-represented compared to national - with LQs of 0.5 or below - comprise Cumbria, Humber, Tees Valley, Lancashire and Liverpool City Region in the north, Black Country and Greater Lincolnshire in the midlands, New Anglia in eastern England and Cornwall and Isles of Scilly in the south west.

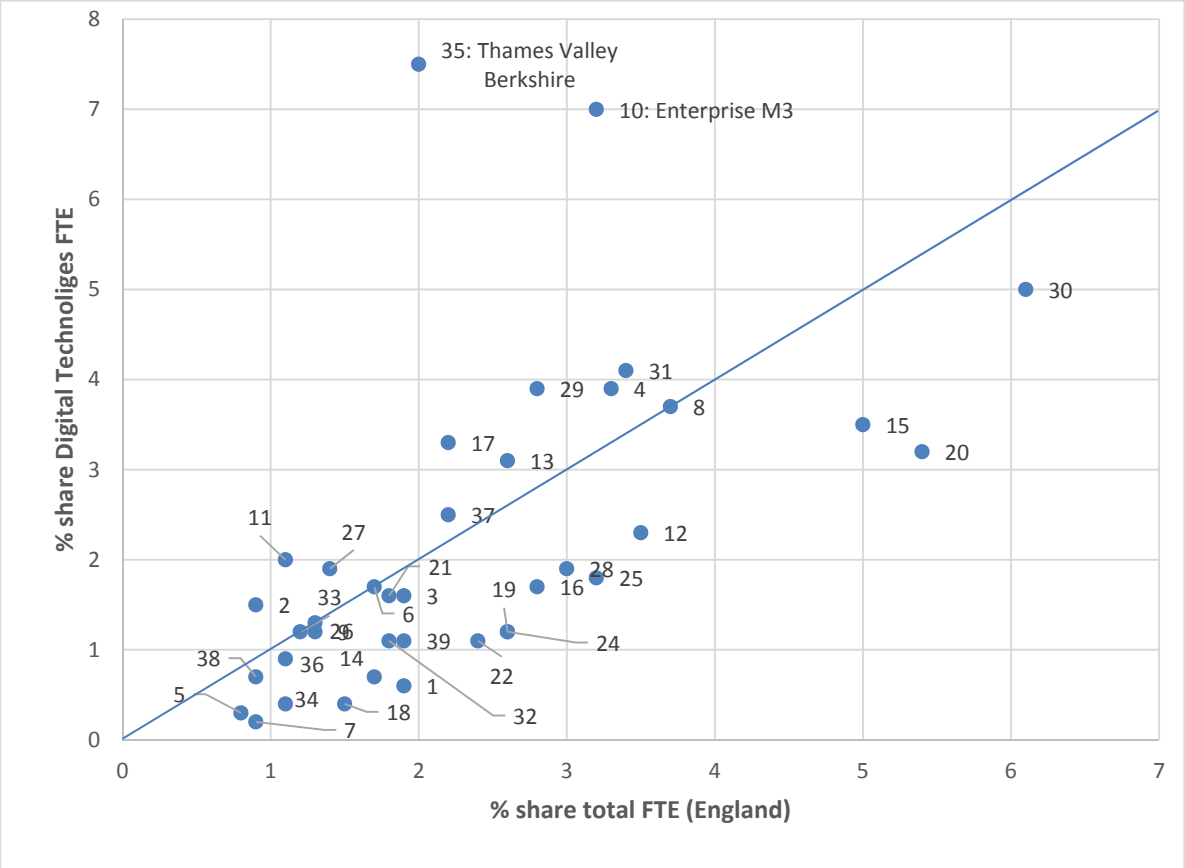
Table 4.28: LEP area location quotients for Digital Technologies, 2013

Digital Technologies Location Quotients, 2013	Key	
Thames Valley Berkshire (3.68)		
Enterprise M3 (2.18)	1.0 – 1.49	
Gloucestershire (1.73)	1.50 – 1.99	
Buckinghamshire Thames Valley (1.62)	2.0 – 2.49	
Hertfordshire (1.48)	2.50 – 2.99	
Solent (1.42)	3.50 - 3.99	
Oxfordshire (1.36)		
South East Midlands (1.23)		
London (1.22)		
Greater Cambridge & Greater Peterborough (1.18)		
Coast to Capital (1.18)		
West of England (1.13)		
Swindon and Wiltshire (1.03)		
Coventry and Warwickshire (1.00)		

Source: Business Register and Employment Survey

4.153 Figure 4.40 compares, for each LEP area, the sector's share of FTE employment locally with the area's share of total FTE employment. The comparative strengths, particularly of Thames Valley Berkshire and Enterprise M3, again stand out.

Figure 4.40: LEP area shares of total (England) and Digital Technologies FTE employment, 2013



Source: Business Register and Employment Survey

Note: London has 20.1% of total employment and 24.5% of Digital Technologies employment so would appear above the line.

Key

LEP area	No	LEP area	No	LEP area	No
Black Country	1	Greater Lincolnshire	14	Oxfordshire	27
Buckinghamshire Thames Valley	2	Greater Manchester	15	Sheffield City Region	28
Cheshire and Warrington	3	Heart of the South West	16	Solent	29
Coast to Capital	4	Hertfordshire	17	South East	30
Cornwall and Isles of Scilly	5	Humber	18	South East Midlands	31
Coventry and Warwickshire	6	Lancashire	19	Stoke-on-Trent and Staffordshire	32
Cumbria	7	Leeds City Region	20	Swindon and Wiltshire	33
Derby, Derbyshire, Nottingham and Nottinghamshire	8	Leicester and Leicestershire	21	Tees Valley	34
Dorset	9	Liverpool City Region	22	Thames Valley Berkshire	35
Enterprise M3	10	London	23 – not included in chart (see Note)	The Marches	36
Gloucestershire	11	New Anglia	24	West of England	37
Greater Birmingham and Solihull	12	North Eastern	25	Worcestershire	38
Greater Cambridge & Greater Peterborough	13	Northamptonshire	26	York, North Yorkshire and East Riding	39

Life Sciences and Healthcare

4.154 Table 4.29 shows the distribution of FTE employment in Life Sciences and Healthcare across the LEP areas. London has 16% of employment in the sector. Including London, the 11 largest employers together account for 60% of all sector jobs: London and, unsurprisingly, a group including the LEP areas in the large second-tier city-regions - Leeds City Region, Greater Manchester, North Eastern, Derby, Derbyshire, Nottingham and Nottinghamshire, Greater Birmingham and Solihull, Sheffield City Region, Heart of the South West and Liverpool City Region – along with Coast to Capital in the south east.

Table 4.29: Life Sciences and Healthcare: FTE employment by LEP area, 2013

LEP area	Region	Classification	FTE	% of England Total
London	London	Capital	241,600	15.7
South East	South East (part East of England)	Lon C-R	91,500	5.9
Leeds City Region	Yorkshire and Humber	2nd Tier	83,100	5.4
Greater Manchester	North West	2nd Tier	81,400	5.3
North Eastern	North East	2nd Tier	74,000	4.8
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	61,700	4.0
Greater Birmingham and Solihull	West Midlands	2nd Tier	60,800	3.9
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	60,100	3.9
Heart of the South West	South West	3rd Tier	55,700	3.6
Liverpool City Region	North West	2nd Tier	54,500	3.5
Coast to Capital	South East (part London)	Lon C-R	51,900	3.4
Solent	South East	3rd Tier	46,700	3.0
Lancashire	North West	3rd Tier	45,400	2.9
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	44,700	2.9
West of England	South West	2nd Tier	41,700	2.7
Enterprise M3	South East	Lon C-R	40,900	2.6
New Anglia	East of England	3rd Tier	39,500	2.6
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	39,200	2.5
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	30,300	2.0
Black Country	West Midlands	2nd Tier	29,500	1.9
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	29,000	1.9

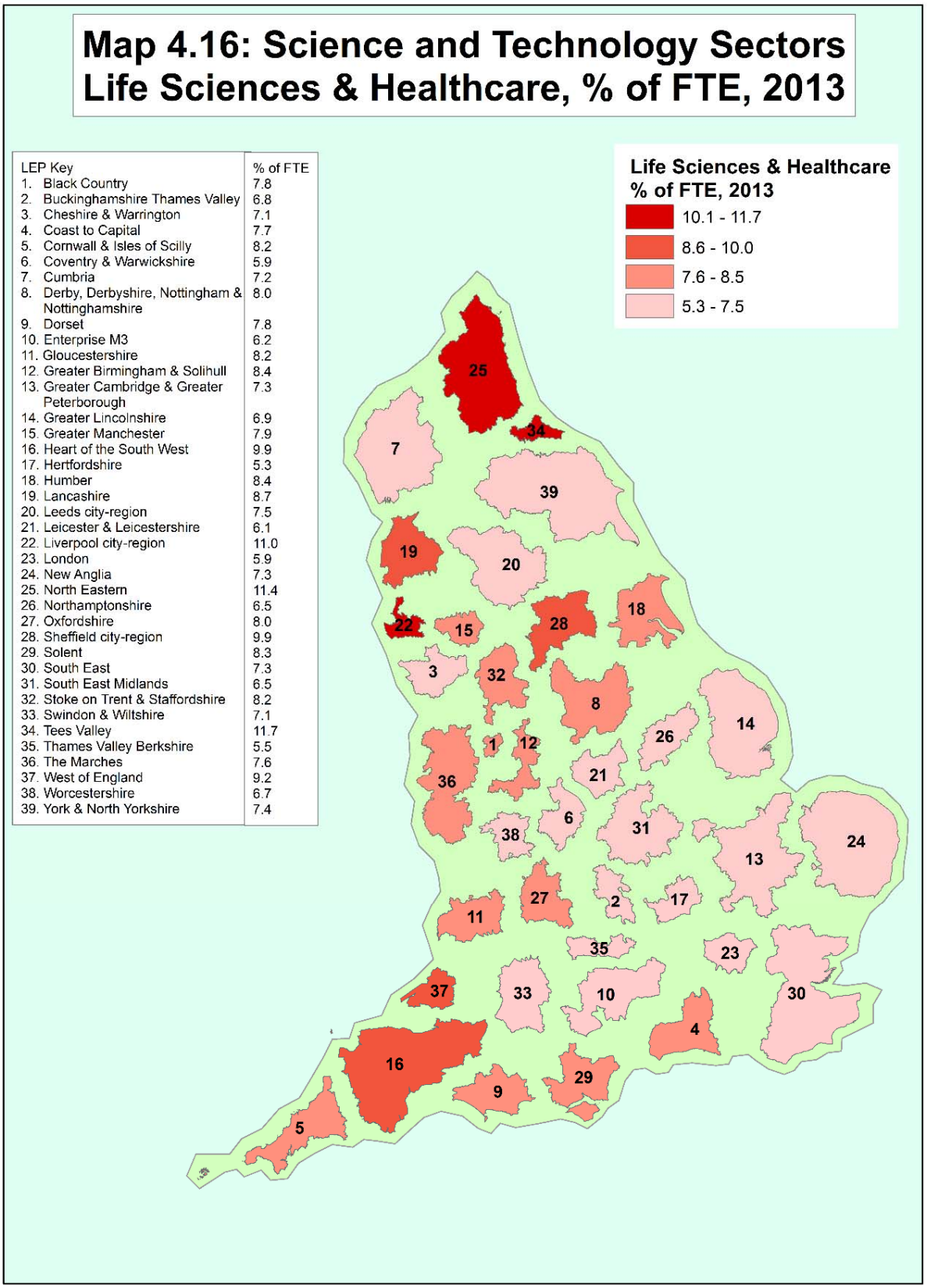
Cheshire and Warrington	North West	3rd Tier	27,200	1.8
Humber	Yorkshire and Humber	3rd Tier	25,800	1.7
Tees Valley	North East	3rd Tier	25,300	1.6
Hertfordshire	East of England	Lon C-R	24,600	1.6
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	23,900	1.5
Leicester and Leicestershire	East Midlands	2nd Tier	22,900	1.5
Oxfordshire	South East	Rural	22,700	1.5
Thames Valley Berkshire	South East	Lon C-R	22,700	1.5
Coventry and Warwickshire	West Midlands	3rd Tier	20,500	1.3
Dorset	South West	3rd Tier	20,200	1.3
Gloucestershire	South West	Urban-rural	19,100	1.2
Northamptonshire	East Midlands	3rd Tier	17,900	1.2
Swindon and Wiltshire	South West	3rd Tier	17,600	1.1
The Marches	West Midlands	Rural	17,400	1.1
Cornwall and Isles of Scilly	South West	Rural	13,800	0.9
Cumbria	North West	Rural	13,500	0.9
Worcestershire	West Midlands	Urban-rural	12,900	0.8
Buckinghamshire Thames Valley	South East	Lon C-R	12,600	0.8
England			**1,543,700**	**100.0**

Source: Business Register and Employment Survey

4.155 Map 4.16 shows the sector's share of total FTE employment in the LEP areas. The highest shares are in the north and North West: Tees Valley, North Eastern and Liverpool City Region LEP areas and the lowest in Hertfordshire in eastern England and Thames Valley Berkshire in the south east.

Map 4.16: Science and Technology Sectors Life Sciences & Healthcare, % of FTE, 2013

LEP Key	% of FTE
1. Black Country	7.8
2. Buckinghamshire Thames Valley	6.8
3. Cheshire & Warrington	7.1
4. Coast to Capital	7.7
5. Cornwall & Isles of Scilly	8.2
6. Coventry & Warwickshire	5.9
7. Cumbria	7.2
8. Derby, Derbyshire, Nottingham & Nottinghamshire	8.0
9. Dorset	7.8
10. Enterprise M3	6.2
11. Gloucestershire	8.2
12. Greater Birmingham & Solihull	8.4
13. Greater Cambridge & Greater Peterborough	7.3
14. Greater Lincolnshire	6.9
15. Greater Manchester	7.9
16. Heart of the South West	9.9
17. Hertfordshire	5.3
18. Humber	8.4
19. Lancashire	8.7
20. Leeds city-region	7.5
21. Leicester & Leicestershire	6.1
22. Liverpool city-region	11.0
23. London	5.9
24. New Anglia	7.3
25. North Eastern	11.4
26. Northamptonshire	6.5
27. Oxfordshire	8.0
28. Sheffield city-region	9.9
29. Solent	8.3
30. South East	7.3
31. South East Midlands	6.5
32. Stoke on Trent & Staffordshire	8.2
33. Swindon & Wiltshire	7.1
34. Tees Valley	11.7
35. Thames Valley Berkshire	5.5
36. The Marches	7.6
37. West of England	9.2
38. Worcestershire	6.7
39. York & North Yorkshire	7.4



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4.156 Table 4.30 lists the 20 LEP areas in which the sector is relatively over-represented in their employment structures compared with national – with LQs above 1.0. The relative specialisation levels are lower than for Digital Technologies with the 2 LEP areas with the highest LQs, both in the north east – Tees Valley and North Eastern – having LQs below 2: 1.55 and 1.22, respectively. The highest LQ is Tees Valley's 1.55 and the lowest is Buckinghamshire Thames Valley's 0.71. National healthcare services provide a relatively even spread of employment across the country. A couple of LEP areas – rural Cornwall and the Isles of Scilly and urban-rural Gloucestershire –have LQs, albeit just above 1. While the capital, London, has the highest share of employment in the sector, the sector is actually under-represented in its employment structure, with an LQ of 0.78.

Table 4.30: LEP area location quotients for Life Sciences and Healthcare, 2013

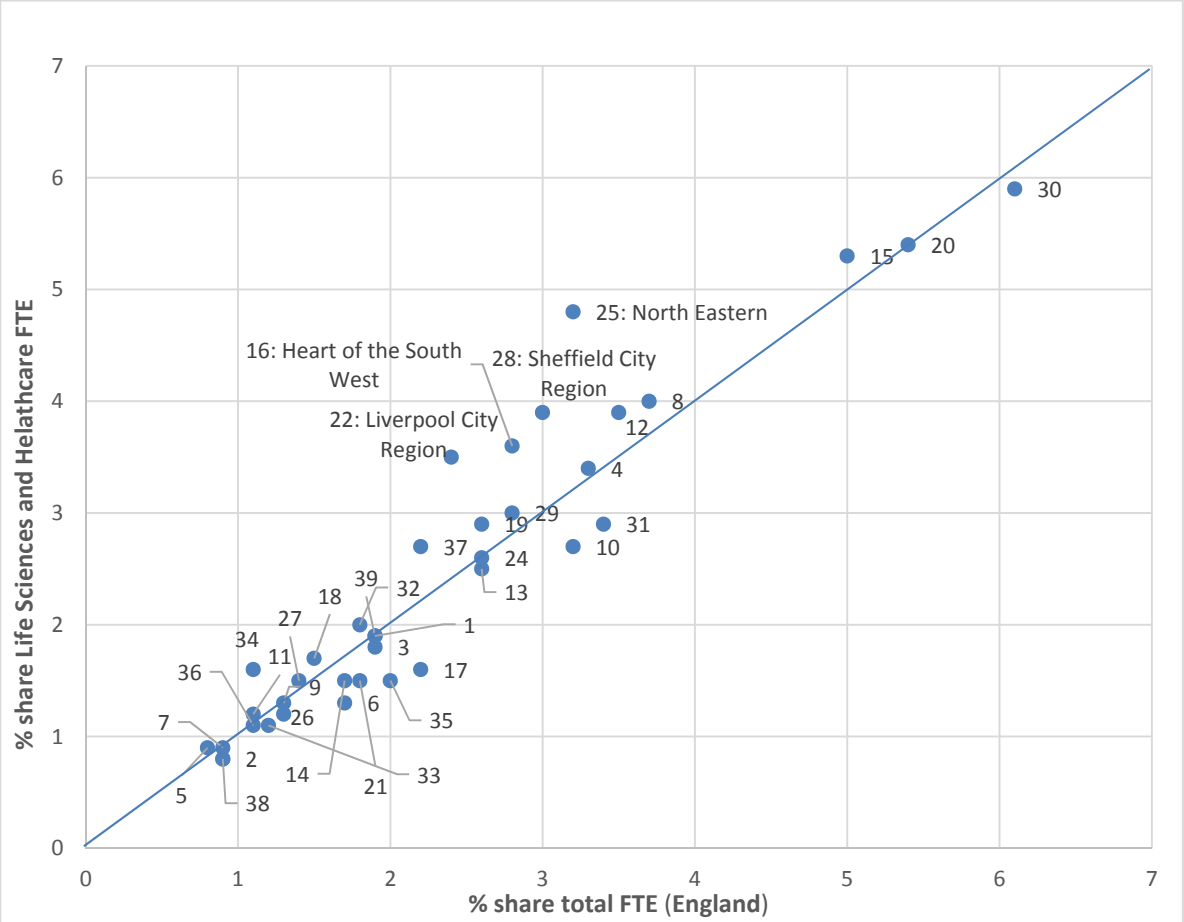
Life Sciences and Healthcare Location Quotients, 2013
Tees Valley (1.55)
North Eastern (1.52)
Liverpool City Region (1.46)
Sheffield City Region (1.31)
Heart of the South West (1.31)
West of England (1.22)
Lancashire (1.15)
Humber (1.12)
Greater Birmingham and Solihull (1.11)
Solent (1.10)
Gloucestershire (1.09)
Stoke-on-Trent and Staffordshire (1.09)
Cornwall and Isles of Scilly (1.09)
Oxfordshire (1.07)
Derby, Derbyshire, Nottingham and Nottinghamshire (1.07)
Greater Manchester (1.05)
Dorset (1.04)
Black Country (1.03)
Coast to Capital (1.02)
The Marches 1.01)
Leeds City Region (1.00)

Key	
1.0 – 1.49	
1.50 – 1.99	
2.0 – 2.49	
2.50 – 2.99	
3.50 - 3.99	

Source: Business Register and Employment Survey

4.157 Figure 4.41 compares, for each LEP area, the sector's share of FTE employment locally with the area's share of total FTE employment. There is a closer clustering of LEP areas around the dividing line reflecting the relatively even distribution of healthcare activities but a number of LEP areas in major second-tier city-regions stand out for their relative specialisms: North Eastern, Sheffield City Region, Liverpool City Region and Heart of the South West.

Figure 4.41: LEP area shares of total (England) and Life Sciences and Healthcare FTE employment, 2013



Source: Business Register and Employment Survey

Note: With 20.1% of total FTE employment and 15.7% of Life Sciences and Healthcare FTE employment, London would appear below the line.

Key

LEP area	No	LEP area	No	LEP area	No
Black Country	1	Greater Lincolnshire	14	Oxfordshire	27
Buckinghamshire Thames Valley	2	Greater Manchester	15	Sheffield City Region	28
Cheshire and Warrington	3	Heart of the South West	16	Solent	29
Coast to Capital	4	Hertfordshire	17	South East	30
Cornwall and Isles of Scilly	5	Humber	18	South East Midlands	31
Coventry and Warwickshire	6	Lancashire	19	Stoke-on-Trent and Staffordshire	32
Cumbria	7	Leeds City Region	20	Swindon and Wiltshire	33
Derby, Derbyshire, Nottingham and Nottinghamshire	8	Leicester and Leicestershire	21	Tees Valley	34
Dorset	9	Liverpool City Region	22	Thames Valley Berkshire	35
Enterprise M3	10	London	23 – not included in chart (see Note)	The Marches	36
Gloucestershire	11	New Anglia	24	West of England	37
Greater Birmingham and Solihull	12	North Eastern	25	Worcestershire	38
Greater Cambridge & Greater Peterborough	13	Northamptonshire	26	York, North Yorkshire and East Riding	39

Publishing and Broadcasting

4.158 Table 4.31 shows the distribution of FTE employment in Publishing and Broadcasting across the LEP areas. London's dominance of the sector is evident, with its 45% share of total FTE employment, followed by three London city-region LEP areas - Thames Valley Berkshire, South East and Enterprise M3 – and two LEP areas in northern second-tier city regions, Leeds City Region and Greater Manchester.

Table 4.31: Publishing and Broadcasting: FTE employment by LEP area, 2013

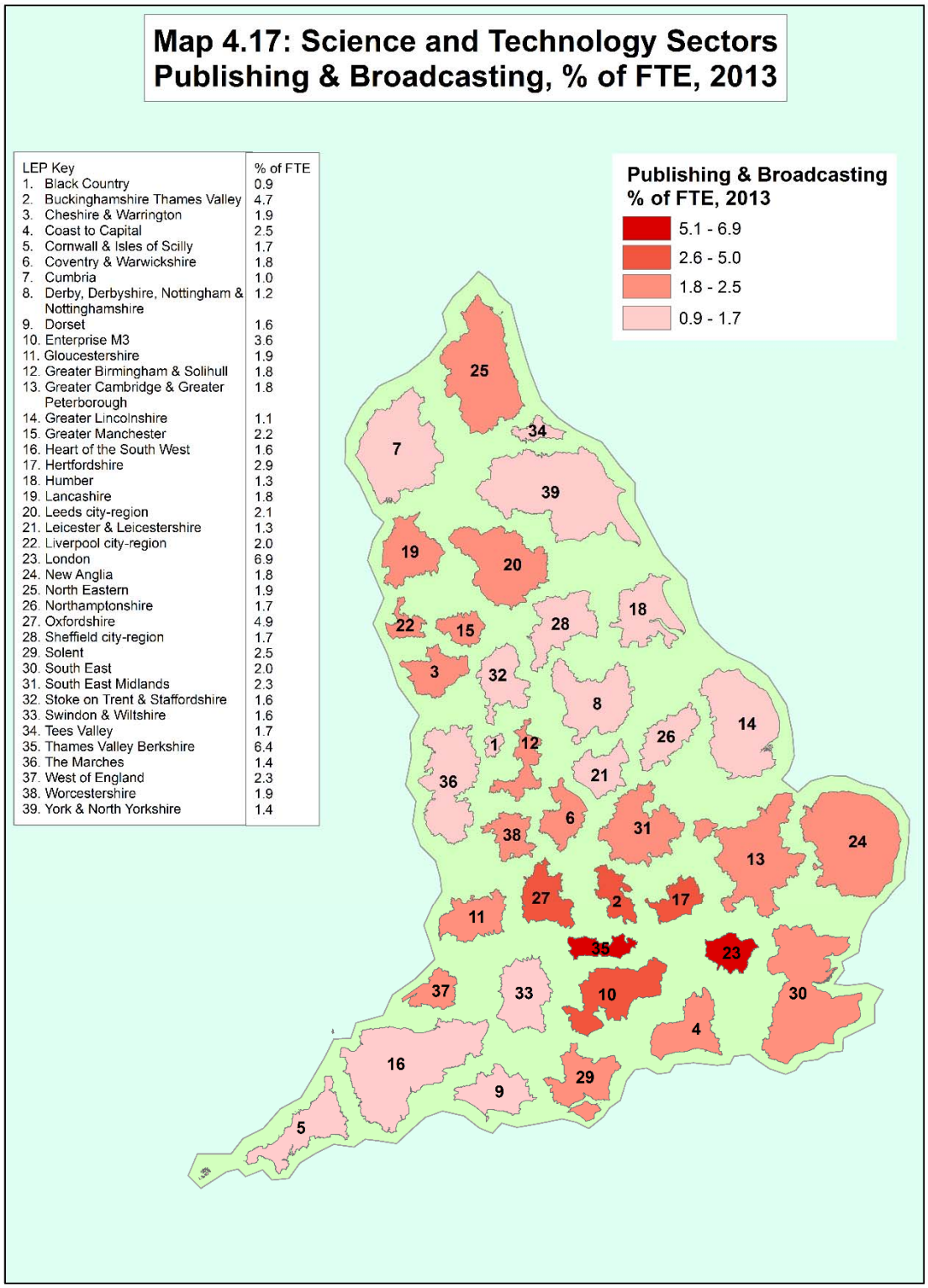
LEP area	Region	Classification	FTE	% of England Total
London	London	Capital	286,000	45.0
Thames Valley Berkshire	South East	Lon C-R	26,700	4.2
South East	South East (part East of England)	Lon C-R	25,400	4.0
Enterprise M3	South East	Lon C-R	23,800	3.7
Leeds City Region	Yorkshire and Humber	2nd Tier	22,700	3.6
Greater Manchester	North West	2nd Tier	22,600	3.6
Coast to Capital	South East (part London)	Lon C-R	16,900	2.7
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	15,900	2.5
Solent	South East	3rd Tier	14,000	2.2
Oxfordshire	South East	Rural	13,800	2.2
Hertfordshire	East of England	Lon C-R	13,200	2.1
Greater Birmingham and Solihull	West Midlands	2nd Tier	12,900	2.0
North Eastern	North East	2nd Tier	12,000	1.9
West of England	South West	2nd Tier	10,600	1.7
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	10,200	1.6
Liverpool City Region	North West	2nd Tier	10,100	1.6
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	9,800	1.5
New Anglia	East of England	3rd Tier	9,700	1.5
Lancashire	North West	3rd Tier	9,200	1.4
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	9,100	1.4
Heart of the South West	South West	3rd Tier	9,000	1.4
Buckinghamshire Thames Valley	South East	Lon C-R	8,700	1.4
Cheshire and Warrington	North West	3rd Tier	7,300	1.1
Coventry and Warwickshire	West Midlands	3rd Tier	6,400	1.0
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	5,700	0.9
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	5,600	0.9
Leicester and Leicestershire	East Midlands	2nd Tier	4,900	0.8
Northamptonshire	East Midlands	3rd Tier	4,800	0.8
Gloucestershire	South West	Urban-rural	4,300	0.7
Dorset	South West	3rd Tier	4,100	0.6
Swindon and Wiltshire	South West	3rd Tier	4,000	0.6
Humber	Yorkshire and Humber	3rd Tier	3,900	0.6
Tees Valley	North East	3rd Tier	3,700	0.6
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	3,600	0.6
Worcestershire	West Midlands	Urban-rural	3,600	0.6
Black Country	West Midlands	2nd Tier	3,400	0.5
The Marches	West Midlands	Rural	3,300	0.5
Cornwall and Isles of Scilly	South West	Rural	2,800	0.4
Cumbria	North West	Rural	1,800	0.3
England	-	-	635,600	100.0

Source: Business Register and Employment Survey

4.159 Map 4.17 shows the sector's share of total FTE employment in the LEP areas. The highest shares are in London and Thames Valley Berkshire and the lowest in the Black Country and Cumbria LEP areas.

Map 4.17: Science and Technology Sectors Publishing & Broadcasting, % of FTE, 2013

LEP Key	% of FTE
1. Black Country	0.9
2. Buckinghamshire Thames Valley	4.7
3. Cheshire & Warrington	1.9
4. Coast to Capital	2.5
5. Cornwall & Isles of Scilly	1.7
6. Coventry & Warwickshire	1.8
7. Cumbria	1.0
8. Derby, Derbyshire, Nottingham & Nottinghamshire	1.2
9. Dorset	1.6
10. Enterprise M3	3.6
11. Gloucestershire	1.9
12. Greater Birmingham & Solihull	1.8
13. Greater Cambridge & Greater Peterborough	1.8
14. Greater Lincolnshire	1.1
15. Greater Manchester	2.2
16. Heart of the South West	1.6
17. Hertfordshire	2.9
18. Humber	1.3
19. Lancashire	1.8
20. Leeds city-region	2.1
21. Leicester & Leicestershire	1.3
22. Liverpool city-region	2.0
23. London	6.9
24. New Anglia	1.8
25. North Eastern	1.9
26. Northamptonshire	1.7
27. Oxfordshire	4.9
28. Sheffield city-region	1.7
29. Solent	2.5
30. South East	2.0
31. South East Midlands	2.3
32. Stoke on Trent & Staffordshire	1.6
33. Swindon & Wiltshire	1.6
34. Tees Valley	1.7
35. Thames Valley Berkshire	6.4
36. The Marches	1.4
37. West of England	2.3
38. Worcestershire	1.9
39. York & North Yorkshire	1.4



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Data are from the Business Register and Employment Survey (BRES). Sector SIC code definitions are from ONS. Map layout by EIUA.

4.160 Table 4.32 lists the LEP areas in which the sector is relatively over-represented in their employment structures compared with national – with LQs above 1.0. There are only five: four in the London city-region - London, Thames Valley Berkshire, Oxfordshire, Buckinghamshire Thames Valley and Enterprise M3 - and rural Oxfordshire. The lowest LQs – of 0.5 or less – are recorded by a group of LEP areas in the midlands - Black Country, Greater Lincolnshire, Derby, Derbyshire, Nottingham and Nottinghamshire Leicester and Leicestershire, The Marches, Stoke-on-Trent and Staffordshire - and Cumbria, Humber and York, North Yorkshire and East Riding in the north.

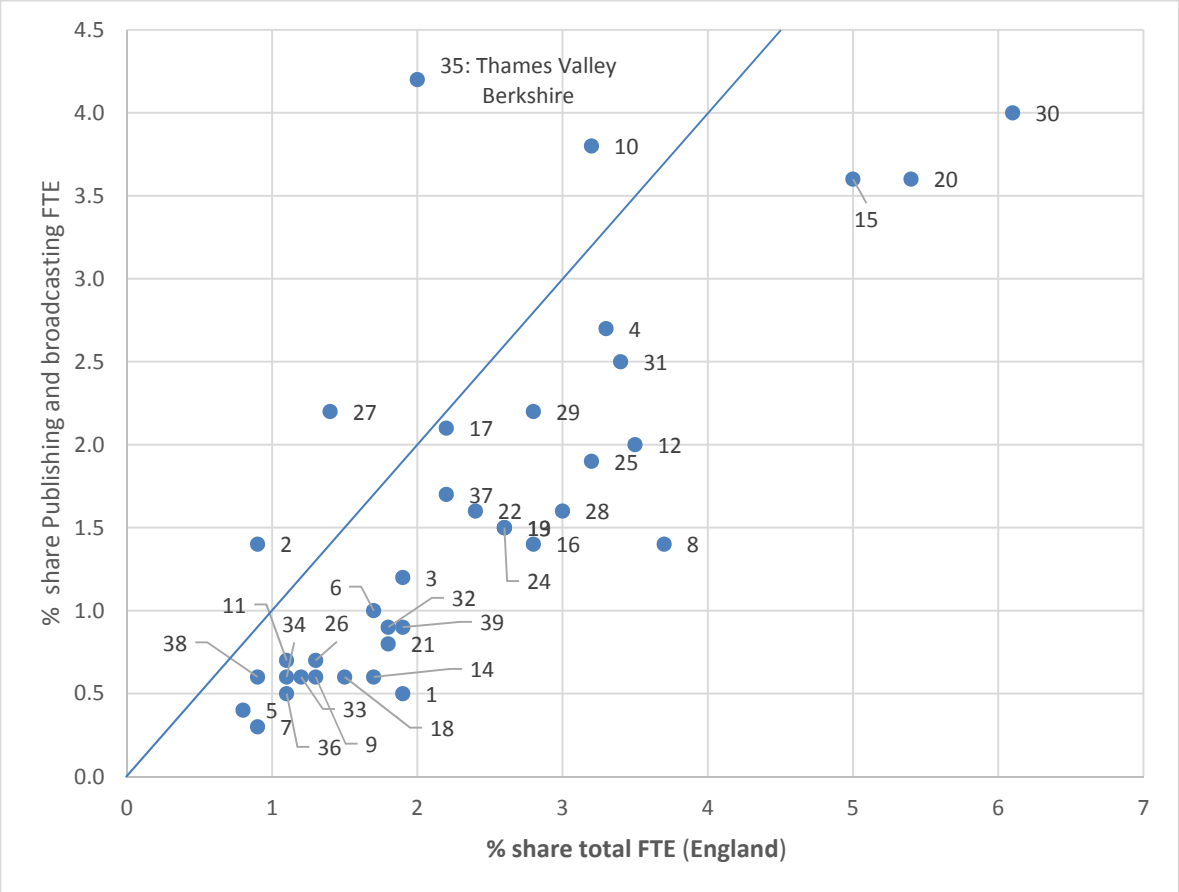
Table 4.32: LEP area location quotients for Publishing and Broadcasting, 2013

Publishing and Broadcasting Location Quotients, 2013	Key	
London (2.24) Thames Valley Berkshire (2.07) Oxfordshire (1.58) Buckinghamshire Thames Valley (1.50) Enterprise M3 (1.16)		
	1.0 – 1.49	
	1.50 – 1.99	
	2.0 – 2.49	
	2.50 – 2.99	
	3.50 - 3.99	

Source: Business Register and Employment Survey

4.161 Figure 4.42 compares, for each LEP area, the sector's share of FTE employment locally with the area's share of total FTE employment. London is not included in the chart but, with 20.1% of total FTE employment and more than double that share of Publishing and Broadcasting FTE employment (45%), it would appear way above the line.

Figure 4.42: LEP area shares of total (England) and Publishing and Broadcasting employment, 2013



Source: Business Register and Employment Survey; Note: With 20.1% of total FTE employment and 45.0 % Publishing and Broadcasting, London would appear way above the line.

Key

LEP area	No	LEP area	No	LEP area	No
Black Country	1	Greater Lincolnshire	14	Oxfordshire	27
Buckinghamshire Thames Valley	2	Greater Manchester	15	Sheffield City Region	28
Cheshire and Warrington	3	Heart of the South West	16	Solent	29
Coast to Capital	4	Hertfordshire	17	South East	30
Cornwall and Isles of Scilly	5	Humber	18	South East Midlands	31
Coventry and Warwickshire	6	Lancashire	19	Stoke-on-Trent and Staffordshire	32
Cumbria	7	Leeds City Region	20	Swindon and Wiltshire	33
Derby, Derbyshire, Nottingham and Nottinghamshire	8	Leicester and Leicestershire	21	Tees Valley	34
Dorset	9	Liverpool City Region	22	Thames Valley Berkshire	35
Enterprise M3	10	London	23 – not included in chart (see Note)	The Marches	36
Gloucestershire	11	New Anglia	24	West of England	37
Greater Birmingham and Solihull	12	North Eastern	25	Worcestershire	38
Greater Cambridge & Greater Peterborough	13	Northamptonshire	26	York, North Yorkshire and East Riding	39

Other Scientific/technological manufacture

4.162 Table 4.33 shows the distribution of FTE employment in Other Scientific/Technological Manufacture across the LEP areas. It is much more evenly spread than Publishing and Broadcasting, with the 11 LEP areas with the largest shares accounting for just over half of employment in the sector. Second-tier Derby, Derbyshire, Nottingham and Nottinghamshire followed by a group of LEP areas in other second-tier city regions - Leeds City Region, North Eastern, Greater Birmingham and Solihull and Greater Manchester – joined by third-tier Lancashire, the South East in the London city-region and third-tier Solent, Heart of the South West, South East Midlands and Greater Cambridge & Greater Peterborough.

4.163 London's employment bias towards services is shown in its 17th placed ranking in share of FTE employment.

Table 4.33: Other scientific/ technological manufacture: FTE employment by LEP area, 2013

LEP area	Region	Classification	FTE	% of England Total
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	38,300	6.1
Leeds City Region	Yorkshire and Humber	2nd Tier	36,200	5.7
North Eastern	North East	2nd Tier	35,300	5.6
Greater Birmingham and Solihull	West Midlands	2nd Tier	34,900	5.5
South East	South East (part East of England)	Lon C-R	32,300	5.1
Lancashire	North West	3rd Tier	28,700	4.5
Greater Manchester	North West	2nd Tier	27,500	4.4
Heart of the South West	South West	3rd Tier	24,200	3.8
Solent	South East	3rd Tier	24,000	3.8
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	23,800	3.8
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	23,200	3.7
Coventry and Warwickshire	West Midlands	3rd Tier	21,100	3.3
New Anglia	East of England	3rd Tier	19,100	3.0
Enterprise M3	South East	Lon C-R	18,600	2.9
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	18,200	2.9
Black Country	West Midlands	2nd Tier	17,700	2.8
London	London	Capital	17,500	2.8
West of England	South West	2nd Tier	17,100	2.7
Humber	Yorkshire and Humber	3rd Tier	16,600	2.6
Cheshire and Warrington	North West	3rd Tier	16,400	2.6
Liverpool City Region	North West	2nd Tier	16,400	2.6
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	16,200	2.6
Leicester and	East Midlands	2nd Tier	13,600	2.2

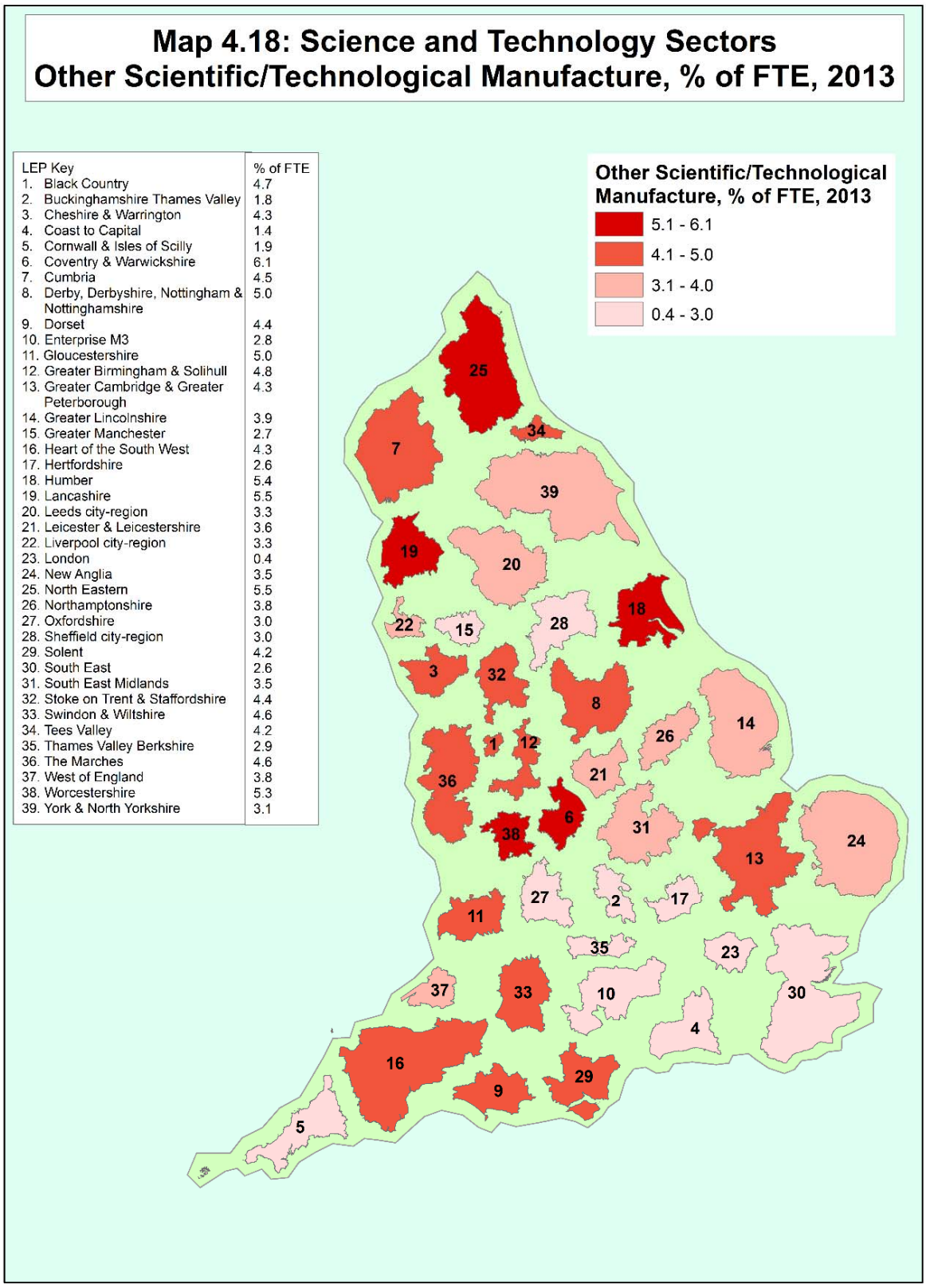
Leicestershire				
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	13,300	2.1
Thames Valley Berkshire	South East	Lon C-R	12,100	1.9
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	12,100	1.9
Hertfordshire	East of England	Lon C-R	11,900	1.9
Gloucestershire	South West	Urban-rural	11,600	1.8
Swindon and Wiltshire	South West	3rd Tier	11,500	1.8
Dorset	South West	3rd Tier	11,300	1.8
The Marches	West Midlands	Rural	10,500	1.7
Northamptonshire	East Midlands	3rd Tier	10,400	1.6
Worcestershire	West Midlands	Urban-rural	10,300	1.6
Coast to Capital	South East (part London)	Lon C-R	9,600	1.5
Tees Valley	North East	3rd Tier	9,000	1.4
Cumbria	North West	Rural	8,500	1.3
Oxfordshire	South East	Rural	8,500	1.3
Buckinghamshire Thames Valley	South East	Lon C-R	3,400	0.5
Cornwall and Isles of Scilly	South West	Rural	3,200	0.5
England			631,400	100.0

Source: Business Register and Employment Survey

4.164 Map 4.18 shows the sector's share of total FTE employment in the LEP areas. The highest shares are in the LEP areas in the north and midlands – Coventry and Warwickshire, Lancashire, North Eastern, Humber, Worcestershire, Gloucestershire and Derby, Derbyshire, Nottingham and Nottinghamshire. The lowest shares are in London, Coast to Capital, Buckinghamshire Thames Valley and Cornwall and the Isles of Scilly.

Map 4.18: Science and Technology Sectors
Other Scientific/Technological Manufacture, % of FTE, 2013

LEP Key	% of FTE
1. Black Country	4.7
2. Buckinghamshire Thames Valley	1.8
3. Cheshire & Warrington	4.3
4. Coast to Capital	1.4
5. Cornwall & Isles of Scilly	1.9
6. Coventry & Warwickshire	6.1
7. Cumbria	4.5
8. Derby, Derbyshire, Nottingham & Nottinghamshire	5.0
9. Dorset	4.4
10. Enterprise M3	2.8
11. Gloucestershire	5.0
12. Greater Birmingham & Solihull	4.8
13. Greater Cambridge & Greater Peterborough	4.3
14. Greater Lincolnshire	3.9
15. Greater Manchester	2.7
16. Heart of the South West	4.3
17. Hertfordshire	2.6
18. Humber	5.4
19. Lancashire	5.5
20. Leeds city-region	3.3
21. Leicester & Leicestershire	3.6
22. Liverpool city-region	3.3
23. London	0.4
24. New Anglia	3.5
25. North Eastern	5.5
26. Northamptonshire	3.8
27. Oxfordshire	3.0
28. Sheffield city-region	3.0
29. Solent	3.0
30. South East	4.2
31. South East Midlands	2.6
32. Stoke on Trent & Staffordshire	3.5
33. Swindon & Wiltshire	4.4
34. Tees Valley	4.6
35. Thames Valley Berkshire	4.2
36. The Marches	2.9
37. West of England	4.6
38. Worcestershire	3.8
39. York & North Yorkshire	5.3
	3.1



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4.165 Table 4.34 lists the LEP areas in which the sector is relatively over-represented in their employment structures compared with national – with LQs above 1.0. There are more than in the other sectors. 27 LEP areas have LQs above 1.0. 10 have LQs between 1.5 and 2.0 – 8 in the north and midlands (Coventry and Warwickshire, Lancashire, North Eastern, Humber, Worcestershire, Derby, Derbyshire, Nottingham and Nottinghamshire, Greater Birmingham and Solihull and the Black Country) and 2 in the south west (Gloucestershire and Swindon and Wiltshire). The lowest - with LQs below 0.5 – were London and Coast to Capital in the London city-region.

Table 4.34: LEP area location quotients for Other Scientific/Technological Manufacture, 2013

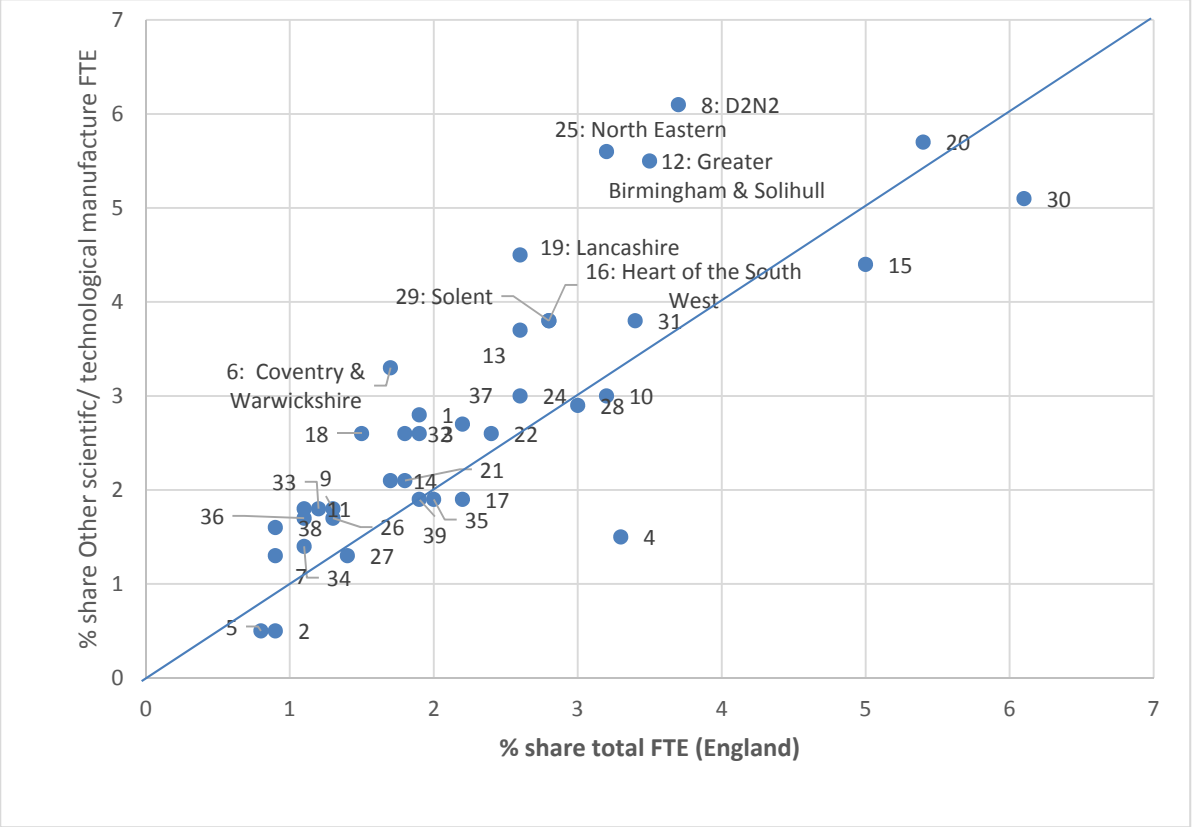
Other scientific/technological manufacture Location Quotients, 2013	Key	
Coventry and Warwickshire (1.96)		
Lancashire (1.78)	1.0 – 1.49	
North Eastern (1.77)	1.50 – 1.99	
Humber (1.76)	2.0 – 2.49	
Worcestershire (1.73)	2.50 – 2.99	
Gloucestershire (1.62)	3.50 - 3.99	
Derby, Derbyshire, Nottingham and Nottinghamshire (1.62)		
Greater Birmingham and Solihull (1.56)		
Black Country (1.51)		
Swindon and Wiltshire (1.50)		
The Marches (1.49)		
Cumbria (1.47)		
Stoke-on-Trent and Staffordshire (1.43)		
Dorset (1.42)		
Greater Cambridge & Greater Peterborough (1.41)		
Cheshire and Warrington (1.40)		
Heart of the South West (1.39)		
Solent (1.37)		
Tees Valley (1.35)		
Greater Lincolnshire (1.25)		
Northamptonshire (1.23)		
West of England (1.22)		
Leicester and Leicestershire (1.17)		
New Anglia (1.15)		
South East Midlands (1.12)		
Liverpool City Region (1.08)		
Leeds City Region (1.06)		
York, North Yorkshire and East Riding (1.00)		

Source: Business Register and Employment Survey

4.166 Figure 4.43 compares, for each LEP area, the sector's share of FTE employment locally with the area's share of total FTE employment. A number of LEP areas in second-tier city regions stand out for their relative specialisms in the sector:

Coventry and Warwickshire, North Eastern, Derby, Derbyshire, Nottingham and Nottinghamshire, Greater Birmingham and Solihull along with Solent and Lancashire.

Figure 4.43: LEP area shares of total (England) and Other Scientific/ Technological Manufacture FTE employment, 2013



Source: Business Register and Employment Survey
Note: With 20.1% of total FTE employment and only 2.8% of Other Scientific/technological manufacture FTE, London would appear well below the line.

Key

LEP area	No	LEP area	No	LEP area	No
Black Country	1	Greater Lincolnshire	14	Oxfordshire	27
Buckinghamshire Thames Valley	2	Greater Manchester	15	Sheffield City Region	28
Cheshire and Warrington	3	Heart of the South West	16	Solent	29
Coast to Capital	4	Hertfordshire	17	South East	30
Cornwall and Isles of Scilly	5	Humber	18	South East Midlands	31
Coventry and Warwickshire	6	Lancashire	19	Stoke-on-Trent and Staffordshire	32
Cumbria	7	Leeds City Region	20	Swindon and Wiltshire	33
Derby, Derbyshire, Nottingham and Nottinghamshire	8	Leicester and Leicestershire	21	Tees Valley	34
Dorset	9	Liverpool City Region	22	Thames Valley Berkshire	35
Enterprise M3	10	London	23 – not included in chart (see Note)	The Marches	36
Gloucestershire	11	New Anglia	24	West of England	37
Greater Birmingham and Solihull	12	North Eastern	25	Worcestershire	38
Greater Cambridge & Greater Peterborough	13	Northamptonshire	26	York, North Yorkshire and East Riding	39

Other Scientific/Technological Services

4.167 Table 4.35 shows the distribution of FTE employment in Other Scientific/ Technological services across the LEP areas. Unlike with 'Other Scientific/ Technological manufacture', London once again is the largest single employer in its services counterpart. The next 6 largest employers – 2 LEP areas in northern second-tier city regions (Leeds City Region and Greater Manchester), 2 in the London city-region (South East and Coast to Capital), rural Oxfordshire and third-tier Greater Cambridge & Greater Peterborough – together with the capital, London, account for half of employment in the sector.

Table 4.35: Other scientific/ technological services FTE employment by LEP area, 2013

LEP area	Region	Classification	FTE	% of England Total
London	London	Capital	197,200	23.2
Leeds City Region	Yorkshire and Humber	2nd Tier	45,400	5.3
Greater Manchester	North West	2nd Tier	43,800	5.2
Greater Cambridge & Greater Peterborough	East of England (part East Midlands)	3rd Tier	39,200	4.6
South East	South East (part East of England)	Lon C-R	37,100	4.4
Coast to Capital	South East (part London)	Lon C-R	34,100	4.0
Oxfordshire	South East	Rural	33,000	3.9
Enterprise M3	South East	Lon C-R	31,000	3.6
West of England	South West	2nd Tier	27,100	3.2
Derby, Derbyshire, Nottingham and Nottinghamshire	East Midlands	2nd Tier	26,800	3.2
Solent	South East	3rd Tier	25,700	3.0
South East Midlands	East Midlands (part South East & East of England)	3rd Tier	24,900	2.9
Greater Birmingham and Solihull	West Midlands	2nd Tier	24,700	2.9
North Eastern	North East	2nd Tier	21,700	2.6
Coventry and Warwickshire	West Midlands	3rd Tier	20,700	2.4
Liverpool City Region	North West	2nd Tier	20,600	2.4
Sheffield City Region	Yorkshire and Humber (part East Midlands)	2nd Tier	20,600	2.4
Leicester and Leicestershire	East Midlands	2nd Tier	19,100	2.2
Thames Valley Berkshire	South East	Lon C-R	17,700	2.1
Cheshire and Warrington	North West	3rd Tier	17,500	2.1
Heart of the South West	South West	3rd Tier	17,300	2.0
Lancashire	North West	3rd Tier	15,900	1.9
York, North Yorkshire and East Riding	Yorkshire and Humber	Rural	15,600	1.8
Hertfordshire	East of England	Lon C-R	15,100	1.8
New Anglia	East of England	3rd Tier	14,500	1.7
Swindon and Wiltshire	South West	3rd Tier	9,600	1.1

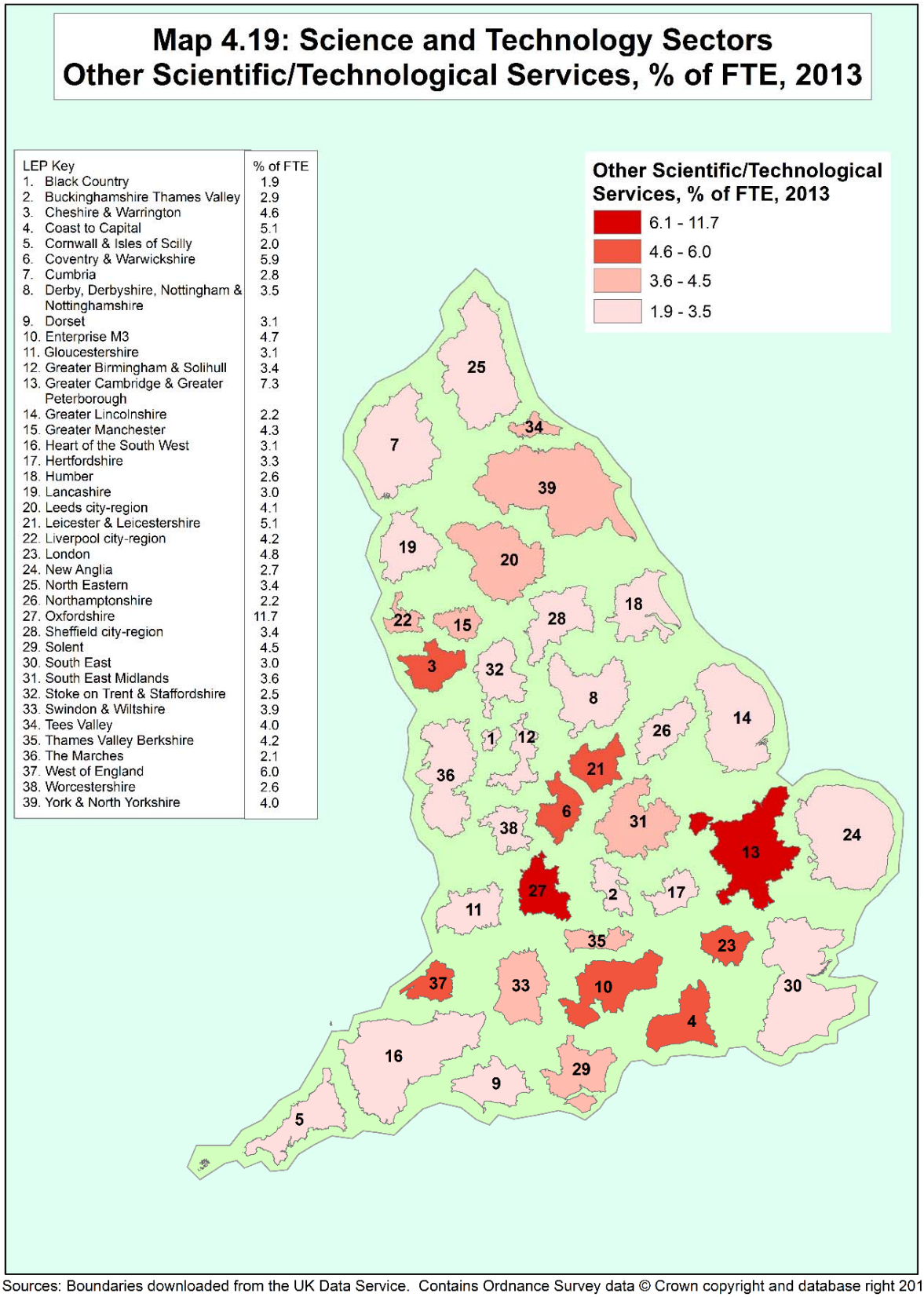
Stoke-on-Trent and Staffordshire	West Midlands	3rd Tier	9,000	1.1
Tees Valley	North East	3rd Tier	8,600	1.0
Humber	Yorkshire and Humber	3rd Tier	8,000	0.9
Dorset	South West	3rd Tier	7,900	0.9
Greater Lincolnshire	East Midlands (part Yorkshire and Humber)	Rural	7,400	0.9
Gloucestershire	South West	Urban-rural	7,100	0.8
Black Country	West Midlands	2nd Tier	7,000	0.8
Northamptonshire	East Midlands	3rd Tier	6,200	0.7
Buckinghamshire Thames Valley	South East	Lon C-R	5,500	0.6
Cumbria	North West	Rural	5,300	0.6
Worcestershire	West Midlands	Urban-rural	5,000	0.6
The Marches	West Midlands	Rural	4,700	0.6
Cornwall and Isles of Scilly	South West	Rural	3,300	0.4
England			849,900	100.0

Source: Business Register and Employment Survey

4.168 Map 4.19 shows the sector's share of total FTE employment in the LEP areas. The highest shares are in rural Oxfordshire in the south east, third-tier Greater Cambridge and Greater Peterborough in eastern England, second-tier West of England in the south west and third-tier Coventry and Warwickshire in the west midlands. The lowest shares are in the second-tier Black Country and the rural LEP areas of Cornwall and Isles of Scilly, The Marches and Greater Lincolnshire.

Map 4.19: Science and Technology Sectors
Other Scientific/Technological Services, % of FTE, 2013

LEP Key	% of FTE
1. Black Country	1.9
2. Buckinghamshire Thames Valley	2.9
3. Cheshire & Warrington	4.6
4. Coast to Capital	5.1
5. Cornwall & Isles of Scilly	2.0
6. Coventry & Warwickshire	5.9
7. Cumbria	2.8
8. Derby, Derbyshire, Nottingham & Nottinghamshire	3.5
9. Dorset	3.1
10. Enterprise M3	4.7
11. Gloucestershire	3.1
12. Greater Birmingham & Solihull	3.4
13. Greater Cambridge & Greater Peterborough	7.3
14. Greater Lincolnshire	2.2
15. Greater Manchester	4.3
16. Heart of the South West	3.1
17. Hertfordshire	3.3
18. Humber	2.6
19. Lancashire	3.0
20. Leeds city-region	4.1
21. Leicester & Leicestershire	5.1
22. Liverpool city-region	4.2
23. London	4.8
24. New Anglia	2.7
25. North Eastern	3.4
26. Northamptonshire	2.2
27. Oxfordshire	11.7
28. Sheffield city-region	3.4
29. Solent	4.5
30. South East	3.0
31. South East Midlands	3.6
32. Stoke on Trent & Staffordshire	2.5
33. Swindon & Wiltshire	3.9
34. Tees Valley	4.0
35. Thames Valley Berkshire	4.2
36. The Marches	2.1
37. West of England	6.0
38. Worcestershire	2.6
39. York & North Yorkshire	4.0



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4.169 Table 4.36 lists the 12 LEP areas in which the sector is relatively over-represented in their employment structures compared with national – with LQs above 1.0. Rural Oxfordshire and third-tier Greater Cambridge and Greater Peterborough lead with, respectively, LQs of 2.82 and 1.76. The LEP areas with the lowest LQs in this sector - with LQs below 0.5 – are second-tier Black Country and rural Cornwall and the Isles of Scilly.

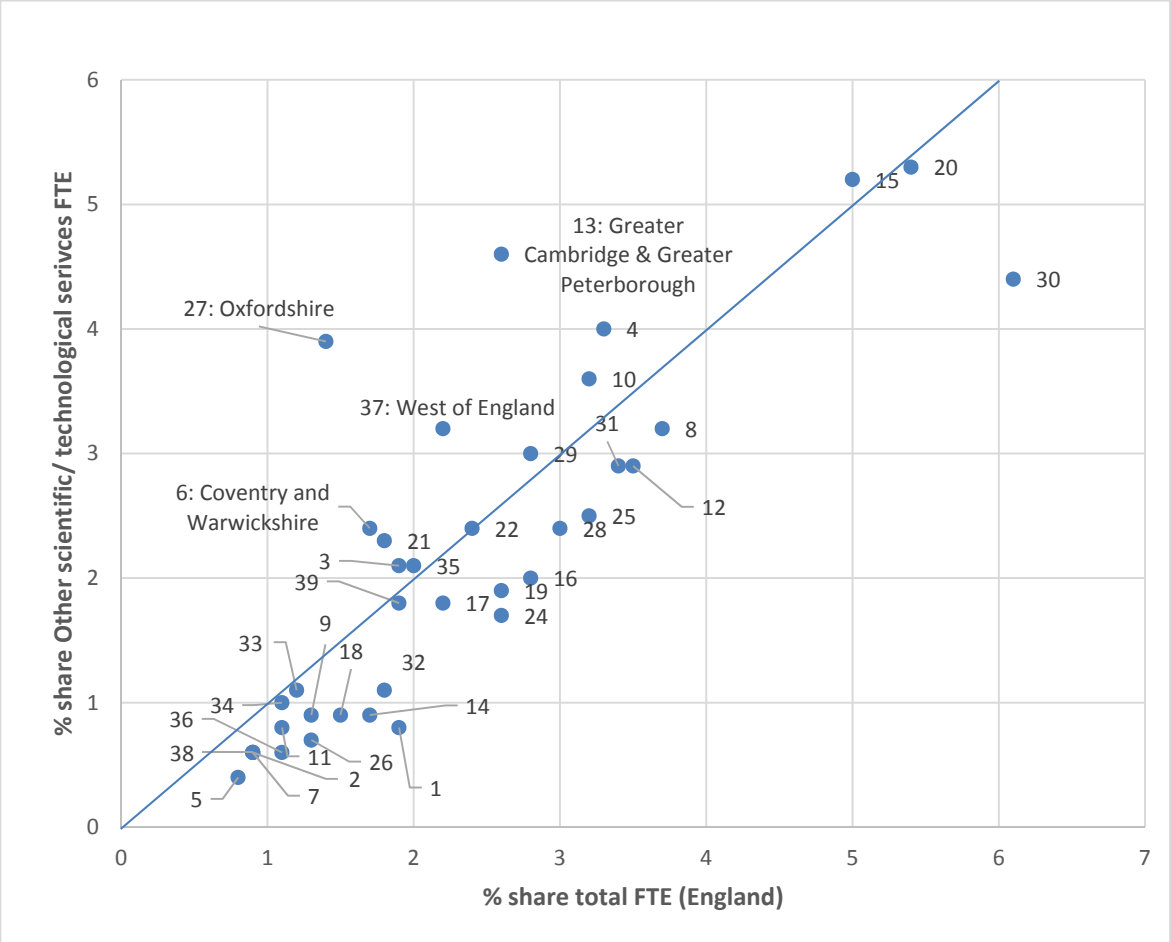
Table 4.36: LEP area location quotients for Other scientific/ technological services, 2013

Other scientific/ technological services Location Quotients, 2013	Key	
Oxfordshire (2.82)		
Greater Cambridge & Greater Peterborough (1.76)	1.0 – 1.49	
West of England (1.44)	1.50 – 1.99	
Coventry and Warwickshire (1.43)	2.0 – 2.49	
Leicester and Leicestershire (1.23)	2.50 – 2.99	
Coast to Capital (1.22)	3.50 - 3.99	
London (1.15)		
Enterprise M3 (1.13)		
Cheshire and Warrington (1.10)		
Solent (1.09)		
Greater Manchester (1.03)		
Thames Valley Berkshire (1.02)		
Liverpool City Region (1.00)		

Source: Business Register and Employment Survey

4.170 The relative strengths of the sector in the Oxfordshire and Greater Cambridge and Greater Peterborough LEP areas can also be seen in the comparison of the sector's share of FTE employment locally with the area's share of total FTE employment in Figure 4.44. West of England and Coventry and Warwickshire also stand out.

Figure 4.44: LEP area shares of total (England) and Other scientific/ technological services FTE employment, 2013



Source: Business Register and Employment Survey
Note: With 20.1% total FTE employment and 23.2% of Other Scientific/ technological services, London would appear above the line.

Key

LEP area	No	LEP area	No	LEP area	No
Black Country	1	Greater Lincolnshire	14	Oxfordshire	27
Buckinghamshire Thames Valley	2	Greater Manchester	15	Sheffield City Region	28
Cheshire and Warrington	3	Heart of the South West	16	Solent	29
Coast to Capital	4	Hertfordshire	17	South East	30
Cornwall and Isles of Scilly	5	Humber	18	South East Midlands	31
Coventry and Warwickshire	6	Lancashire	19	Stoke-on-Trent and Staffordshire	32
Cumbria	7	Leeds City Region	20	Swindon and Wiltshire	33
Derby, Derbyshire, Nottingham and Nottinghamshire	8	Leicester and Leicestershire	21	Tees Valley	34
Dorset	9	Liverpool City Region	22	Thames Valley Berkshire	35
Enterprise M3	10	London	23 – not included in chart (see Note)	The Marches	36
Gloucestershire	11	New Anglia	24	West of England	37
Greater Birmingham and Solihull	12	North Eastern	25	Worcestershire	38
Greater Cambridge & Greater Peterborough	13	Northamptonshire	26	York, North Yorkshire and East Riding	39

Structures and Incentives: LEP innovation approach and governance

4.171 Since we are primarily interested in the collective role of key local actors in fostering knowledge creation and diffusion rather than 'given' national structures and incentives such as intellectual property protection we have chosen to focus on indicators of LEPs' supportiveness of innovation as proxy measures. Table 4.37 presents three specific pointers as to how supportive LEPs and their partners are of innovation. They should be viewed jointly rather than separately for two main reasons. We lack complete data. Also each rating is our best estimate on the basis of the available documentary evidence since conducting primary research was not part of our brief.

4.172 We compiled and reviewed the main strategic documents produced by LEPs including the Strategic Economic Plans and European Structural Investment Fund (EUSIF) strategies to assess approaches to innovation (see Appendix D6 for summaries). The evidence suggests that all LEPs and their partners are taking innovation seriously. Innovation features to some degree in all their strategic documents. It accounts for between 10% and 40% of their total ERDF allocation, although it is important to note that it was not possible from available documentation to specify the proportion devoted to innovation in almost a third of LEPs' EUSIFs. More than a half of all LEPs have dedicated innovation groupings.

4.173 LEPs which have prioritised innovation most in terms of ERDF allocations (more than 30% of their total) are mainly located in the south east and east of England (Greater Cambridge and Peterborough, Hertfordshire, Oxfordshire, Thames Valley Berkshire) though Coventry and Warwickshire LEP also features. There are a considerable number of other LEPs throughout England who are also planning to invest a significant portion of their ERDF on innovation: Cheshire & Warrington, Enterprise M3, New Anglia, Heart of the South West, Stoke on Trent and Staffordshire, York & North Yorkshire, Black Country, South East Midlands, Tees Valley and Coast to Capital (25-30%).

4.174 LEPs which appear to have across the board strengths in terms of governance and networking include: Enterprise M3, Leeds City Region, North Eastern, Tees Valley, Greater Cambridge & Peterborough, Hertfordshire, New Anglia, Liverpool City region, London and Cornwall and the Isles of Scilly, though in the latter three cases this is a guestimate as we lack definitive information about their ERDF allocations.

Table 4.37: Qualitative assessment of LEPs' approach to innovation

LEP	Innovation Strategy	% allocation of ERDF to TO1 (innovation)*1	Dedicated LEP 'innovation group'/panel*2
Black Country	•	26%	•
Buckinghamshire and Thames Valley	••	24%	No
Cheshire and Warrington	•	30%	••
Coast to Capital	••	25%	No
Cornwall and the Isles of Scilly	•••	Not specified	•••
Coventry and Warwickshire	••	33%	••
Cumbria	•	20%	No
Derby, Derbyshire, Nottingham and Nottinghamshire	•••	20%	No
Dorset	•	Not specified	No
Enterprise M3	•••	30%	•••
Gloucestershire	•	10%	••
Greater Birmingham and Solihull	••	14%	•
Greater Cambridge and Greater Peterborough	••	40%	•••
Greater Lincolnshire	••	Not specified	No
Greater Manchester	••	Not specified	No
Heart of the South West	•	28%	No
Hertfordshire	••	40%	•••
Humber	•	10%	No
Lancashire	••	Not specified	No
Leeds City Region	•••	17%	•••
Leicester and Leicestershire	••	19%	•
Liverpool City Region	•••	Not specified	•••
London	••	Not specified	•••
New Anglia	••	28%	•••
North Eastern	•••	22%	•••
Northamptonshire	••	17%	No
Oxfordshire	••	39%	No
Sheffield City Region	••	13%	••
Solent	••	19%	•••
South East	••	20%	No
South East Midlands	••	25%	••
Stoke on Trent and Staffordshire	••	28%	•
Swindon and Wiltshire	••	Not specified	No
Tees Valley	•••	25%	•••
Thames Valley Berkshire	••	39%	No
The Marches	•	Not specified	No
West of England	••	Not specified	••
Worcestershire	•	17%	No
York and North Yorkshire	••	27%	No

Notes: See below for table key

Key to Table 4.37

*1	'Not specified' means that the financial allocation to TO1 (innovation) has not been clearly stated in the LEP's EUSIF document. This is either because the financial allocation information in the document does not clearly separate ERDF and ESF funding allocations for the thematic objectives, or that financial allocations have not been specifically allocated by thematic objective.
*2	Some LEPs with a 'no' in this category do discuss establishing an 'innovation sub-group/panel' in their SEP/EUSIF documents. However at the time the research was conducted there was no evidence that these groups were currently in existence or operational. Others registering a 'no' may have an 'enterprise panel' in place but we could not consistently establish whether such panels dealt with 'innovation' per se from the documentary evidence. Admittedly this is a moving picture, and structures and partnerships will have developed, but this is our best judgement based on the documentation and LEP consultation exercise undertaken at the time.
Innovation Strategy	• = No innovation strategy document; but LEP discusses its overall approach to innovation in its SEP and EUSIF documents. •• = In addition to the above, LEP has separate strategies for some/all of Governments' Key Industrial Sectors or those in the 8 Great Technologies and/or discusses its approach to these sectors in-depth within its SEP/EUSIF. ••• = LEP has a stand-alone innovation strategy document.
Presence of LEP 'innovation group/panel'	No = No evidence of innovation sub-group/panel or key sector sub-groups that are formal part of LEP structure. • = LEP has 'experts'/sector champions that it uses for advice, but these are not a formal part of the LEP structure. ••= LEP has sectoral groups covering innovation-related sectors, e.g. 8 Great Technologies and Governments Key Industrial Sectors. •••= LEP has dedicated innovation sub-group/panel.

4.5 Broader Environment

4.175 The 'broader environment' element of the framework seeks to capture 'the economic and societal context with which the science and innovation system interacts' (BIS, 2014a). The indicators here are designed to capture the relative strengths of LEP local economies in terms of labour force participation, business and entrepreneurial activity, earnings, quality of life/place and local connectivity.

4.176 We focus on 5 headline indicators for this element of the framework:

- Employment rates (Annual Population Survey);
- Average earnings (ASHE);
- Enterprise and entrepreneurial activity (BRES);
- Average travel to work times ((Annual Population Survey);
- Quality of life/place (Halifax Quality of Life Survey);
- Broadband infrastructure (OFCOM).

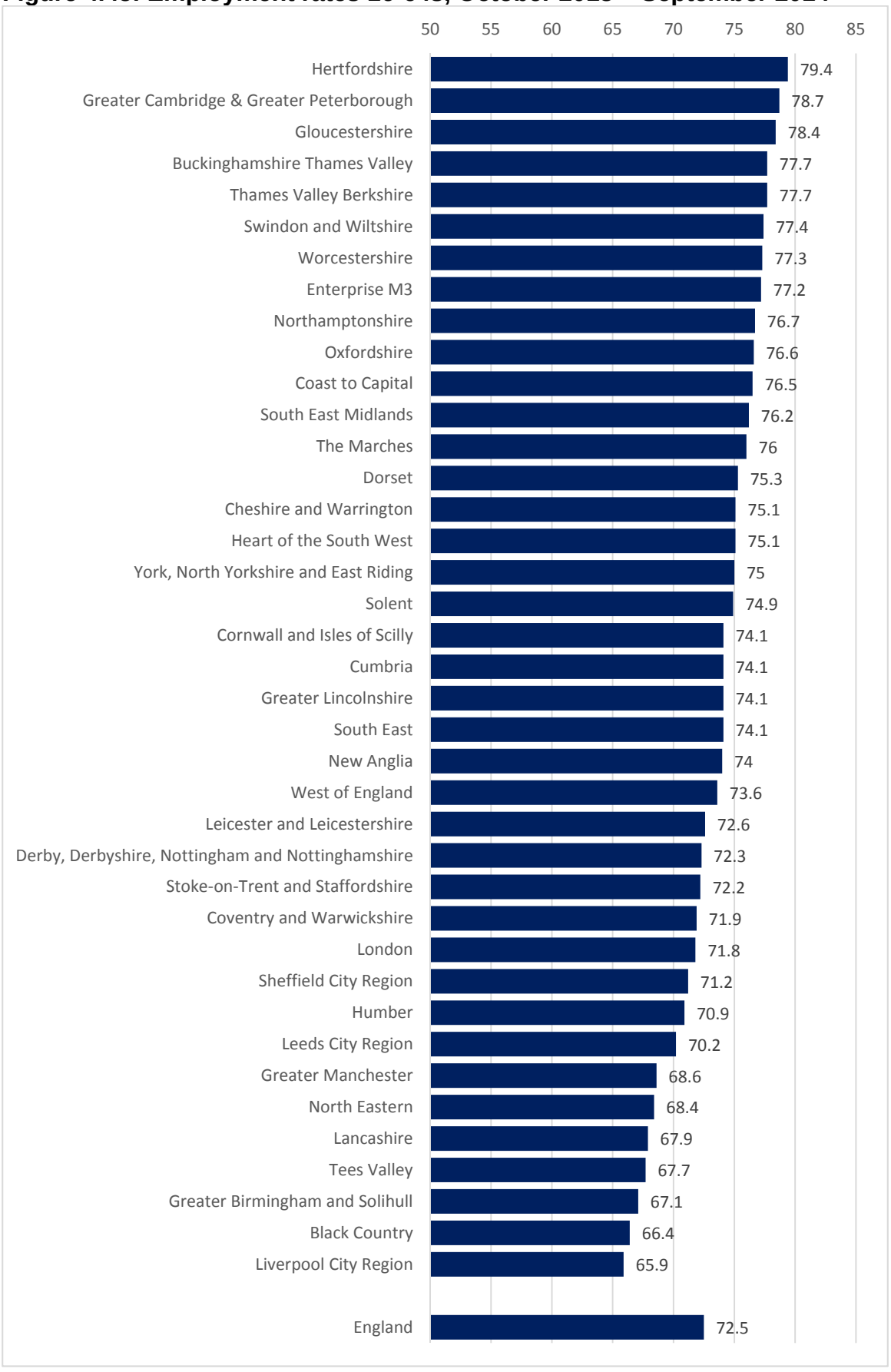
4.177 Other second-order indicators that could also be used would be population (by age bands) and unemployment rates.

Broader environment: Employment rates

4.178 Figure 4.45 shows the variation in employment rates across the LEP areas for 2013/14. With an average rate for England of 72.5%, the rates range across the LEP areas from 65.9% in Liverpool City Region to 79.4% in Hertfordshire. There is a broad 'north-south' divergence with a few exceptions. All of the LEP areas in eastern England, the south west and the south east (with the notable exception of London) had employment rates above the rate for England.

4.179 The East Midlands also stands out from the rest of the midlands and north with all but one of its five LEP areas having above national rates and Derby, Derbyshire, Nottingham and Nottinghamshire only just below. The majority of LEP areas in the West Midlands, North West and Yorkshire and Humber and both of the LEP areas in the North East of England had employment rates below national. The exceptions were urban-rural Worcestershire and rural The Marches in the West Midlands, third-tier Cheshire and Warrington and rural Cumbria in the north west and rural York, North Yorkshire and East Riding in Yorkshire and the Humber.

Figure 4.45: Employment rates 16-64s, October 2013 – September 2014



Source: Annual Population Survey

Broader environment: Earnings

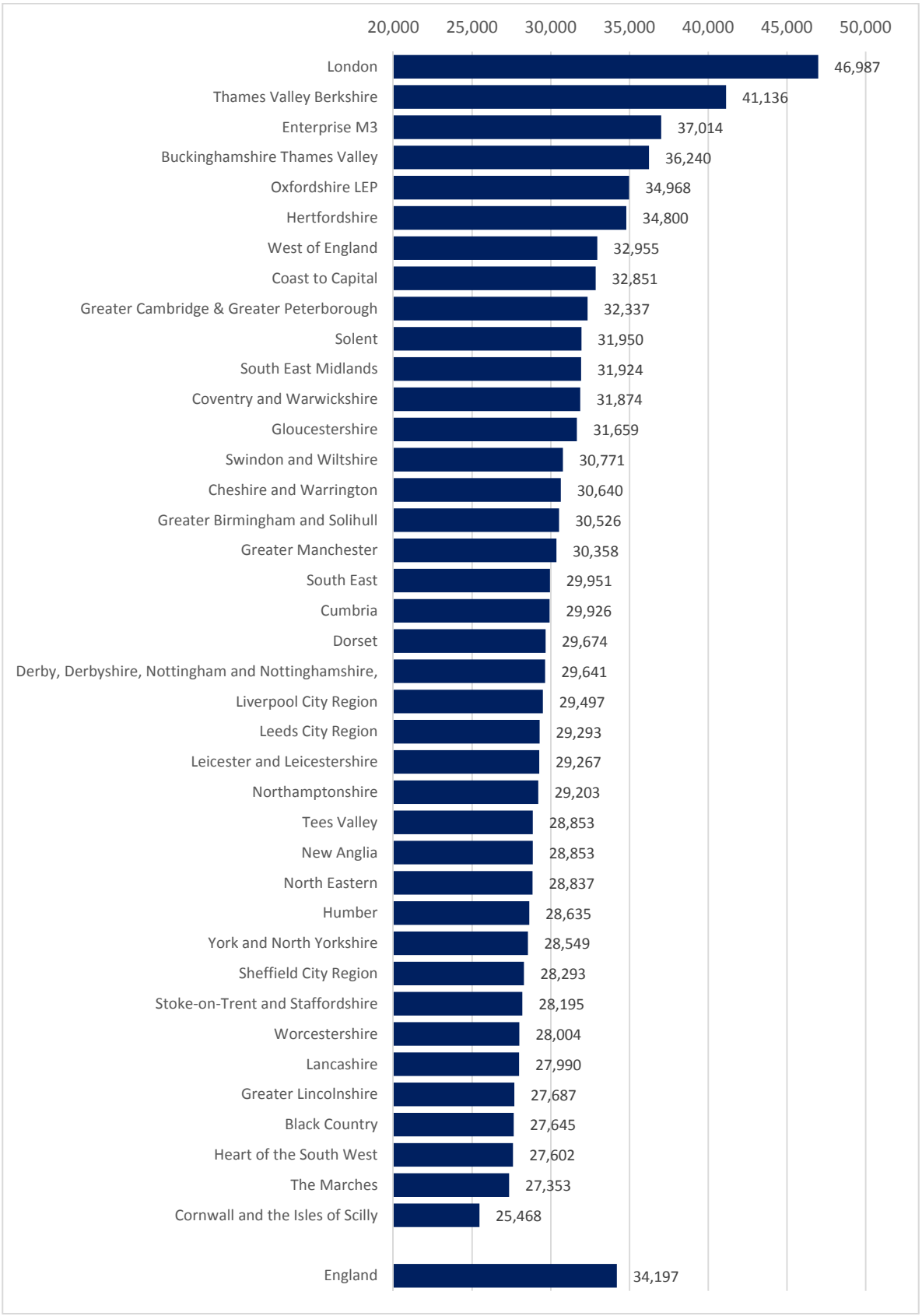
4.180 We use average earnings as a proxy for local demand conditions, a key driver of innovation. Figure 4.46 charts average gross full-time earnings by LEP area for 2014. London has the highest figure (£46,987), over one and a half times that of the lowest, Cornwall and the Isles of Scilly (£25,468).

4.181 Only six LEP areas have average earnings figures above the England average: London and five of the 'Greater Thames Valley Six': Thames Valley Berkshire, Enterprise M3, Buckinghamshire Thames Valley, Oxfordshire LEP and Hertfordshire. The other 'Greater Thames Valley Six' LEP area, Coast to Capital, is ranked eighth, after West of England and just above Greater Cambridge and Greater Peterborough.

4.182 Third-tier South East Midlands is the highest ranked LEP area in the midlands (ranked 11th) and third-tier Cheshire and Warrington the highest ranked northern LEP area (ranked 15th).

4.183 The lowest earnings are in rural Cornwall and the Isles of Scilly in the southwest and rural The Marches in the west midlands, with earnings levels 75% and 80%, respectively, of the England average.

Figure 4.46: Average gross annual full-time earnings (workplace based) by LEP area, 2014



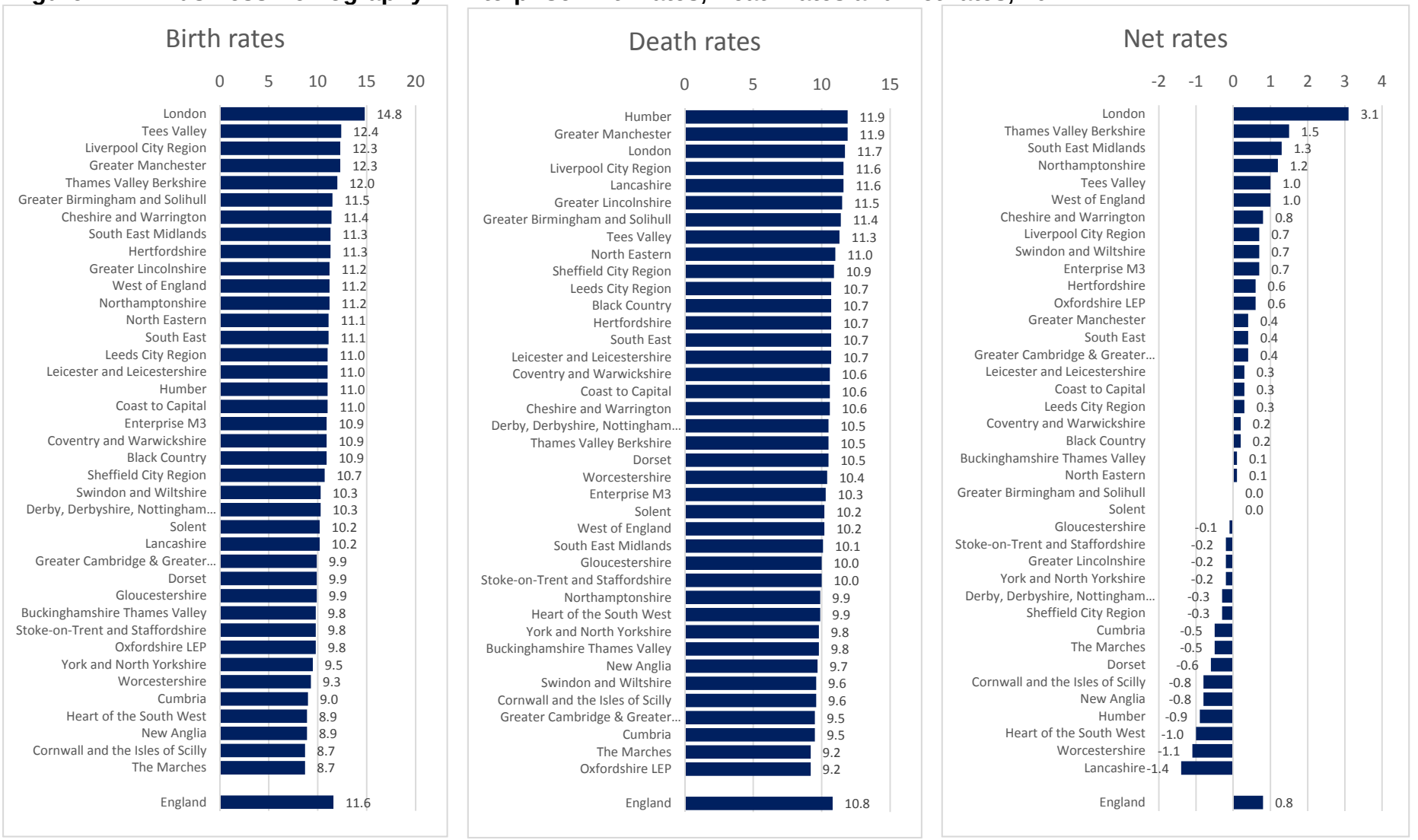
Source: ASHE

Broader environment: Enterprise and entrepreneurial activity

4.184 Figure 4.47 provides a snapshot of rates of birth, death and net growth of enterprises across LEP areas in 2012. Map 4.20 shows the geography of net growth, the varying balance between firm growth and death rates. In that year, the business base increased in England. 22 of the 39 LEP areas had positive growth, two had no growth and the business base contracted in 15.

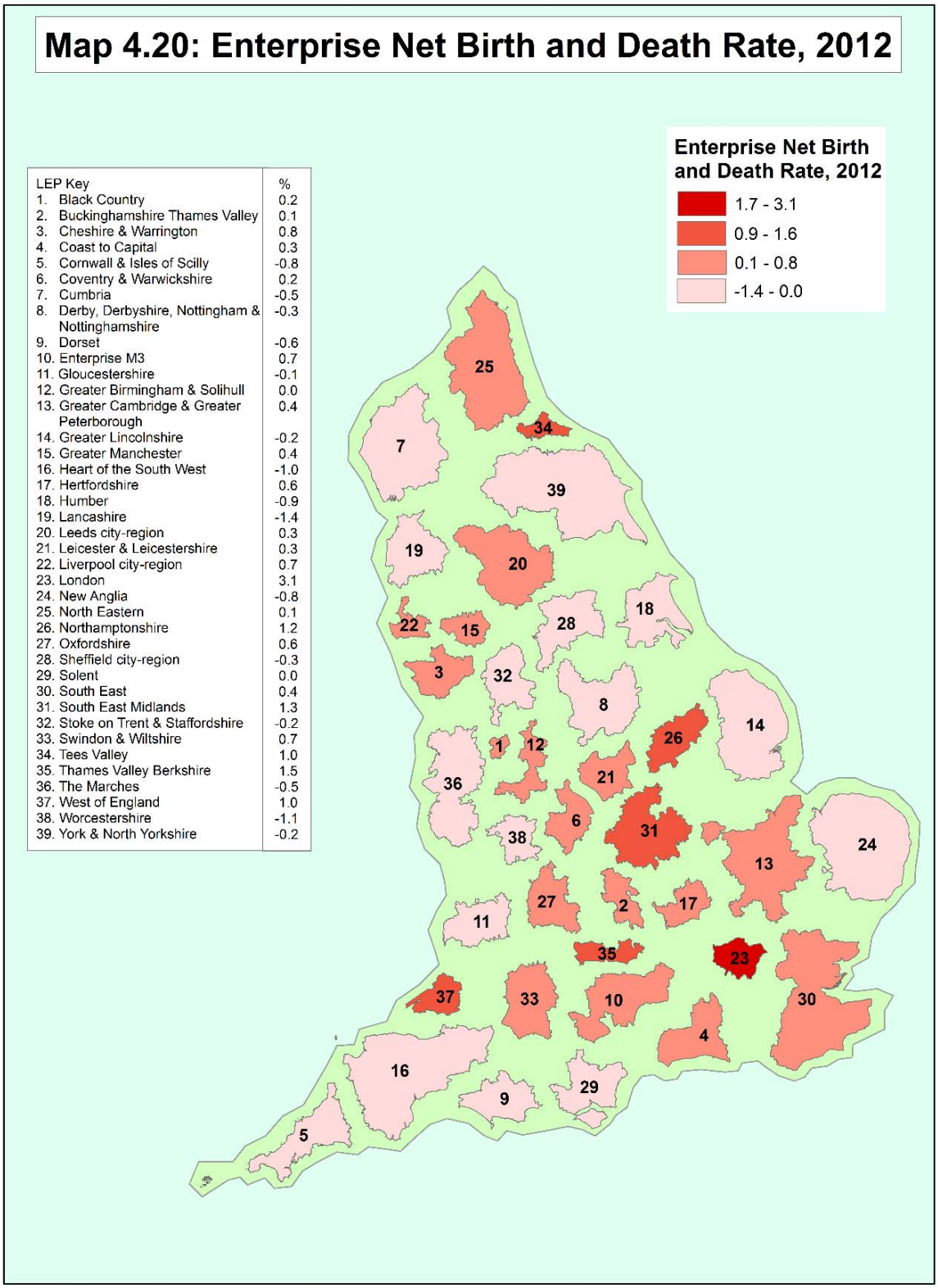
4.185 London had the biggest net growth followed by five LEP areas in both north and south with growth above the England average: Thames Valley Berkshire, South East Midlands, Northamptonshire, Tees Valley and West of England. The biggest contractions, again traversing both north and south were in Lancashire, Worcestershire, Heart of the South West, Humber, New Anglia and Cornwall and the Isles of Scilly.

Figure 4.47: Business Demography – Enterprise Birth rates, Death rates and Net rates, 2012



Source: ONS Business Demography; Notes: The enterprise birth/death rate is the number of births/deaths per 100 active enterprises in an area for the given year. The net rate is birth rate minus death rate.

Map 4.20: Enterprise Net Birth and Death Rate, 2012



LEP Key	%
1. Black Country	0.2
2. Buckinghamshire Thames Valley	0.1
3. Cheshire & Warrington	0.8
4. Coast to Capital	0.3
5. Cornwall & Isles of Scilly	-0.8
6. Coventry & Warwickshire	0.2
7. Cumbria	-0.5
8. Derby, Derbyshire, Nottingham & Nottinghamshire	-0.3
9. Dorset	-0.6
10. Enterprise M3	0.7
11. Gloucestershire	-0.1
12. Greater Birmingham & Solihull	0.0
13. Greater Cambridge & Greater Peterborough	0.4
14. Greater Lincolnshire	-0.2
15. Greater Manchester	0.4
16. Heart of the South West	-1.0
17. Hertfordshire	0.6
18. Humber	-0.9
19. Lancashire	-1.4
20. Leeds city-region	0.3
21. Leicester & Leicestershire	0.3
22. Liverpool city-region	0.7
23. London	3.1
24. New Anglia	-0.8
25. North Eastern	0.1
26. Northamptonshire	1.2
27. Oxfordshire	0.6
28. Sheffield city-region	-0.3
29. Solent	0.0
30. South East	0.4
31. South East Midlands	1.3
32. Stoke on Trent & Staffordshire	-0.2
33. Swindon & Wiltshire	0.7
34. Tees Valley	1.0
35. Thames Valley Berkshire	1.5
36. The Marches	-0.5
37. West of England	1.0
38. Worcestershire	-1.1
39. York & North Yorkshire	-0.2

Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2014. Enterprise data from ONS Business Demography. Map layout by EIUA. Notes: The net rate has been calculated as the enterprise birth rate minus the enterprise death rate for each LEP. The net increase or decrease is expressed as a rate per 100 active enterprises in an area. Therefore if an area has a net increase, it means that its birth rate exceeded its death rate in a given year. Likewise, if it had a negative net rate then its death rate exceeded its birth rate.

Broader environment: Quality of life/place

4.186 The attractiveness of localities for researchers and scientists is, of course, heavily conditioned by the employment opportunities offered by the existing spatial distribution of knowledge-intensive industries, research organisations and research-intensive universities. The attractiveness of localities can also be assessed using a broad 'quality of life and place' measure that combines economic indicators with social and environmental ones. We use here the annual 'Quality of Life Survey' undertaken by Halifax, part of the Lloyds Bank Group. Survey is something of a misnomer as it is constructed from a range of existing data sources and indicators that cover the labour market, the housing market, the environment, education, health and personal well-being.

4.187 The data are collected for all 405 Local Authority Districts in the UK. Each local authority district is given a score out of 10 for each of the 21 variables in the index (Table 4.38). Scores in each of the 7 broad groups are averaged and then the seven group scores are summed to create an overall quality of life score.

Table 4.38: Halifax Quality of Life Survey, 2014: indicators and data sources

Group	Variable	Period covered
Labour	Employment rate %	Jul 2013-Jun 2014
	Gross weekly Earnings £s	April 2014 Northern Ireland (NI) – April 2013, NISRA (both up rated by average weekly earnings index to September 2014)
	% of adults(16+) with highest qualification gained	2011 Census data
Housing	Number of rooms in house	England & Wales 2011 ONS Census Data Scotland – Housing Conditions Survey 2009/11 Northern Ireland November 2014 Halifax data
	% of houses with central heating and sole use of bathroom	England & Wales 2011 ONS Census Data Scotland – housing Conditions Survey 2009/11 NI – Halifax Data to November 2014.
	House prices to Earnings ratio	12 months to November 2014
	Households with a good level of broadband access (i.e. a download speed of at least 2Mbps):	Point Topic June 2014

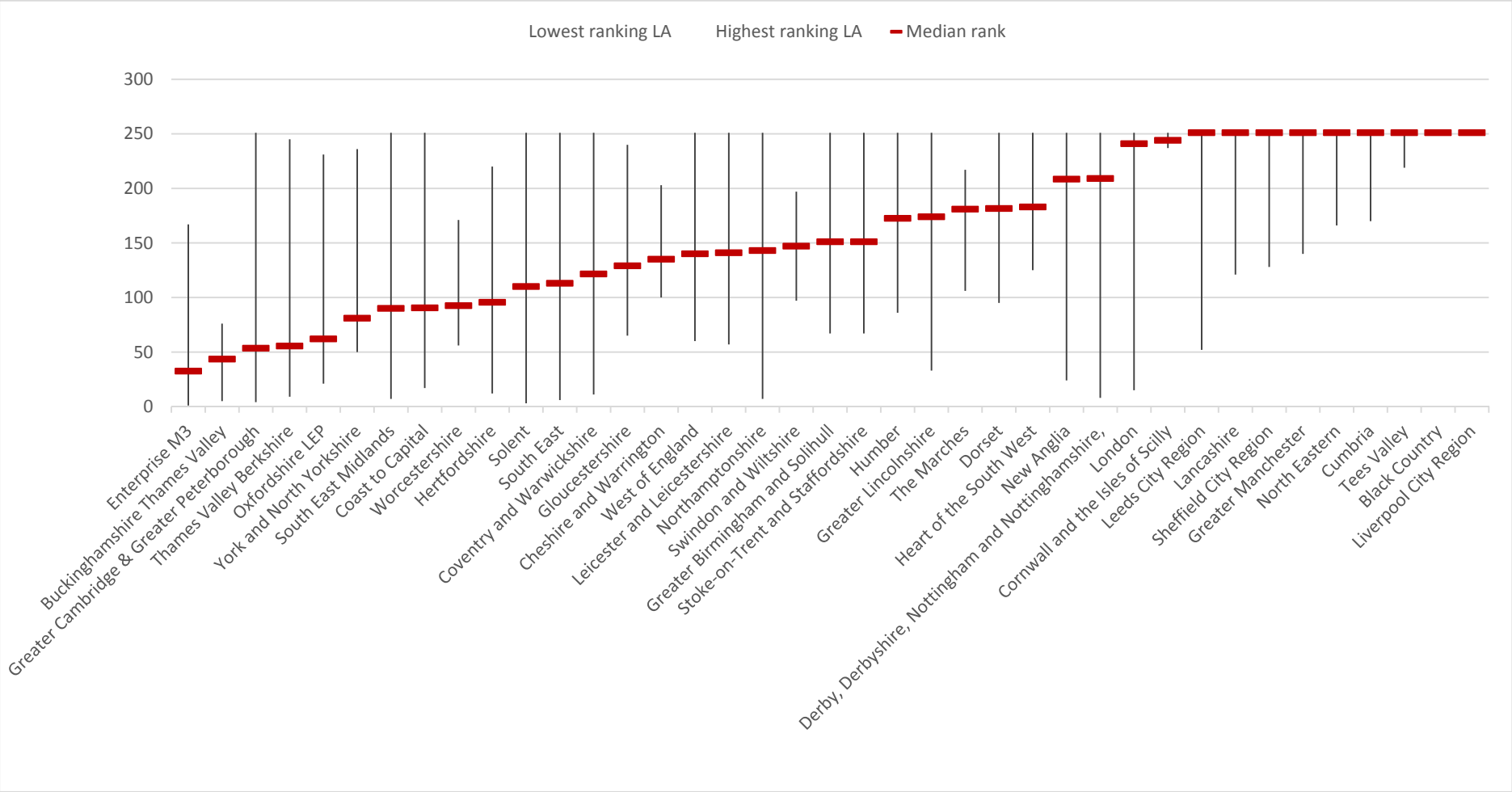
Urban environment	Population density per square km	2013 – ONS
	Traffic flows per square km	2013
	Burglary rate per 10,000 population	British Crime Survey 2011/12 Scotland 2011/12; Northern Ireland 2011/12
	CO2 Emissions per tonne per capita	2012 Department of Energy and Climate Change (covers period 2005-2012)
Physical environment	Average annual rainfall mm	Met Office Average 2009/2013
	Annual sunshine hours	Met Office Average 2009/2013
Health	% in good or fairly good health	2011 Census
	Life expectancy at birth for males	England, Wales & Scotland 2011/13; Northern Ireland 2010/12 Education
	Number of pupils in primary school class	January 2014 England; Wales, and Northern Ireland 2013/14; Scotland 2013
	% of 15yr+ olds with 5 or more GCSEs A-C grade or Scottish equivalent	2012/2013 England; 2013/14 Wales; Scotland 2013; Northern Ireland 2012/13
Personal Well-Being	Life Satisfaction	April 2013-March 2014 ONS
	Worthwhile	April 2013-March 2014 ONS
	Happiness	April 2013-March 2014 ONS
	Anxiety	April 2013-March 2014 ONS

Source: Halifax

4.188 The overall index is only published for the top 250 Local Authority Districts. In Figure 4.48, we have allocated these districts to LEP areas, which thus comprise a range of individual district rankings in term of index scores. The figure shows this range and the median ranking for each LEP area. For the 154 Local Authority Districts for which scores are not published, we have allocated a notional ranking of 251+.

4.189 The pattern is again one of broad 'north-south' with a few exceptions. The highest ranked LEP areas are in the south east and eastern England including Enterprise M3, Buckinghamshire Thames Valley, Greater Cambridge & Greater Peterborough, Thames Valley Berkshire, Oxfordshire, Coast to Capital, Hertfordshire, Solent, and South East. These are joined by York and North Yorkshire and Cheshire and Warrington in the north, South East Midlands, Worcestershire, Coventry and Warwickshire, Leicester and Leicestershire and Northamptonshire from the midlands and Gloucestershire, West of England and Swindon and Wiltshire from the south west.

Figure 4.48: Halifax UK Quality of Life Survey 2014 – The Rankings: range and median rank of Local Authorities within each LEP (where 1=best and LEPs are ordered by median first and where this is identical by highest ranking LA



Source: Halifax Quality of Life Survey 2014; Notes: Halifax provide rankings for the top 250 Local Authorities (LAs). All LAs outside of the top 250 have been given a notional rank of "251". Each line shows the range in rankings from the lowest to the highest ranked LA within each LEP.

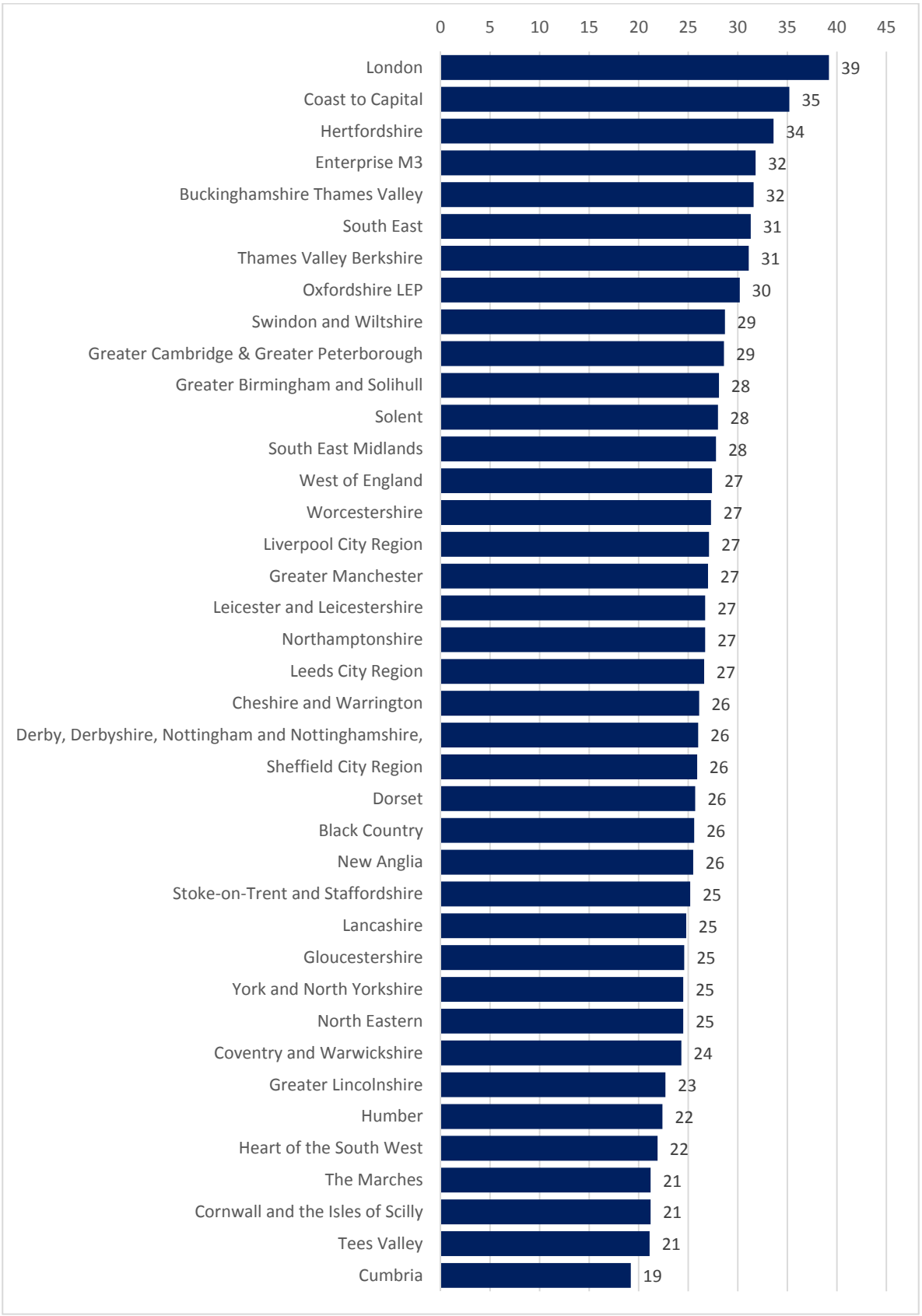
Broader environment: Average travel to work times

4.190 Figure 4.49 shows average travel to work times across the LEP areas in 2012. The capital, London, unsurprisingly has the highest time, at 39 minutes, twice that of the lowest, rural Cumbria with 19 minutes. The average across the LEPs is just under 27 minutes and just under half of the LEP areas, 17, have times above this average.

4.191 The highest times, half an hour plus, are in the LEP areas in the London city-region: London, the 'Greater Thames Valley Six' (Coast to Capital, Hertfordshire, Enterprise M3, Buckinghamshire Thames Valley, Thames Valley Berkshire and Oxfordshire) and South East.

4.192 Third-tier Greater Cambridge and Greater Peterborough LEP area has above average travel to work times in eastern England, mirrored in the midlands by third-tier South East Midlands, urban-rural Worcestershire, second-tier Greater Birmingham and Solihull and in the south west by third-tier Swindon and Wiltshire and second-tier West of England. The two northern LEP areas with (just) above average travel to work times are second-tier Liverpool City Region and Greater Manchester.

Figure 4.49: Average travel to work times in minutes for residents in LEPs, 2012



Source: Annual Population Survey

Broader environment: Broadband infrastructure

4.193 In our LEP consultation, broadband access and speed were repeatedly cited as important factors in the local innovation infrastructure.

4.194 Maps 4.21 and 4.22 show the availability of superfast broadband and average download speeds across LEP areas. There is a clear contrast in broadband access and speed between urban and rural LEP areas, as summarised in Table 4.39. The LEP areas with particularly high access and speed are in the northern and midlands and south western second-tier city regions and in London and its wider city-region. The LEP areas with particularly low broadband access and speed are in the rural areas in the north, midlands, south west and eastern England.

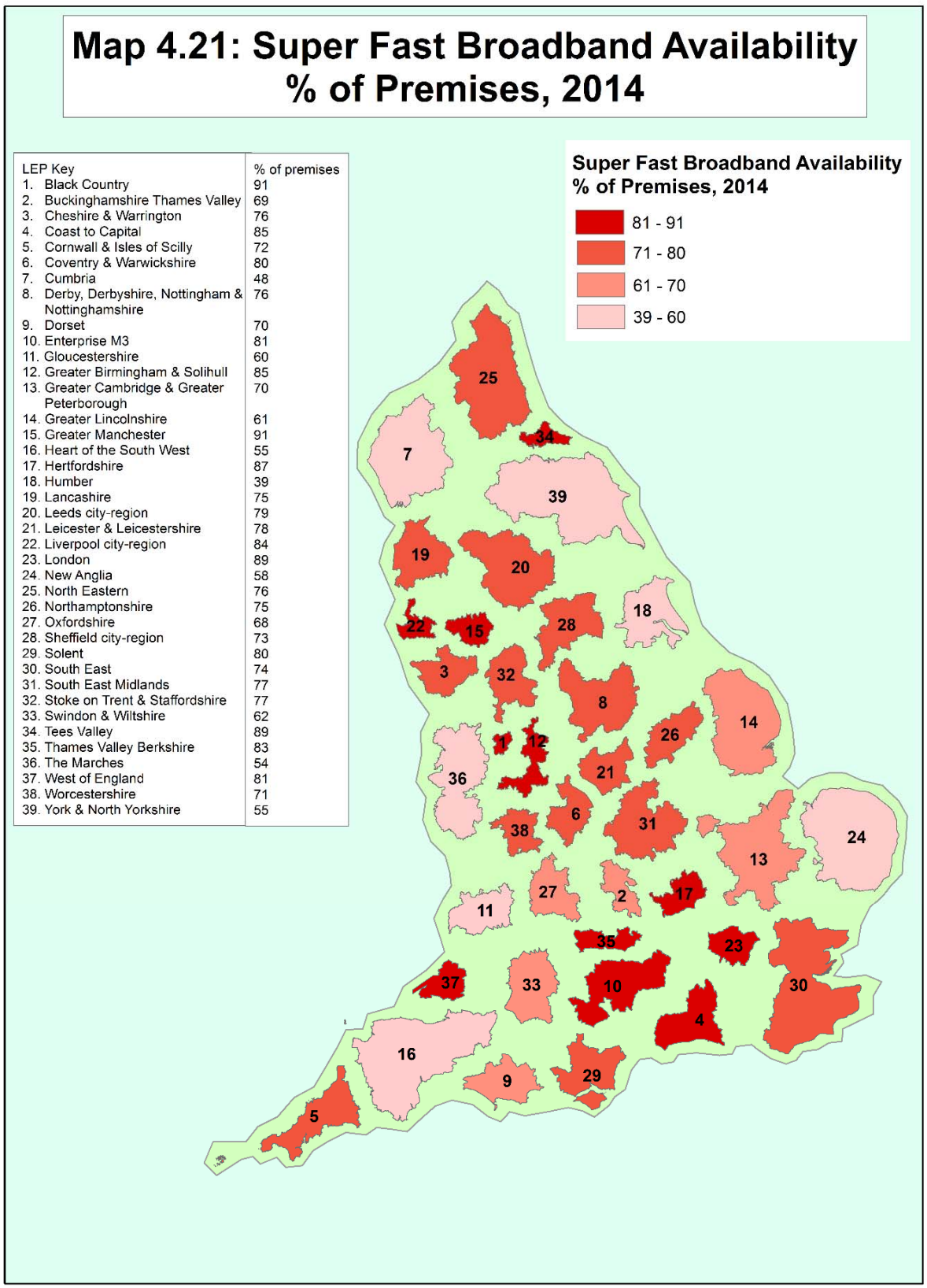
Table 4.39: Strong and weak broadband infrastructure

Broadband infrastructure		
	Superfast Broadband Availability (% premises)	Average download speeds (megabits per second)
	High (81-91%)	High (27-31 mgbs/s)
Region	LEP area	LEP area
North East	Tees Valley	Tees Valley
North West	Greater Manchester Liverpool city-region	Greater Manchester
West Midlands	Black Country Greater Birmingham & Solihull	Black Country
South East	Coast to Capital Enterprise M3 Thames Valley Berkshire	Enterprise M3 Thames Valley Berkshire
South West	West of England	West of England
London	London	London
Eastern England	Hertfordshire	Hertfordshire
	Low (39-60%)	Low (12-18 mgbs/s)
Region	LEP area	LEP area
North West	Cumbria	Cumbria
Yorkshire & the Humber	Humber York, North Yorkshire & East Riding	York, North Yorkshire & East Riding
West Midlands	The Marches	The Marches
South West	Gloucestershire Heart of South West	Cornwall and Isles of Scilly Heart of South West
Eastern England	New Anglia	New Anglia

Source: OFCOM

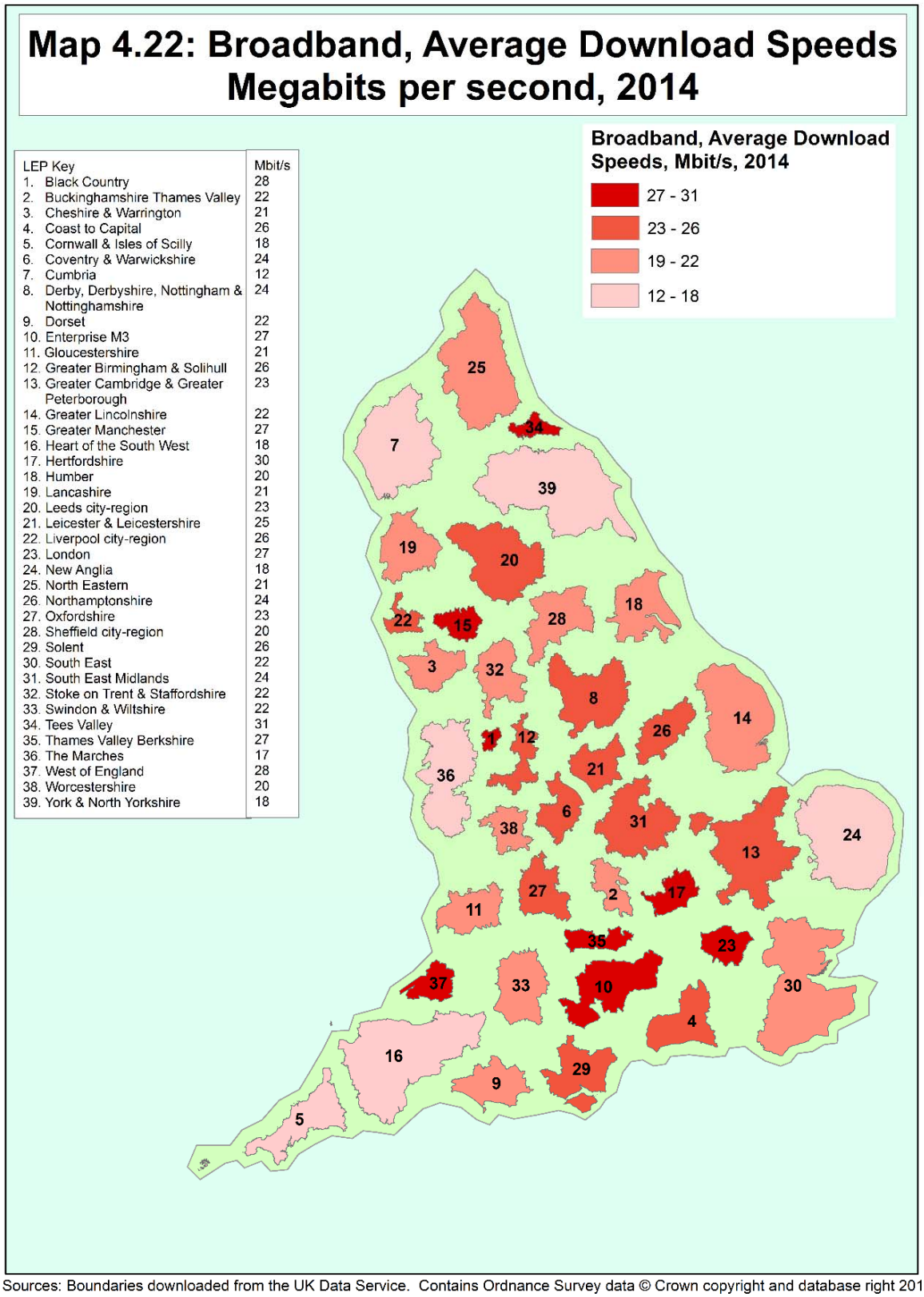
Map 4.21: Super Fast Broadband Availability % of Premises, 2014

LEP Key	% of premises
1. Black Country	91
2. Buckinghamshire Thames Valley	69
3. Cheshire & Warrington	76
4. Coast to Capital	85
5. Cornwall & Isles of Scilly	72
6. Coventry & Warwickshire	80
7. Cumbria	48
8. Derby, Derbyshire, Nottingham & Nottinghamshire	76
9. Dorset	70
10. Enterprise M3	81
11. Gloucestershire	60
12. Greater Birmingham & Solihull	85
13. Greater Cambridge & Greater Peterborough	70
14. Greater Lincolnshire	61
15. Greater Manchester	91
16. Heart of the South West	55
17. Hertfordshire	87
18. Humber	39
19. Lancashire	75
20. Leeds city-region	79
21. Leicester & Leicestershire	78
22. Liverpool city-region	84
23. London	89
24. New Anglia	58
25. North Eastern	76
26. Northamptonshire	75
27. Oxfordshire	68
28. Sheffield city-region	73
29. Solent	80
30. South East	74
31. South East Midlands	77
32. Stoke on Trent & Staffordshire	77
33. Swindon & Wiltshire	62
34. Tees Valley	89
35. Thames Valley Berkshire	83
36. The Marches	54
37. West of England	81
38. Worcestershire	71
39. York & North Yorkshire	55



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. SFBB data from OFCOM. For a number of LEPs county level data have been apportioned to relevant LEP districts based on an estimated share of premises figure calculated from a household count from the 2011 Census and a business count of local units from the UK Business Counts data set. Map layout by EIUA.

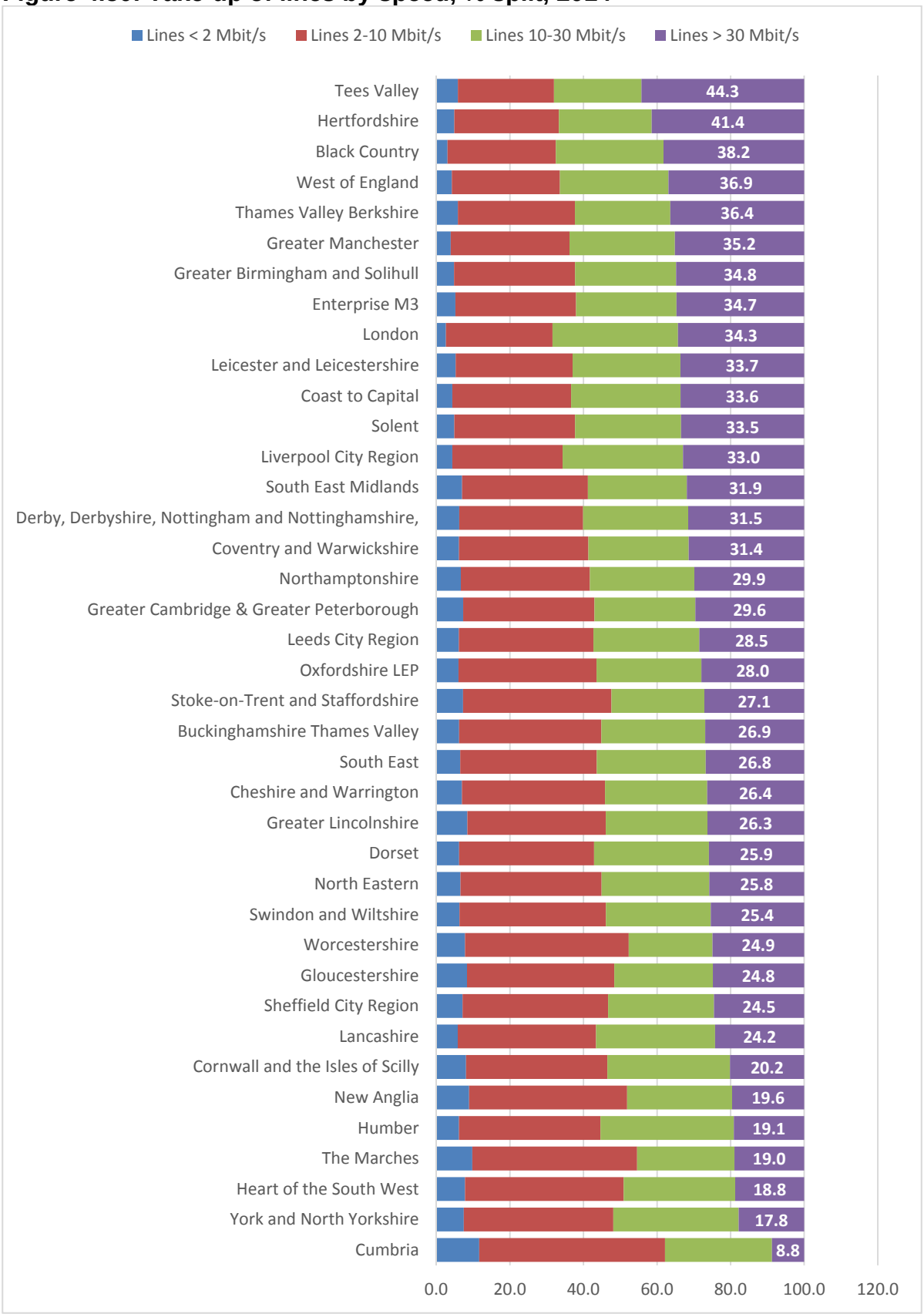
Map 4.22: Broadband, Average Download Speeds Megabits per second, 2014



Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2015. Broadband average download speed data from OFCOM. For a number of LEPs county level data have been apportioned to relevant LEP districts based on an estimated share of premises figure calculated from a household count from the 2011 Census and a business count of local units from the UK Business Counts data set. Map layout by EIUA.

4.195 Figure 4.50 shows the variation in the take up of broadband lines by speed within LEP areas as well as between them. The LEP areas with overall the highest broadband access and speed also have the highest proportionate take up of the fastest line speeds (above 30 megabits per second) within them: Tees Valley and Greater Manchester in the north; Black Country in the midlands; West of England in the south west; Thames Valley Berkshire, Enterprise M3 and London in the south-east and Hertfordshire in eastern England. The LEP area with the highest proportionate share of the fastest line speed, Tees Valley, with a 44% take-up, also has 32% take-up of line speeds below 10 megabits per second. Appendix D7 provides the figures by different line speeds.

Figure 4.50: Take-up of lines by speed, % split, 2014



Source: OFCOM; Notes: For a number of LEP areas county level data have been apportioned to relevant LEP districts based on an estimated share of premises figure calculated from a household count from the 2011 Census and a business count of local units from the UK Business Counts data set.

4.6 Innovation outputs

4.196 We use two datasets for the headline indicators for the 'Innovation outputs' element of the framework – the measurable outputs that are proxies for 'sought-after economic and societal benefits that innovation systems can help secure' (BIS, 2014a):

- Gross Value Added (GVA) per capita and per hour worked as key indicators of economic output and productivity (ONS);
- Key indicators of the self-reported innovation activities of firms from the UK Community Innovation Survey (from analysis by the Enterprise Research Centre at the University of Warwick).

Innovation outputs: GVA per capita and per hour worked

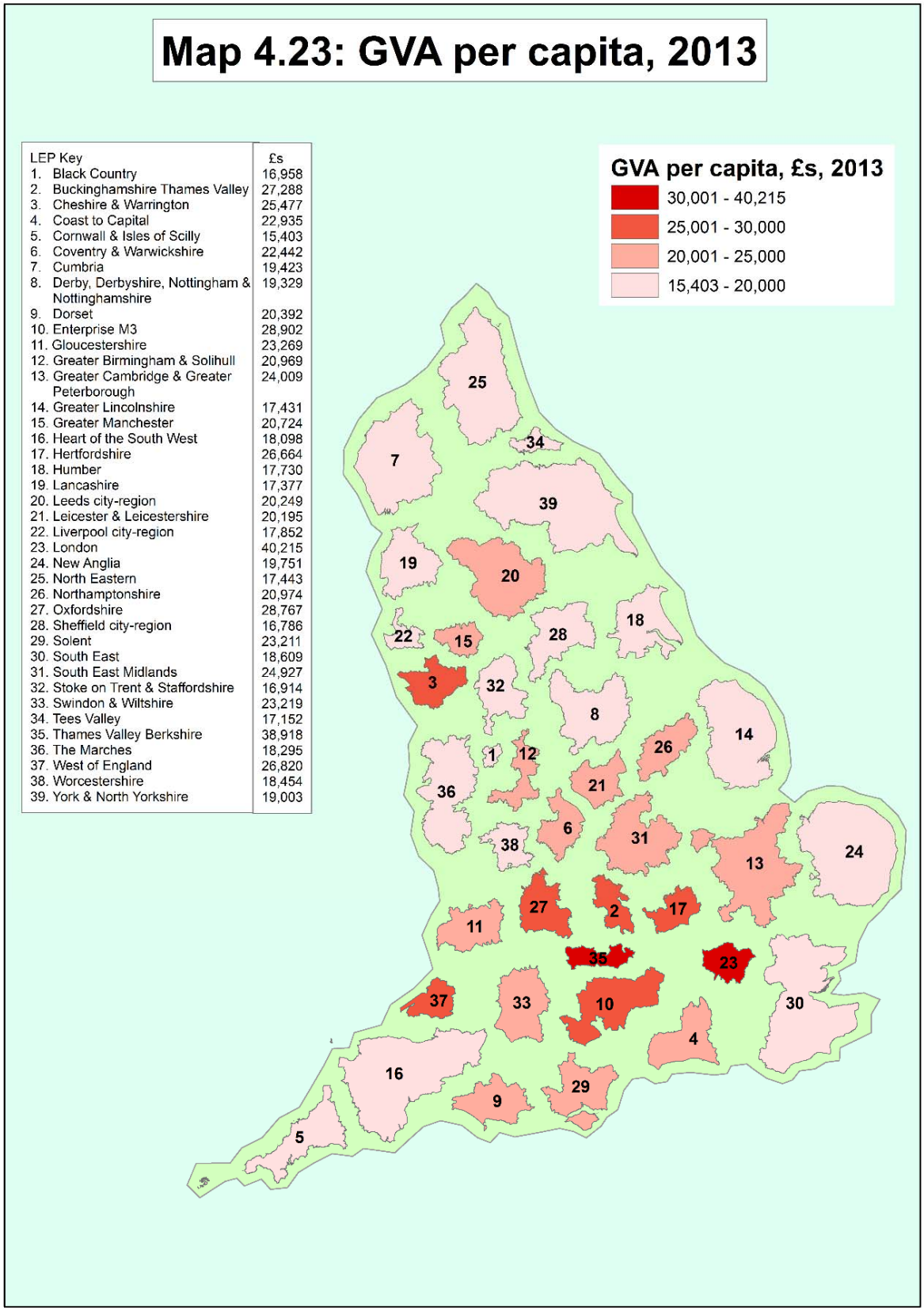
4.197 Map 4.23 shows GVA per capita for LEP areas in 2013, illustrating the marked sub-regional imbalance in economic output across the country. London has the highest figure, £40,215, over two and a half times that of the lowest, Cornwall and the Isles of Scilly LEP area, with its figure of £15,403. The capital, London's GVA per capita is two thirds higher than the figure for England. Rural Cornwall and the Isles of Scilly's GVA per capita is less than two thirds of the England figure.

4.198 Seven LEP areas have GVA per capita levels which are 10% or more higher than the figure for England: London, five of the 'Greater Thames Valley Six' group of LEP areas - Thames Valley Berkshire, Enterprise M3, Oxfordshire, Buckinghamshire Thames Valley and Hertfordshire – and West of England in the south west. There are only two other LEP areas with GVA per capita levels above the England average: third-tier Cheshire and Warrington and South East Midlands, by 6% and 4%, respectively.

4.199 LEP areas with GVA per capita levels between 60% and 75% of the England average are in the north midlands and south west: Liverpool City Region, Humber, North Eastern, Lancashire, Tees Valley and Sheffield City Region in the north, Greater Lincolnshire; Black Country and Stoke-on-Trent and Staffordshire in the midlands; and Heart of the South West and Cornwall and Isles of Scilly in the south west.

Map 4.23: GVA per capita, 2013

LEP Key	£s
1. Black Country	16,958
2. Buckinghamshire Thames Valley	27,288
3. Cheshire & Warrington	25,477
4. Coast to Capital	22,935
5. Cornwall & Isles of Scilly	15,403
6. Coventry & Warwickshire	22,442
7. Cumbria	19,423
8. Derby, Derbyshire, Nottingham & Nottinghamshire	19,329
9. Dorset	20,392
10. Enterprise M3	28,902
11. Gloucestershire	23,269
12. Greater Birmingham & Solihull	20,969
13. Greater Cambridge & Greater Peterborough	24,009
14. Greater Lincolnshire	17,431
15. Greater Manchester	20,724
16. Heart of the South West	18,098
17. Hertfordshire	26,664
18. Humber	17,730
19. Lancashire	17,377
20. Leeds city-region	20,249
21. Leicester & Leicestershire	20,195
22. Liverpool city-region	17,852
23. London	40,215
24. New Anglia	19,751
25. North Eastern	17,443
26. Northamptonshire	20,974
27. Oxfordshire	28,767
28. Sheffield city-region	16,786
29. Solent	23,211
30. South East	18,609
31. South East Midlands	24,927
32. Stoke on Trent & Staffordshire	16,914
33. Swindon & Wiltshire	23,219
34. Tees Valley	17,152
35. Thames Valley Berkshire	38,918
36. The Marches	18,295
37. West of England	26,820
38. Worcestershire	18,454
39. York & North Yorkshire	19,003

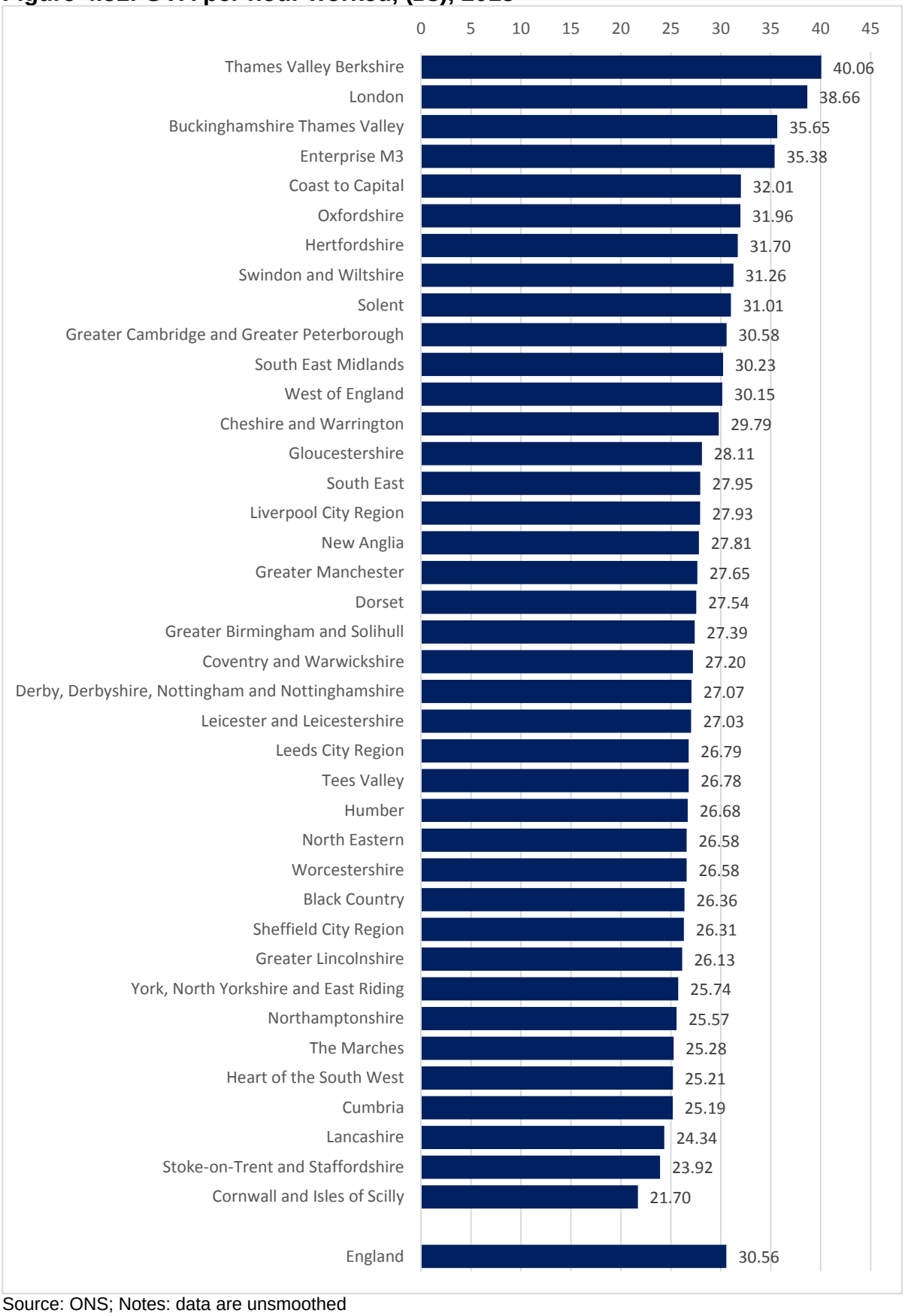


Sources: Boundaries downloaded from the UK Data Service. Contains Ordnance Survey data © Crown copyright and database right 2014. GVA per capita data from ONS. Map layout by EIUA.

4.200 Figure 4.51 gives figures for GVA by hours worked across LEP areas in 2013 to give an indication of relative productivity. The highest figure is in the Thames Valley Berkshire LEP area (£40) just under twice that of the lowest, in rural Cornwall and the Isles of Scilly (£21.70). Four LEP areas have GVA per hour worked figures 10% or more than the England average. All of these are ones with similar relativities for GVA per capita and all are in the London city-region: London, Thames Valley Berkshire, Enterprise M3 and Buckinghamshire Thames Valley.

4.201 Three LEP areas have GVA per hour worked figures between 70% and 80% of the England average: rural Cornwall and Isles of Scilly in the south west, third-tier Stoke-on-Trent and Staffordshire in the west midlands and third-tier Lancashire in the north west.

Figure 4.51: GVA per hour worked, (£s), 2013



Source: ONS; Notes: data are unsmoothed

Innovation outputs: Innovation activities by firm: evidence from the Community Innovation Survey

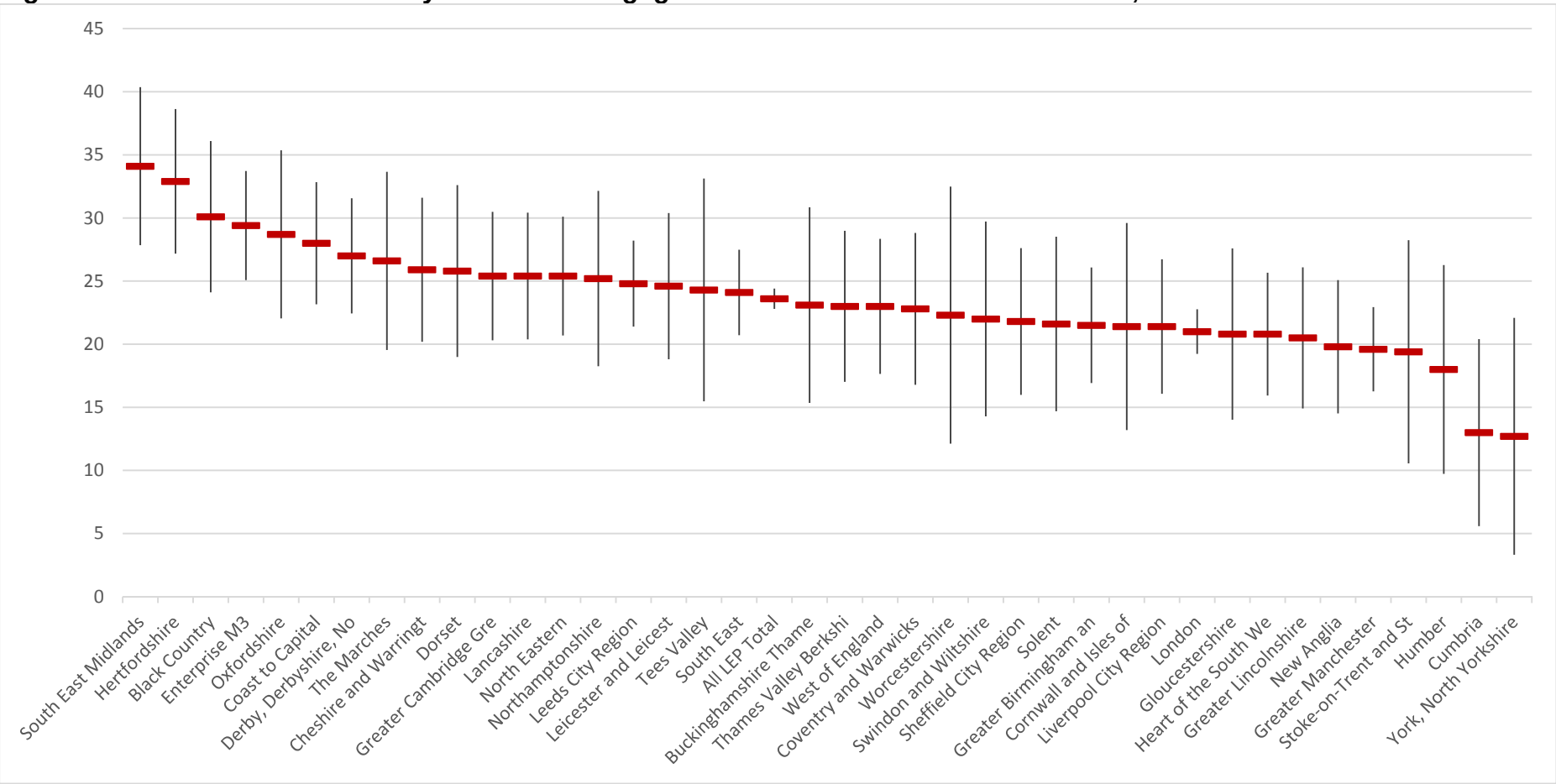
Firms engaged in product and process innovation

4.202 According to data from the UK Innovation Survey, just under a quarter (23.6%) of firms in LEP areas as a whole reported that they were engaged in product or process innovation between 2008 and 2010 (Figure 4.47). The highest figure was in third-tier South East Midlands (34.1%) and the lowest (12.7%) in rural York, North Yorkshire and the East Riding.

4.203 The LEP areas with the highest proportions of firms engaged in product and process innovation (10% higher than LEP average or more) comprise Hertfordshire in eastern England and a mix of midlands and south eastern LEPs: South East Midlands, Black Country, D2N2 and The Marches in the midlands and Enterprise M3, Oxfordshire and Coast to Capital in the south east.

4.204 The LEP areas with the lowest proportions of firms engaged in product and process innovation (10% less than LEP average or more) bring together London with a mix of LEP areas spanning the south west, the midlands, eastern England and the north: Gloucestershire, Heart of the South West in the south west; Greater Lincolnshire and Stoke-on-Trent and Staffordshire in the midlands; New Anglia in eastern England; and Greater Manchester, Humber and Cumbria in the north.

Figure 4.52: UK Innovation Survey: % of firms engaged in Product or Process Innovation, 2008-10



Source: Enterprise Research Centre (ERC) analysis of the UK Innovation Survey 7; Notes: the lines indicate standard errors. Data acknowledgement: The statistical data used here is from the Office of National Statistics (ONS) and is Crown copyright and reproduced with the permission of the controller of HMSO and Queens Printer for Scotland. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. The analysis upon which this paper is based uses research datasets which may not exactly reproduce National Statistics aggregates.

Innovation expenditure as a share of turnover

4.205 Innovation expenditure accounted on average for 2.5% of enterprise turnover for LEP areas a whole between 2008 and 2010 (figure 4.53). The responses ranged from more than twice this figure in Oxfordshire (5.2%) to just 40% of it, in Stoke on Trent and Staffordshire. 14 LEP areas had figures above the LEP average and 25 below it.

4.206 The LEP areas with firms spending 10% or more than the LEP average comprised: Oxfordshire, Solent, Enterprise M3, Thames Valley Berkshire, Coast to Capital and London in the south east; Cumbria and Greater Manchester in the north west; Hertfordshire in eastern England and Northamptonshire in the midlands.

4.207 The LEP areas with the lowest figures - between 40% and 70% of the LEP average – comprised: Stoke-on-Trent and Staffordshire, Greater Lincolnshire and Worcestershire in the midlands; Gloucestershire, Cornwall and the Isles of Scilly and Heart of the South West in the south west and Tees Valley and Humber in the north.

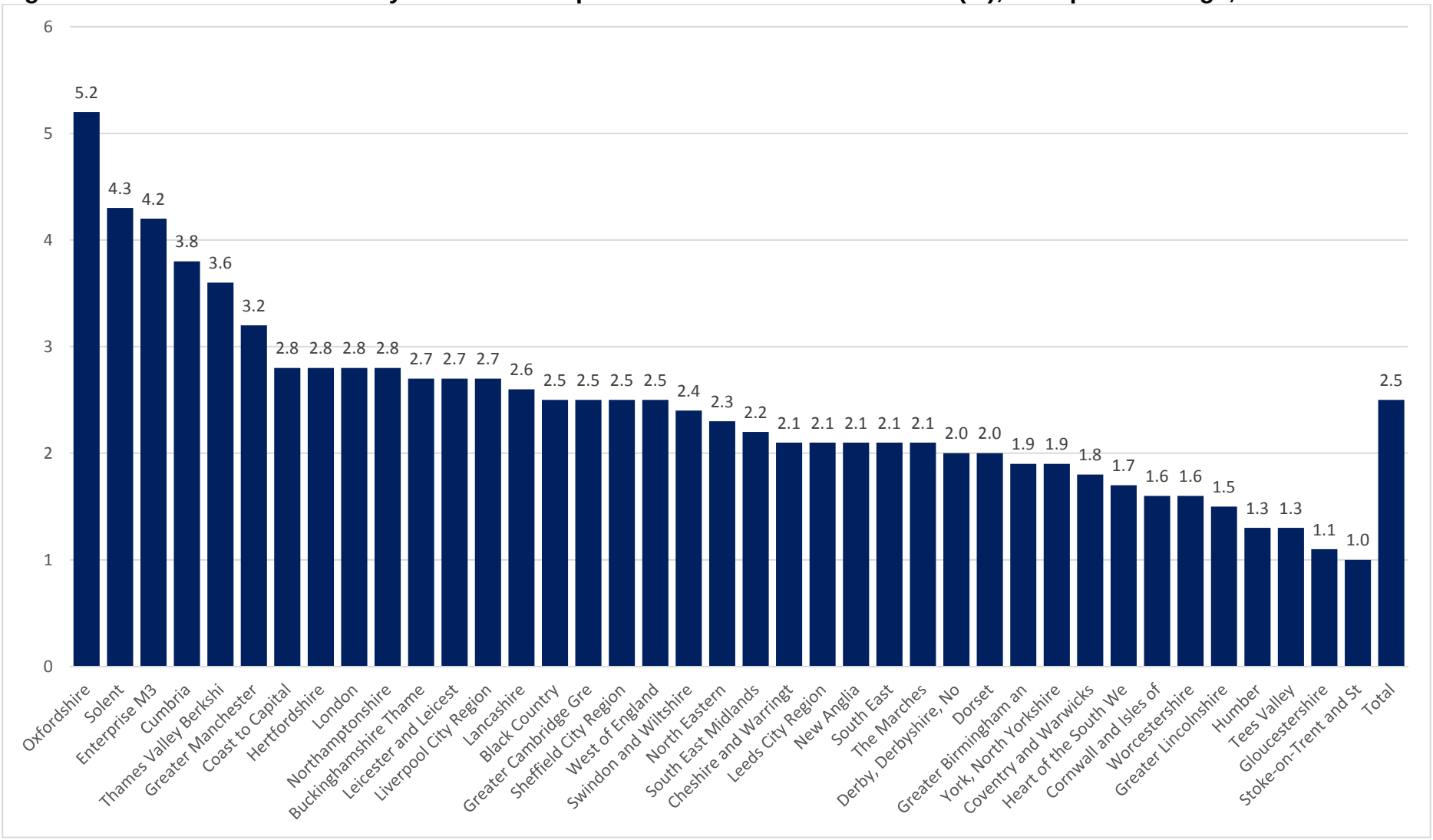
Share of turnover generated by innovative goods/services

4.208 Figure 4.54 shows the firm average of turnover generated by innovative goods/services between 2008 and 2010 by LEP area. The highest reported figure was in Dorset (18.9%), nearly five times that of the lowest, Humber (3.8%).

4.209 Rural Oxfordshire in the south east had the second highest figure (15.9%) but a group of six LEP areas in the north and midlands also reported relatively high figures of 20% or more above the LEP total: second-tier North Eastern, third-tier Tees Valley and second-tier Liverpool City Region in the north; third-tier South East Midlands and second-tier Leicester and Leicestershire in the midlands; and Enterprise M3 in the London city-region in the south east.

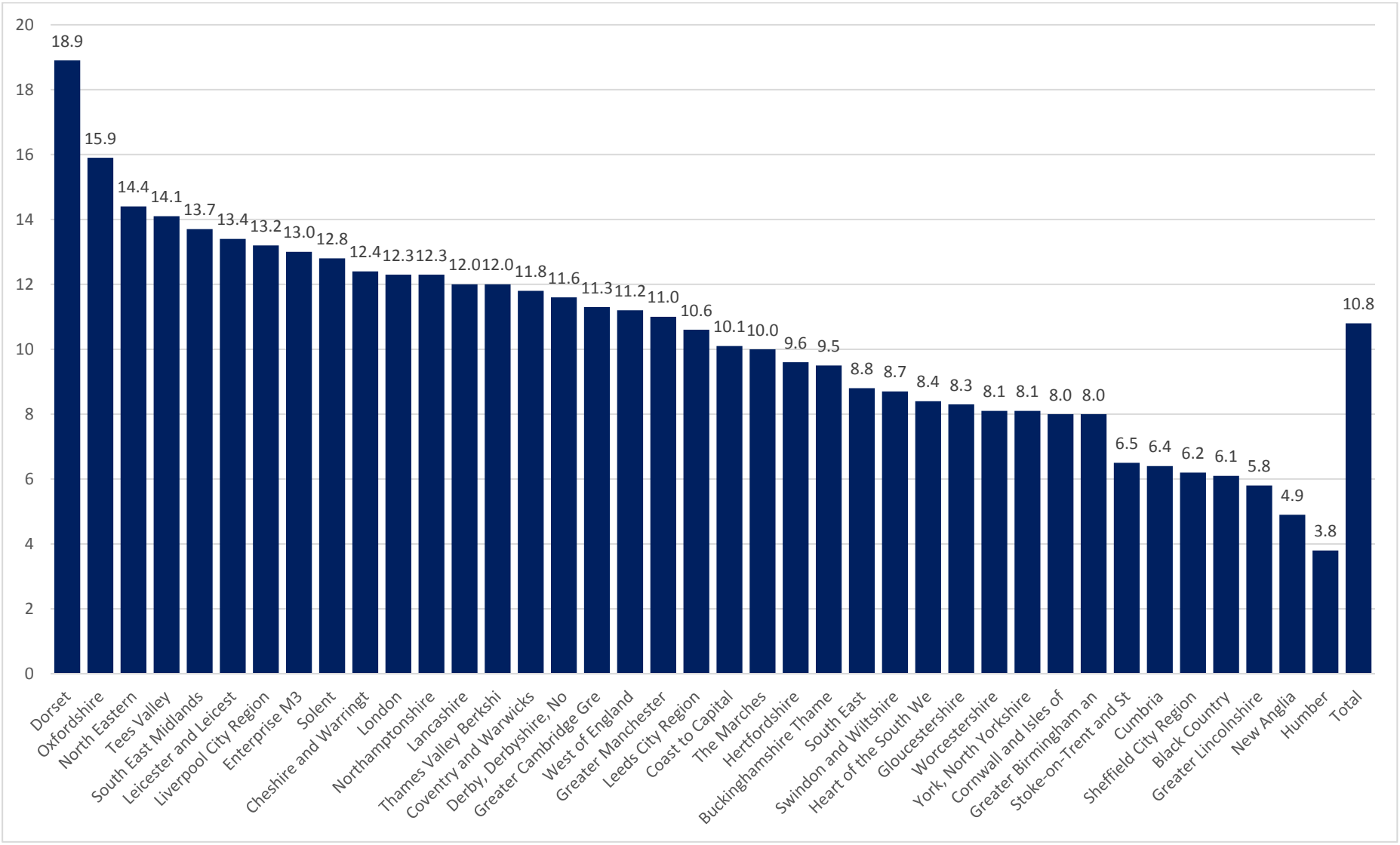
4.210 The Humber figure was just over a third of the LEP total average and the other LEP areas with notably low figures - ranging from 35% to 65% of the total LEP average - were a mix of rural and urban LEP areas in eastern England, the midlands and north: third-tier New Anglia in eastern England; rural Greater Lincolnshire and second-tier Black Country in the midlands; and second-tier Sheffield City Region and rural Cumbria in the north.

Figure 4.53: UK Innovation Survey: Innovation expenditure as a share of turnover (%), enterprise average, 2008-10



Source: Enterprise Research Centre (ERC) analysis of the UK Innovation Survey 7

Figure 4.54: UK Innovation Survey: Share of turnover generated by innovative goods/services (%), enterprise average, 2008-10



Source: Enterprise Research Centre (ERC) analysis of the UK Innovation Survey 7

4.7 The overall picture

4.211 The final element of our work was to consider whether we could draw together the evidence in a meaningful way. We specifically examined whether certain indicators were pivotal in explaining the variance in other indicators and also whether they were related to one another. We did this for two main reasons. We wanted to explore whether there was a statistical basis for grouping together certain indicators in order to produce more summative measures. Secondly, if some indicators proved particularly important innovation factors that might suggest that they be weighted in some way. As a first step we therefore undertook a Principal Component Analysis of 19 individual indicators. This failed to identify any dominant indicators. We then investigated whether there were any correlations between the individual datasets. The detailed results are shown in the matrix chart in Figure 4.55. (The blue squares show areas where there is a good positive correlation between datasets, red squares show areas of good negative correlation and yellow and green squares show where datasets are slightly positively or negatively correlated with each other, respectively). We then simplified the results in Figure 4.56 to assist interpretation.

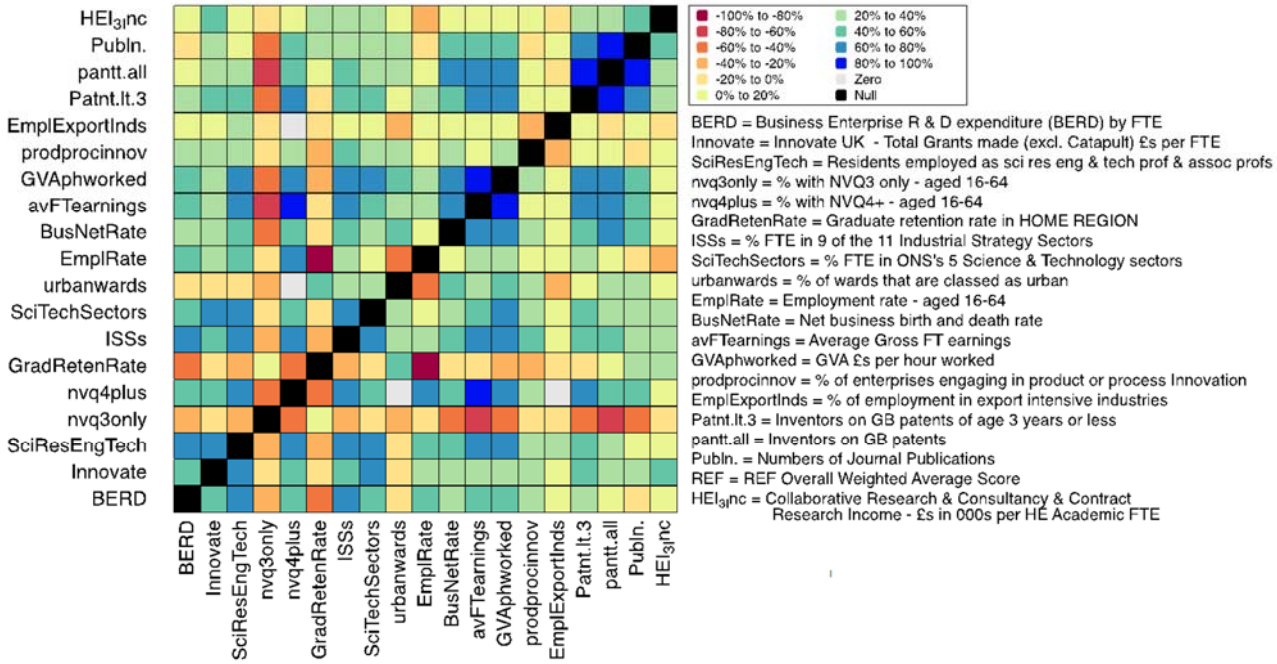
4.212 In terms of positive correlations we discovered that:

1. There is a link between Innovate UK investment and jobs in Science and Technology and the UK Industrial Strategy Sectors, which is to be expected as Innovate UK target excellence in such areas, and also NVQ4 Plus levels, and Average Earnings and GVA per hour worked.
2. There is also a link between NVQ4 plus levels of qualification and earnings, GVA per hour, inventors (patents) and employment in the Science and Technology fields, and employment rates.
3. The business birth rate links to GVA per hour and average earnings.
4. Patenting (or inventor levels) links to the business birth rate, GVA per hour and average earnings.
5. Publications, patents and REF scores are linked.

4.213 Conversely, graduate retention and employment, NVQ3 only and average earnings and NVQ3 only and Inventor numbers (as defined by patents) are negatively correlated to one another. One would expect a relationship between NVQ levels and both earnings and patenting as inventors tend to have higher levels of qualification and higher qualifications are needed for higher paid jobs. However the negative correlation between Graduate Retention and Employment Rates in a LEP is more surprising as one might expect there to be higher employment in areas where there is more graduate retention. This could be explained either by the way in which competition for available jobs plays out in different local economies, differences in graduate employability or the limitations of the data.

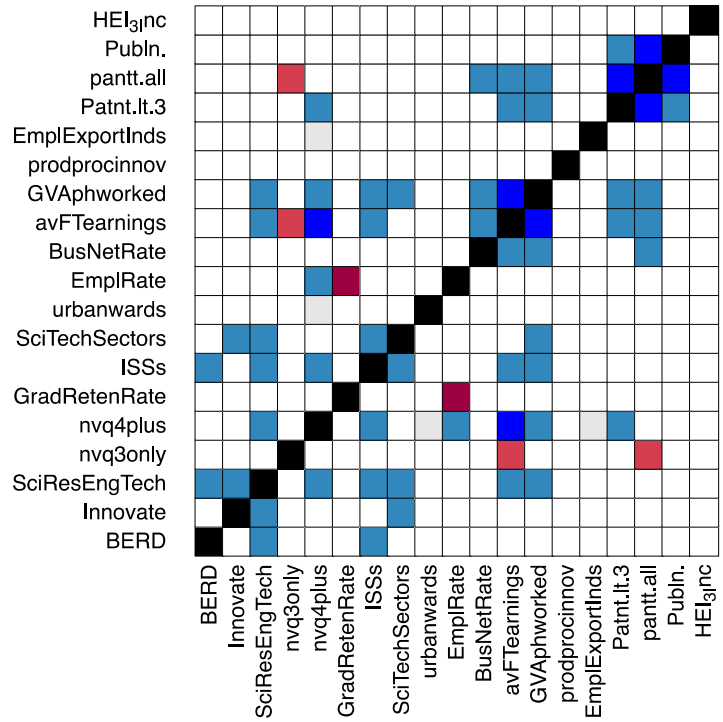
4.214 We drew two main conclusions from this analysis. First there was no prime facie statistical case for combining the indicators in any way given the inconclusive results of the principal components analysis. Second, the correlations suggested that higher level skills, Innovate UK investment and patents were especially important indicators and related to a number of other headline indicators.

Figure 4.55: Correlation Matrix of 19 Datasets



Note: Shading indicates factors that are positively or negatively correlated to each other as indicated by the key. Anything that is between 60 and 100 in either the positive or negative ranges, should be considered to indicate a relationship between the factors.

Figure 4.56: Correlation Matrix of 19 Datasets



Note: For details of the factors, see Figure 4.55. Blue shading indicates that factors that are strongly and positively correlated to each other, whilst red squares indicate those factors that are strongly negatively correlated to each other.

5. Conclusions on LEPs' comparative innovation strengths

5.1 This report presents for the first time a framework and set of indicators for gauging LEP innovation strengths. It pulls together a comprehensive set of supporting data and presents a brief commentary on each indicator. It also contains new analysis of such strengths, especially in terms of research publications and patents.

5.2 However, we would counsel that the assembled body of evidence is used with great care. The set of headline indicators presented only provides a partial view of local comparative strengths owing to:

- The shortage of data at LEP level;
- Caveats and qualifications about available data;
- The absence of measures for some key innovation factors;

5.3 LEPs and partners should therefore in our view be afforded the opportunity to supplement the data with local intelligence. Our summary of LEPs' key strategic documents (Appendix D6) seeks to capture their 'take' and approach to innovation but the context is dynamic and rapidly changing, which is inevitable given the nature of innovation.

5.4 This report has revealed a very varied picture of local innovation strengths. All LEPs have comparative strengths on some elements and indicators. Some are more marked than others. Some of the enabling factors are more spatially concentrated, others more dispersed. For example, Business Research and Development Expenditure is relatively concentrated while Higher Education Research and Development Expenditure is more evenly spread across the country. The same distinction can be drawn between public and private investment generally. Some LEPs have major clusters of innovative firms in related economic sectors while others have niche advantages in highly specialised sectors of the economy. Some sectors such as construction and health are distributed relatively evenly across the country.

5.5 However, it is clear that some LEP areas have more strings to their bow than others as they have strengths across the board. The evidence strongly suggests that some have a more balanced, sustainable innovation system assuming that our more qualitative indicators (e.g. soft mapping of knowledge assets, LEP innovation groups) have captured to a reasonable extent the key characteristics of such systems.

5.6 Echoing wider realities of economic geography, London and the South East dominate in terms of many of the key metrics such as business research and development expenditure, equity and venture capital, many categories of

Innovate UK investment, proportion of people with higher level qualifications and higher order skills in STEM professions, range of innovative sectors and knowledge assets and innovation outputs such as GVA/hour worked and employment rates. On the other hand, midlands and northern innovation strengths in terms of high value manufacturing are clearly evident, as they attract significant Innovate UK investment, such as for the Catapults.

5.7 We end the report by briefly summarising and highlighting which LEPs stand out in terms of the six innovation elements and their constituent headline indicators. For each element we highlight in a table the LEP areas in the top third of the rankings of key indicators. The full rankings of all 39 LEP areas are provided in Appendix E.

Money

5.8 **Business expenditure on R&D** (BERD) per FTE employment is headed by third-tier Coventry and Warwickshire and a mix of third-tier city-region LEP areas and LEP areas in the London city-region. These are joined by rural Oxfordshire, the core second-tier city-region of Derby, Derbyshire, Nottingham and Nottinghamshire and urban-rural Gloucestershire (Table 5.1).

Table 5.1: R&D expenditure – Business Enterprise R & D expenditure (BERD) by FTE, 2013, Highest ranked '1'

Rank	LEP	Region	Classification
1	Coventry and Warwickshire	WM	3rd Tier
2	Hertfordshire	EoE	Lon CR
3	Cheshire and Warrington	NW	3rd Tier
4	Thames Valley Berkshire	SE	Lon CR
5	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
6	Buckinghamshire Thames Valley	SE	Lon CR
7	Enterprise M3	SE	Lon CR
8	Swindon and Wiltshire	SW	3rd Tier
9	Oxfordshire	SE	Rural
10	Solent	SE	3rd Tier
11	Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier
12	New Anglia	EoE	3rd Tier
13	Gloucestershire	SW	Urban-rural

Source: ONS

5.9 A number of LEP areas in the north and midlands (the third tier Tees Valley and Coventry & Warwickshire city-regions and the core second-tier North Eastern and, Sheffield City Regions) have received significant amounts of **Innovate UK funding** (Table 5.2). This distribution is testament to their strengths in advanced manufacturing and the same applies to some south western LEP areas (second-tier West of England and urban-rural Gloucestershire). All LEPs appear to have strengths in at least some of the Great Technologies on the basis of the allocation of the relevant Innovate UK funding streams although south eastern third-tier city-region LEP areas in the golden triangle (Oxfordshire; Greater Cambridge and Greater Peterborough)

have the greatest range of such strengths, with upper rankings in three quarters of the 8 categories.

Table 5.2: Innovate UK grants –Total Grants, £s per FTE, 2010-15, Highest ranked '1'

Rank	LEP	Region	Classification
1	Tees Valley	NE	3rd Tier
2	Coventry and Warwickshire	WM	3rd Tier
3	Oxfordshire	SE	Rural
4	West of England	SW	2nd Tier
5	North Eastern	NE	2nd Tier
6	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
7	Sheffield City Region	YH (part EM)	2nd Tier
8	South East Midlands	EM (part SE & EoE)	3rd Tier
9	Enterprise M3	SE	Lon CR
10	Gloucestershire	SW	Urban-rural
11	London	London	Capital
12	Solent	SE	3rd Tier
13	Leicester and Leicestershire	EM	2nd Tier

Source: Innovate UK

5.10 The capital leads by some distance in terms of access to Regional **Private Equity and Venture Capital** per FTE employment over the period 2011-13. There is a regional hierarchy headed by London and the South East, followed by the North East and North West, then East and West Midlands, Yorkshire and the Humber and finally the South West and East of England. Such regional data can however conceal local strengths in supply of venture capital such as that associated with Cambridge Angels in Greater Cambridge and Greater Peterborough LEP area.

5.11 HMRC regional data on **Research and Development Tax Credits** reveals a different hierarchy. While London and the South East still dominate, West Midlands rates more highly and the North West, North East and Yorkshire and the Humber less so.

Talent

5.12 Mirroring the patterns for R&D expenditure, the highest shares of **'science and technology' jobs** are in a belt of 'hi-tech' LEP areas stretching from the second-tier West of England city-region and third-tier Swindon and Wiltshire in the south west through the London city-region LEP areas of Buckinghamshire Thames Valley, Enterprise M3, Thames Valley Berkshire, rural Oxfordshire and London itself to third-tier Greater Cambridge and Greater Peterborough in the East of England (Table 5.3). Third-tier Cheshire and Warrington and Coventry and Warwickshire have the highest shares in, respectively, the north and Midlands.

Table 5.3: % of all in employment who are in 'science, research, engineering and technology' professions and associated professions, July 2013 – June 2014, Highest ranked '1'

Rank	LEP	Region	Classification
1	Oxfordshire	SE	Rural
2	Thames Valley Berkshire	SE	Lon CR
3	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
4	West of England	SW	2nd Tier
5	Enterprise M3	SE	Lon CR
6	Cheshire and Warrington	NW	3rd Tier
7	Swindon and Wiltshire	SW	3rd Tier
8	Buckinghamshire Thames Valley	SE	Lon CR
9	Hertfordshire	EoE	Lon CR
10	Solent	SE	3rd Tier
11=	Coventry and Warwickshire	WM	3rd Tier
11=	Worcestershire	WM	Urban-rural
13=	Cumbria	NW	Rural
13=	Leicester and Leicestershire	EM	2nd Tier
13=	London	London	Capital

Source: Annual Population Survey

5.13 In terms of the share of the **workforce qualified at NVQ4 and above**, the capital, London, leads followed by the 'Greater Thames Valley 6' cluster of LEP areas: Oxfordshire, Buckinghamshire Thames Valley, Thames Valley Berkshire, Enterprise M3, Hertfordshire and Coast to Capital (Table 5.4). London and LEP areas in the wider London city-region are particularly strong in high-level skills. In the north, third-tier Chester and Warrington and rural York, North Yorkshire and East Riding have above average shares of residents with NVQ4+ qualifications. Conversely, LEPs incorporating largely old industrial areas or rural areas tend to have lower shares of people with high level qualifications and higher order skills in STEM professions and the highest shares of workers with no qualifications.

Table 5.4: % of residents qualified to level 'NVQ 4+', 2013, Highest ranked '1'

Rank	LEP	Region	Classification
1	London	London	Capital
2	Oxfordshire	SE	Rural
3	Buckinghamshire Thames Valley	SE	Lon CR
4	Thames Valley Berkshire	SE	Lon CR
5	Enterprise M3	SE	Lon CR
6	Hertfordshire	EoE	Lon CR
7	Coast to Capital	SE (part London)	Lon CR
8	Cheshire and Warrington	NW	3rd Tier
9	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
10	West of England	SW	2nd Tier
11	York, North Yorkshire and East Riding	YH	Rural
12	Coventry and Warwickshire	WM	3rd Tier
13=	Worcestershire	WM	Urban-rural
13=	Gloucestershire	SW	Urban-rural

Source: Annual Population Survey

5.14 LEP areas in the capital and in the core second-tier city-regions with their large civic universities dominate **Higher Education** and head the ranking in terms of graduates (Table 5.5). This pattern can also be seen in terms specifically of STEM graduates, although LEP areas in third tier city-regions (notably Lancashire and Heart of the South West) also feature (Table 5.6). London LEP area HEIs dominate postgraduate enrolments to an even greater extent than undergraduates and together with the core second-tier city-region LEP areas of Greater Manchester, North Eastern, Greater Birmingham and Solihull and Leeds City Region and rural Oxfordshire account for just over half of all postgraduate enrolments in England. In terms of doctoral degrees in STEM subjects the 'Oxbridge' LEP areas stand out along with the capital and the core second-tier city region LEP areas in the north, midlands and south west and third-tier Solent in the south east (Table 5.7).

Table 5.5: Students graduating with first degrees with honours in HEIs by LEP area, 2013/14

Rank	LEP	Region	Classification
1	London	London	Capital
2	Leeds City Region	Y&H	2nd Tier
3	Greater Manchester	NW	2nd Tier
4	North Eastern	NE	2nd Tier
5	South East	SE	Lon CR
6	Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier
7	Solent	SE	3rd Tier
8=	South East Midlands	EM (part SE & SW)	3rd Tier
8=	Lancashire	NW	3rd Tier
10	West of England	SW	2nd Tier
11=	Greater Birmingham and Solihull	WM	2nd Tier
11=	Sheffield City Region	Y&H (part EM)	2nd Tier
13	Liverpool City Region	NW	2nd Tier

Source: HESA

Table 5.6: Number of STEM first degrees with honours, qualifiers, 2013-14, Highest ranked '1'

Rank	LEP	Region	Classification
1	London	London	Capital
2	Leeds City Region	YH	2nd Tier
3	Greater Manchester	NW	2nd Tier
4	North Eastern	NE	2nd Tier
5	Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier
6	South East	SE (part EoE)	Lon CR
7	Solent	SE	3rd Tier
8	Sheffield City Region	YH (part EM)	2nd Tier
9	Liverpool City Region	NW	2nd Tier
10	West of England	SW	2nd Tier
11	Lancashire	NW	3rd Tier
12	Greater Birmingham and Solihull	WM	2nd Tier
13	Heart of the South West	SW	3rd Tier

Source: HESA

Table 5.7: Number of STEM Doctorates (that meet criteria for a research based award), 2013-14, Highest ranked '1'

Rank	LEP	Region	Classification
1	London	London	Capital
2	Greater Manchester	NW	2nd Tier
3	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
4	Oxfordshire	SE	Rural
5	Leeds City Region	YH	2nd Tier
6	Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier
7	West of England	SW	2nd Tier
8	North Eastern	NE	2nd Tier
9	Sheffield City Region	YH (part EM)	2nd Tier
10	Leicester and Leicestershire	EM	2nd Tier
11	Greater Birmingham and Solihull	WM	2nd Tier
12	Solent	SE	3rd Tier
13	Liverpool City Region	NW	2nd Tier

Source: HESA

5.15 The highest **graduate retention** rates - above 75% - are in the capital and second- and third-tier city-region LEP areas in the north and midlands: Liverpool City Region, Black Country, Greater Manchester, Lancashire, North Eastern, Tees Valley and Greater Birmingham and Solihull. The lowest are in LEP areas in the more rural eastern England and midlands and wider London city-region area: Hertfordshire (the lowest at 50%) in eastern England; Northamptonshire, South East Midlands, Greater Lincolnshire and The Marches in the midlands; along with Buckinghamshire Thames Valley and Enterprise M3 in the south east. However, it is noticeable that, while the retention rates for graduates domiciled in the south east and eastern England regions of the innovative 'Greater Thames Valley Six' LEP areas are relatively low, a relatively high proportion of their graduates are domiciled in the London region after graduation. There is a notably significant 'London effect' drawing students away from these LEP areas.

5.16 It should be noted that LEPs' comparative position can change depending on the metric selected. If one allows for the relative size for example of some knowledge assets such as universities, some punch above, others below their weight.

Knowledge Assets

5.17 The capital, London, is in a league of its own in terms of volume of **research publications** owing to its sheer number of HEIs. And there are clear clusters of LEP areas based on the presence, unsurprisingly, of research intensive universities. After London, the big producers are a mix of LEP areas in third-

tier city-regions across the country and a strong group of LEP areas in second-tier city-regions in the north, midlands and south west (Table 5.8). There is some divergence from the best fit relationship line between number of research organisations and volume of output with some LEPs performing better in terms of this proxy for productivity than one might expect, others less so. Interestingly London LEP area's performance is average in this respect, which highlights the importance of LEP areas around the country which perform strongly in terms of productivity. Southern LEP areas tend to be stronger in both publication output and impact than those in the north, with the notable exceptions of Leeds City Region and Greater Manchester. If one drills down and investigates particular research domains, the above clusters again emerge but other important pockets of excellence in many LEP areas become apparent. Some LEP areas produce small numbers of publications but of high impact (e.g. environmental engineering in rural Cornwall and the Isles of Scilly).

Table 5.8: Total Publication Output – ("past 2 years"), Highest ranked '1'

Rank	LEP	Region	Classification
1	London	London	Capital
2	Leeds City Region	YH	2nd Tier
3	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
4	Solent	SE	3rd Tier
5	Oxfordshire	SE	Rural
6	West of England	SW	2nd Tier
7	Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier
8	North Eastern	NE	2nd Tier
9	Greater Manchester	NW	2nd Tier
10	Coventry and Warwickshire	WM	3rd Tier
11	Heart of the South West	SW	3rd Tier
12	Greater Birmingham and Solihull	WM	2nd Tier
13	Leicester and Leicestershire	EM	2nd Tier

Source: Scopus, PubMed and institutional repositories

5.18 Certain LEP areas consistently have the most **patents** (measured in terms of address of inventors). Looking just at 5-10 year old active patents Greater Cambridge & Greater Peterborough clearly dominates followed by the London city-region LEP areas of Thames Valley Berkshire, Enterprise M3 and South East, rural Oxfordshire and the Solent third-tier city-region LEP area also in the south east (Table 5.9). Third-tier Cheshire & Warrington and second-tier Leeds City Region are the only northern LEP areas in the top third of the ranking. Although there is patenting activity in Greater Manchester and Leeds City Region LEP areas, there is generally a relative paucity of inventors in northern cities. LEP areas with research intensive universities tend to have greater numbers of inventors. However, there is a notable cohort of mainly but

not exclusively southern LEP areas without such institutions that have patenting rates that are consistent with those that do have them (Buckinghamshire and Thames Valley and Hertfordshire in the London city-region; rural Dorset and Hertfordshire and third-tier Swindon and Wiltshire in the south west; and third-tier Stoke-on-Trent and Staffordshire in the midlands). This indicates that the extent of patenting in those LEP areas is not that dependent on the presence of publicly-funded HEIs. We found little evidence of cross-over between relatively high concentrations of employment in innovation sectors and research activity, suggesting that industries are able to choose with whom they work irrespective of location. We did encounter a mismatch between good performance in terms of research publications and that of patenting particularly in a number of northern LEP areas.

Table 5.9: Inventor population (with patents 5 to 10 years old), (up to October 2014), Highest ranked '1'

Rank	LEP	Region	Classification
1	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
2	Thames Valley Berkshire	SE	Lon CR
3	Enterprise M3	SE	Lon CR
4	South East	SE (part EoE)	Lon CR
5	Oxfordshire	SE	Rural
6	Solent	SE	3rd Tier
7	West of England	SW	2nd Tier
8	South East Midlands	EM (part SE & EoE)	3rd Tier
9	Cheshire and Warrington	NW	3rd Tier
10	Leeds City Region	YH	2nd Tier
11	Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier
12	Swindon and Wiltshire	SW	3rd Tier
13	Coast to Capital	SE (part London)	Lon CR

Source: USPTO and Espacenet

5.19 Turning to **knowledge exchange and collaboration** between HEIs, businesses and the wider community, it is no surprise that the capital reported the highest total income for this source given the concentration of HEIs in it. It accounted for a quarter of the annual average income for the three years 2010/11 to 2012/13. HEIs in the capital and in 4 other LEP areas - Oxfordshire, Greater Cambridge and Greater Peterborough, Leeds City Region and Greater Manchester - together accounted for half of the total. Interestingly the picture changes when the figures are standardised by number of academic staff to allow for size. The capital, London, slips down while Hertfordshire moves into first place. Some of the LEP areas in the core second-tier city-regions also slip down the ranking, notably Greater Manchester, Derby, Derbyshire, Nottingham and Nottinghamshire and West

of England. LEP areas rating highly in this respect include core second-tier city-region LEP areas in the midlands and north (Coventry and Warwickshire, Leicester and Leicestershire, North Eastern, Liverpool and Leeds), third-tier Coventry and Warwickshire in the midlands and rural York, North Yorkshire and East Riding in the north (Table 5.10).

Table 5.10: HE-BCI – Total Reported Income per HE Academic FTE - 2010/11 - 2012/13 - 3 year average, Highest ranked '1'

Rank	LEP	Region	Classification
1	Hertfordshire	EoE	Lon CR
2	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
3	Oxfordshire	SE	Rural
4	Coventry and Warwickshire	WM	3rd Tier
5	York, North Yorkshire and East Riding	YH	Rural
6	Liverpool City Region	NW	2nd Tier
7	Leicester and Leicestershire	EM	2nd Tier
8	North Eastern	NE	2nd Tier
9	Leeds City Region	YH	2nd Tier
10	London	London	Capital
11	Solent	SE	3rd Tier
12	Black Country	WM	2nd Tier
13	The Marches	WM	Rural

Source: HE-BCI

Structures and incentives

5.20 BBSD/IDBR **industrial strategy data** shows that the degree to which industries cluster and concentrate varies a great deal by sector. Comparative strengths in agri-tech are unsurprisingly found in the rural LEP areas. In terms of oil and gas, coastal LEP areas such as Humber, Tees Valley and Greater Lincolnshire stand out while Cumbria especially but also Derby, Derbyshire, Nottingham and Nottinghamshire, Lancashire, Gloucestershire and Cheshire and Warrington LEPs are relatively strong in the nuclear sector. Turning to the three Industrial Strategy manufacturing sectors, there are aerospace clusters in LEP areas in the north (Lancashire, Cheshire & Warrington), the midlands (Derby, Derbyshire, Nottingham & Nottinghamshire) the south west (West of England, Heart of the South West, and Gloucestershire) and the south east (Solent). Automotive clusters occur are widespread and occur in LEP areas in the midlands (Coventry & Warwickshire, Greater Birmingham and Solihull, Worcestershire, The Marches), the north (Cheshire & Warrington, North Eastern, Humber), the south west (Swindon & Wiltshire) and the south east (Oxfordshire). Hertfordshire, Swindon and Wiltshire, Oxfordshire, Humber and Solent LEPs contain life sciences clusters. The most pronounced information economy sector clusters are to be found in the London city-region LEP areas - Thames Valley Berkshire, Enterprise M3 and Buckinghamshire Thames Valley. By contrast, the construction sector, together with the

education and professional and business services sectors are relatively evenly distributed throughout the country.

5.21 Table 5.11 shows those LEPs with across the board strengths in the Government's 9 industrial strategy sectors for which comparable data is available. London city-region and the South East and other golden triangle LEP areas (Oxfordshire and Greater Cambridge & Greater Peterborough) constitute well over half of the highest ranked LEP areas with a couple of midlands LEP second tier areas and one northern third tier LEP area occupying the remaining top placings.

Table 5.11: % of FTE in 9 of 11 Industrial Strategy Sectors, 2012, Highest ranked '1'

Rank	LEP	Region	Classification
1	Thames Valley Berkshire	SE	Lon CR
2	Oxfordshire	SE	Rural
3	Hertfordshire	EoE	Lon CR
4	Enterprise M3	SE	Lon CR
5	Coventry and Warwickshire	WM	3rd Tier
6	London	London	Capital
7	Buckinghamshire Thames Valley	SE	Lon CR
8	Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier
9	Cheshire and Warrington	NW	3rd Tier
10	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
11	West of England	SW	2nd Tier
12	Solent	SE	3rd Tier
13	Greater Birmingham and Solihull	WM	2nd Tier

Source: Enterprise Research Centre

5.22 Data for ONS's **science and technology sector** classification reveal both science and technology-based manufacturing and services clusters. The capital, London, has a quarter of digital technologies employment in the sector and if one adds the 5 south eastern LEP areas (Thames Valley Berkshire, Enterprise M3, South East, Solent and Coast to Capital) and two midlands LEPs (South East Midlands and Derby, Derbyshire, Nottingham and Nottinghamshire) they account for 60% of all employment. Such industries are particularly important in employment terms to Thames Valley Berkshire and Enterprise M3 LEPs. Life sciences and healthcare industries are particularly found in London and large second-tier city-region LEP areas (Leeds City Region, Greater Manchester, North Eastern, Derby, Derbyshire, Nottingham and Nottinghamshire, Greater Birmingham and Solihull, Sheffield City Region, Heart of the South West and Liverpool City Region), along with Coast to Capital in the London city-region. These sectors especially matter to northern LEP areas (Tees Valley, North Eastern, Liverpool City Region, Sheffield City region) and also the Heart of the South West LEP area. London

heavily dominates publishing and broadcasting with its 45% share of total FTE employment but this sector is also important to three London city-region LEP areas (Thames Valley Berkshire, South East and Enterprise M3) and two northern second-tier city region LEPs (Leeds City Region and Greater Manchester). Other scientific/technological manufacture is more evenly spread with 11 LEPs accounting for just over half of employment in the sector: Derby, Derbyshire, Nottingham and Nottinghamshire followed by a group of second-tier city LEPs (Leeds City Region, North Eastern, Greater Birmingham and Solihull and Greater Manchester), Lancashire, the South West and Solent, Heart of the South West, South East Midlands and Greater Cambridge & Greater Peterborough. Highest employment shares and location quotients tend to be found in northern and midland LEPs (Coventry and Warwickshire, Lancashire, North Eastern, Humber, Worcestershire, and Derby, Derbyshire, Nottingham and Nottinghamshire) and also Gloucestershire in the south west. The capital once again is the largest single employer in the other scientific/ technological services sector and together with two northern second-tier city LEP regions (Leeds City Region and Greater Manchester), two London city-region LEPs (South East and Coast to Capital), rural Oxfordshire and third tier Greater Cambridge and Greater Peterborough account for half of employment in the sector. Selective south eastern (Oxfordshire), eastern (Greater Cambridge & Greater Peterborough, south western (West of England) and midland (Coventry and Warwickshire) LEP areas stand out in terms of this sector's share of total employment.

5.23 In terms of strength across the five science and technology sectors, rural Oxfordshire heads the rankings, followed by Thames Valley Berkshire in the London city-region, second-tier West of England, third-tier Greater Cambridge and Greater Peterborough and Enterprise M3 in the London city-region (Table 5.12). LEP areas in the south together account for almost half of the top third of LEP areas in the rankings. However, some south western (second-tier West of England, as already noted and urban-rural Gloucestershire), northern (second-tier North Eastern and Liverpool City Region and third-tier Tees Valley) and midlands (third-tier Coventry and Warwickshire) LEP areas also feature.

Table 5.12: % of FTE in the 5 Science & Technology Sectors, ONS definitions, 2013, Highest ranked '1'

Rank	LEP	Region	Classification
1	Oxfordshire	SE	Rural
2	Thames Valley Berkshire	SE	Lon CR
3	West of England	SW	2nd Tier
4	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
5	Enterprise M3	SE	Lon CR
6	Solent	SE	3rd Tier
7	North Eastern	NE	2nd Tier
8	Gloucestershire	SW	Urban-rural
9	Coventry and Warwickshire	WM	3rd Tier

10	Tees Valley	NE	3rd Tier
11	Liverpool City Region	NW	2nd Tier
12	London	London	Capital
13	Buckinghamshire Thames Valley	SE	Lon CR

Source: Business Register and Employment Survey

5.24 Turning to **LEPs' and partners' supportiveness of innovation**, innovation featured to a varying extent in their strategic documents, accounting for between 10% and 40% of their total ERDF allocation. More than a half of all LEPs have dedicated innovation groupings. South east and east of England LEPs such as Greater Cambridge and Peterborough, Hertfordshire, Oxfordshire, Thames Valley Berkshire particularly prioritised ERDF investment in innovation though Coventry and Warwickshire LEP and many other LEPs also plan to invest a significant portion of their ERDF allocation on innovation. LEPs appearing to have across the board strengths in terms of governance and networking included: Enterprise M3, Leeds City Region, North Eastern, Tees Valley, Greater Cambridge and Peterborough, Hertfordshire, New Anglia, and also, most probably, London, Liverpool City Region and Cornwall and the Isles of Scilly.

Broader environment

5.25 Southern LEP areas, with the notable exception of London, occupy the upper echelons of **employment rates** rankings with LEP areas in eastern England (Hertfordshire, Greater Cambridge and Greater Peterborough), the south west (Gloucestershire, Swindon and Wiltshire), the south east (Buckinghamshire Thames Valley, Thames Valley Berkshire, Enterprise M3, Oxfordshire, Coast to Capital) all featuring (Table 5.13). Many midlands LEP areas also register (South East Midlands, Worcestershire, Northamptonshire, The Marches).

Table 5.13: Employment rates, 16-64s, October 2013 – September 2014, Highest ranked '1'

Rank	LEP	Region	Classification
1	Hertfordshire	EoE	Lon CR
2	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
3	Gloucestershire	SW	Urban-rural
4=	Buckinghamshire Thames Valley	SE	Lon CR
4=	Thames Valley Berkshire	SE	Lon CR
6	Swindon and Wiltshire	SW	3rd Tier
7	Worcestershire	WM	Urban-rural
8	Enterprise M3	SE	Lon CR
9	Northamptonshire	EM	3rd Tier
10	Oxfordshire	SE	Rural
11	Coast to Capital	SE (part London)	Lon CR
12	South East Midlands	EM (part SE & EoE)	3rd Tier
13	The Marches	WM	Rural

Source: Annual Population Survey

5.26 Using **mean gross full time earnings** as a proxy for local demand conditions, London leads by some margin followed by five of the 'Greater Thames Valley Six' LEP areas (Thames Valley Berkshire, Enterprise M3, Buckinghamshire Thames Valley, Oxfordshire, and Hertfordshire). Interestingly, these are the only LEP areas with earnings above English average. Third tier regions in the south west (West of England, Gloucestershire), south east (Solent), east (Greater Cambridge and Greater Peterborough) and midlands (South East Midlands, Coventry and Warwickshire) occupy most of the other leading places in the rankings (Table 5.14).

Table 5.14: Mean gross full time earnings, workplace-based, 2014, Highest ranked '1'

Rank	LEP	Region	Classification
1	London	London	Capital
2	Thames Valley Berkshire	SE	Lon CR
3	Enterprise M3	SE	Lon CR
4	Buckinghamshire Thames Valley	SE	Lon CR
5	Oxfordshire	SE	Rural
6	Hertfordshire	EoE	Lon CR
7	West of England	SW	2nd Tier
8	Coast to Capital	SE (part London)	Lon CR
9	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
10	Solent	SE	3rd Tier
11	South East Midlands	EM (part SE & EoE)	3rd Tier
12	Coventry and Warwickshire	WM	3rd Tier
13	Gloucestershire	SW	Urban-rural

Source: Annual Survey of Hours and Earnings

5.27 In terms of **entrepreneurial activity**, the capital had the biggest net growth in enterprises followed by Thames Valley Berkshire in the wider London city-region (Table 5.15). Others in the top third of business growth performance include Enterprise M3 and Hertfordshire in the London city-region, second-tier West of England, Liverpool and Greater Manchester and rural Oxfordshire. These are joined by a group of third tier LEP areas located in different parts of England: South East Midlands and Northamptonshire in the east midlands, Tees Valley in the north east, Swindon and Wiltshire in the south west and Cheshire & Warrington in the north west.

Table 5.15: Net Business Birth and Death Rate, 2012, Highest ranked '1'

Rank	LEP	Region	Classification
1	London	London	Capital
2	Thames Valley Berkshire	SE	Lon CR
3	South East Midlands	EM (part SE & EoE)	3rd Tier
4	Northamptonshire	EM	3rd Tier
5	Tees Valley	NE	3rd Tier
6	West of England	SW	2nd Tier
7	Cheshire and Warrington	NW	3rd Tier
8	Liverpool City Region	NW	2nd Tier
9	Swindon and Wiltshire	SW	3rd Tier
10	Enterprise M3	SE	Lon CR
11	Hertfordshire	EoE	Lon CR
12	Oxfordshire	SE	Rural
13	Greater Manchester	NW	2nd Tier

Source: ONS Business Demography

5.28 LEP areas which are rated most highly in terms of their **quality of life** and as good places to live tend to be in the south east and eastern England (Enterprise M3, Buckinghamshire Thames Valley, Greater Cambridge and Greater Peterborough, Thames Valley Berkshire, Oxfordshire, Coast to Capital, Hertfordshire, Solent, South East). However a number of LEP areas in the midlands (South East Midlands, Worcestershire, Coventry and Warwickshire) together with York, North Yorkshire and East Riding also do comparatively well in the rankings (Table 5.16).

Table 5.16: Halifax Quality of Life Survey, 2014, ranking based on median rank of each LEP's constituent Local Authorities, Highest ranked '1'

Rank	LEP	Region	Classification
1	Enterprise M3	SE	Lon CR
2	Buckinghamshire Thames Valley	SE	Lon CR
3	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
4	Thames Valley Berkshire	SE	Lon CR
5	Oxfordshire	SE	Rural
6	York, North Yorkshire and East Riding	YH	Rural
7	South East Midlands	EM (part SE & EoE)	3rd Tier
8	Coast to Capital	SE (part London)	Lon CR
9	Worcestershire	WM	Urban-rural
10	Hertfordshire	EoE	Lon CR
11	Solent	SE	3rd Tier
12	South East	SE (part EoE)	Lon CR
13	Coventry and Warwickshire	WM	3rd Tier

Source: Halifax

5.29 LEP areas with the lowest **travel to work times** fall into two main categories. They tend to be either rural LEP areas throughout England (Cumbria, Cornwall and Isles of Scilly, The Marches, Greater Lincolnshire, York, North Yorkshire and East Riding) or, with the exception of second-tier North Eastern, third tier city regions located outside London and the south east and other major conurbations (Tees Valley, Heart of the South West, Humber, Coventry and Warwickshire, Lancashire and Stoke-on Trent (Table 5.17).

Table 5.17: Travel to work times, 2012, Lowest is ranked '1'

Rank	LEP	Region	Classification
1	Cumbria	NW	Rural
2	Tees Valley	NE	3rd Tier
3	Cornwall and Isles of Scilly	SW	Rural
4	The Marches	WM	Rural
5	Heart of the South West	SW	3rd Tier
6	Humber	YH	3rd Tier
7	Greater Lincolnshire	EM (part YH)	Rural
8	Coventry and Warwickshire	WM	3rd Tier
9	North Eastern	NE	2nd Tier
10	York, North Yorkshire and East Riding	YH	Rural
11	Gloucestershire	SW	Urban-rural
12	Lancashire	NW	3rd Tier
13	Stoke-on-Trent and Staffordshire	WM	3rd Tier

Source: Annual Population Survey

Table 5.18: Broadband Super-Fast Broadband Availability, 2014, Highest is ranked '1'

Rank	LEP	Region	Classification
1	Black Country	WM	2nd Tier
2	Greater Manchester	NW	2nd Tier
3	Tees Valley	NE	3rd Tier
4	London	London	Capital
5	Hertfordshire	EoE	Lon CR
6	Greater Birmingham and Solihull	WM	2nd Tier
7	Coast to Capital	SE (part London)	Lon CR
8	Liverpool City Region	NW	2nd Tier
9	Thames Valley Berkshire	SE	Lon CR
10	Enterprise M3	SE	Lon CR
11	West of England	SW	2nd Tier
12	Coventry and Warwickshire	WM	3rd Tier
13	Solent	SE	3rd Tier

Source: OFCOM

Table 5.19: Broadband, Average Download Speed, 2014, Highest is ranked '1'

Rank	LEP	Region	Classification
1	Tees Valley	NE	3rd Tier
2	Hertfordshire	EoE	Lon CR
3	Black Country	WM	2nd Tier
4	West of England	SW	2nd Tier
5	London	London	Capital
6	Greater Manchester	NW	2nd Tier
7	Enterprise M3	SE	Lon CR
8	Thames Valley Berkshire	SE	Lon CR
9	Liverpool City Region	NW	2nd Tier
10	Solent	SE	3rd Tier
11	Coast to Capital	SE (part London)	Lon CR
12	Greater Birmingham and Solihull	WM	2nd Tier
13	Leicester and Leicestershire	EM	2nd Tier

Source: OFCOM

Table 5.20: Take-up of lines > 30 Mbit/s (number of lines) by Local Authority - % of households/premises, 2014

Rank	LEP	Region	Classification
1	Tees Valley	NE	3rd Tier
2	Hertfordshire	EoE	Lon CR
3	Black Country	WM	2nd Tier
4	West of England	SW	2nd Tier
5	Thames Valley Berkshire	SE	Lon CR
6	Greater Manchester	NW	2nd Tier
7	Greater Birmingham and Solihull	WM	2nd Tier
8	Enterprise M3	SE	Lon CR
9	London	London	Capital
10	Leicester and Leicestershire	EM	2nd Tier
11	Coast to Capital	SE (part London)	Lon CR
12	Solent	SE	3rd Tier
13	Liverpool City Region	NW	2nd Tier

Source: OFCOM

5.30 The LEP areas with particularly high **broadband access and speed** are in the northern and midlands and south western second- and third-tier city regions and in London and parts of its wider city-region. Low broadband access and speed tends to be most of an issue in LEPs located in rural areas in the north, midlands, south west and eastern England. **Take up** of the fastest line speeds (above 30 megabits per second) is highest in LEP areas with the highest broadband access and speed (Tables 5.18-5.20).

Innovation outputs

5.31 We used **GVA/capita** as a measure of relative economic weight. London dominates in this respect, followed by five of the 'Greater Thames Valley Six' group of LEP areas - Thames Valley Berkshire, Enterprise M3, Oxfordshire, Buckinghamshire Thames Valley and Hertfordshire – and the West of England. A number of third tier city regions in the south east, east of England, south west and north west also ranked highly (Table 5.21). The picture in terms of productivity (**GVA per hours worked**) is broadly similar except that Coast to Capital in the London city-region features much more prominently on this measure.

5.32 The LEP areas with the highest proportions of **firms engaged in product and process innovation** other than Hertfordshire in eastern England were either in midlands (South East Midlands, Black Country, D2N2, The Marches) or the south east (Enterprise M3, Oxfordshire and Coast to Capital). A number of third tier city regions in the north west, north east, south west and eastern England also rank comparatively highly (Table 5.23).

5.33 LEP areas containing firms with the highest levels of **innovation expenditure in relation to turnover** were concentrated in the south east (Oxfordshire, Solent, Enterprise M3, Thames Valley Berkshire, Coast to Capital and London) but also found elsewhere in the north west (Cumbria and Greater Manchester), eastern England (Hertfordshire) and midlands (Northamptonshire).

5.34 Dorset then Oxfordshire contained firms generating the most **turnover from innovative goods and services** but a group of LEP areas in the north (North Eastern, Tees Valley and Liverpool City Region) and midlands (South East Midlands and Leicester and Leicestershire) and south east (Enterprise M3 also reported relatively high figures.

Table 5.21: GVA per capita, Highest is ranked '1'

Rank	LEP	Region	Classification
1	London	London	Capital
2	Thames Valley Berkshire	SE	Lon CR
3	Enterprise M3	SE	Lon CR
4	Oxfordshire	SE	Rural
5	Buckinghamshire Thames Valley	SE	Lon CR
6	West of England	SW	2nd Tier
7	Hertfordshire	EoE	Lon CR
8	Cheshire and Warrington	NW	3rd Tier
9	South East Midlands	EM (part SE & EoE)	3rd Tier
10	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
11	Gloucestershire	SW	Urban-rural
12	Swindon and Wiltshire	SW	3rd Tier
13	Solent	SE	3rd Tier

Source: ONS

Table 5.22: GVA per hour worked, £s 2013, Highest is ranked '1'

Rank	LEP	Region	Classification
1	Thames Valley Berkshire	SE	Lon CR
2	London	London	Capital
3	Buckinghamshire Thames Valley	SE	Lon CR
4	Enterprise M3	SE	Lon CR
5	Coast to Capital	SE (part London)	Lon CR
6	Oxfordshire	SE	Rural
7	Hertfordshire	EoE	Lon CR
8	Swindon and Wiltshire	SW	3rd Tier
9	Solent	SE	3rd Tier
10	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
11	South East Midlands	EM (part SE & EoE)	3rd Tier
12	West of England	SW	2nd Tier
13	Cheshire and Warrington	NW	3rd Tier

Source: ONS

Table 5.23: UKCIS – Product or Process Innovation, % of enterprises, 2008-10

Rank	LEP	Region	Classification
1	South East Midlands	EM (part SE & EoE)	3rd Tier
2	Hertfordshire	EoE	Lon CR
3	Black Country	WM	2nd Tier
4	Enterprise M3	SE	Lon CR
5	Oxfordshire	SE	Rural
6	Coast to Capital	SE (part London)	Lon CR
7	Derby, Derbyshire, Nottingham and Nottinghamshire	EM	2nd Tier
8	The Marches	WM	Rural
9	Cheshire and Warrington	NW	3rd Tier
10	Dorset	SW	3rd Tier
11	Greater Cambridge & Greater Peterborough	EoE (part EM)	3rd Tier
12	Lancashire	NW	3rd Tier
13	North Eastern	NE	2nd Tier

Source: Enterprise Research Centre (ERC) analysis of the UK Innovation Survey 7

6. Avenues for further research

6.1 This report represents the first comprehensive attempt to analyse innovation at the LEP level by corralling existing sources of data and adding in new analysis. Time and resource issues constrained the scope and depth of the research. In this chapter we discuss ways in which the analysis could be extended in future.

Trend data

6.2 One of the main drawbacks of this research is that it presents only a snapshot picture. With some of the indicators we discovered substantial year on year variation. Although this problem will be rectified to some extent in time as indicators are updated, a shorter term option would be to incorporate more historic information in the data repository. This would provide a better indication of direction of travel. Most of the headline indicators (with the exception of Innovate UK funding datasets) say more about present performance than trajectory and future potential. One LEP suggested that another way of getting at potential would be to measure the appetite for innovation by, for example, looking at the volume of funding applications rather than just success in securing funding. The feasibility for collecting this kind of information could be explored with relevant funding bodies.

Qualitative data

6.3 This report has featured mainly quantitative data. There is significant scope to extend qualitative mapping of LEPs' innovation strengths. Possibilities include:

- Collecting data on both the membership of key innovation hubs/networks based within each LEP and attendance at their events which would give some indication of their significance and drawing power. Repeating this exercise would reveal whether such hubs are gaining or lessening in influence over time.
- Mapping which organisations collaborate with the growing number of Catapult Centres.
- Investigating the nature and extent of representation on key innovation groupings in each LEP would reveal more about the extent of networking, innovation groups and hubs' relative standing. This would also point to the extent to which their members either operate in sectoral silos or across such boundaries because they sit on innovation groupings in different key industrial sectors and Great Technologies.

LEP Geography

6.4 Some data are only available at the regional level at the moment which limits their usefulness to LEPs (e.g. venture capital; research and development tax credits; graduate retention). The feasibility of making such data available at LEP level should be explored with the relevant bodies. ONS's ability to produce LEP-level Business Enterprises Research and Development data shows that it can be done.

Extending the analysis

6.5 Given additional time and resource, there would be considerable scope to enhance the sophistication of some of the metrics. For example, identification of all the authors of research publications not just the leads would give a fuller picture of where research is taking place and also the extent of research collaboration in particular domains.

Drilling down

6.6 This report has only presented highly aggregated data for some indicators (e.g. industrial structure; publications and patents). If necessary, we could produce far more detailed data which would reveal niche strengths that are concealed by broad-brush metrics. For example, LEP publications data could be made available by sub-domain rather than simply presenting each LEP's overall research strengths. Publications and patents data are post-coded which would enable them to be reworked and presented for any geography (e.g. local authority district, regions etc.).

Data presentation

6.7 The data in this report could be presented and analysed very differently depending upon the purpose of the exercise. This report is structured around the headline indicators and compares LEPs in those terms as that was our brief. Individual LEPs might prefer an across the board assessment of their own comparative strengths by either reworking the data themselves or requesting this of BIS or the authors. Individual LEPs may also wish to benchmark themselves against respective national averages and also the performance of selected peers rather than all other LEPs.

6.8 If all the data were spatially referenced and tagged with a full descriptor this would permit deployment of visualisation techniques which would enable the selection, at the press of a button, of relevant knowledge assets (e.g. related centres of expertise). This would also enable individual LEPs to detect where there are related strengths elsewhere.

Strategy verification

6.9 Another potentially valuable piece of work for LEPs might be to investigate whether the evidence suggests there is the necessary knowledge economy expertise and innovation capacity to support particular aspects of a LEP's Smart Specialisation

Strategy or innovation plan. Some LEP plans present a menu of innovation assets, activities and candidates for further investment but do not make clear on what basis they will allocate funding. Such an exercise would entail comparing the key messages from the data analysis with LEPs' innovation policies and programmes. The outcome could be that a LEP will seek support to develop a particular capability in order to deliver that stream of a plan. Alternatively, the evidence might strongly suggest that the LEP concerned will not be able to deliver that part of their plan in a realistic timescale. Once it is clear which innovation streams from a LEP can be supported by local research and/or clinical expertise and other knowledge assets, a brief market analysis could be carried out to highlight the estimated global value of the relevant markets and give a forecast compound annual growth rate from third party data where available. Such information could be secured from industry reports or failing that relevant company performance data. Such an exercise could indicate to LEPs how to prioritise interventions over time. There may, for example, be active investment market interest in some innovative technologies, declining appetite for others and more modest but nevertheless increasing interest in yet other technologies.

Informing investment decisions

6.10 The data assembled in this report could be analysed in such a way as to inform investment decisions not just by LEPs but also national bodies such as BIS and Innovate UK.

Supplementary indicators

6.11 In the course of conducting the research, we identified a second string of supplementary indicators which could provide additional colour and useful intelligence to individual LEPs, especially if they were to score highly on those indicators. LEPs suggested yet further indicators in the consultation exercise. One option would be to extend our principal component analysis so as to incorporate both the headline and secondary indicators to establish the degree to which the headline indicators capture the variance in the secondary indicators.

Data sharing

6.12 The data consultation revealed that some LEPs are conducting their own innovation benchmarking exercises. A few are collecting primary data on innovation. This expertise and intelligence could be pooled by launching an open access website. Such data sharing could form a useful adjunct to the LEP innovation data repository provided quality control mechanisms are put in place.

Gaps in understanding

6.13 Some important aspects of the innovation environment such as 'openness,' 'buzz', appeal to young talented workers and international as well as domestic students have proved difficult to pin down, define and measure and need further investigation. Available quality of life measures are too broad in scope to capture these factors. Most quality of life metrics consist of a basket of indicators, some of

which feature elsewhere in the innovation framework, resulting in double counting. Possible proxies include: internet presence of key innovation groups, support organisations, internet cafés/'café society.'

6.14 Demand-side measures of innovation at LEP level if not generally are less well developed than supply-side ones. The most comprehensive data on innovation is to be found in the UKCIS but in some instances sample sizes at the LEP level are too small for the data to be reliable. Either sample sizes should be boosted at LEP level or separate surveys should be developed to deal with this data deficit. One LEP consultee pressed for the re-instatement of the UK innovation scorecard.

6.15 We were also struck by mismatches between what both the literature review and LEP consultation exercise revealed as important drivers of innovation and the available data at LEP level. There are at present a shortage of good hard and soft indicators which gauge the role of leadership and the health and strength of 'entrepreneurial systems.' Different forms of social media are significantly affecting many aspects of the innovation process (e.g. crowd funding; innovator: user interfaces) but at present such influences are neither fully understood nor systematically measured. Some LEPs contain innovative public sector and voluntary and community sector organisations but at present both social and public sector innovation are not properly captured by either quantitative or qualitative indicators.

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