

University-SME engagement: the geography of connectivity across England and the effects on innovation

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Executive Summary

1. This report investigates two issues: the extent of university-small and medium-sized enterprises (SME) interaction in the UK and the impact of that interaction on innovation outcomes in SMEs. The report provides new information on the extent of higher education institution (HEI) interaction with the SME sector and how that level of activity could be increased if universities were able to match the best performance in their group within a previously established typology.
2. Drawing on data from the Higher Education-Business and Community Interaction survey (HE-BCI) and the Business Structures Database (BSD) we profile the geographic pattern of SME-university interaction across the 39 Local Enterprise Partnership (LEP) areas of England. Data from the UK Innovation Survey (UKIS) is used to estimate the effect on innovation where SMEs do interact with universities.

HEI-SME interaction

3. Comparing information on the number of research, consultancy and training contracts with SMEs reported by HEIs in England with the overall population of SMEs provides an indication of the penetration or concentration of the HEI sector into this potential market. We find that:
 - HEIs are undertaking one research contract for every 231 SMEs in England (with five to 250 employees)
 - HEIs reported one consultancy contract for every 9.4 SMEs in England;
 - HEIs reported one facilities and equipment (F&E) contract for every 27.69 SMEs in England.
4. These proportions vary widely however between LEP areas depending on the presence of HEIs in the locality and their level of engagement with the SME sector. For example, in terms of research contracts the highest concentration levels were recorded in Leicester and Leicestershire LEP area (1:39.2 SMEs) with the lowest in Bucks, Thames Valley (1:5,129 SMEs).
5. To illustrate the potential gains from spreading best practice in university-SME engagement we calculate the number of potential contracts which would be taking place if each university was matching the upper quartile limit performance within its cluster using a typology developed as part of a previous evaluation of knowledge exchange funding. This suggests, for example, a potential increase in the number of contract research engagements from 1,936 to 2,357 – or a move from 1:231 (i.e. one contract to 231 SMEs) to 1:189.

Driving SME innovation

6. Our econometric analysis suggests that small firms collaborating with UK universities as part of their innovation activity are on average 9.4-17.3 percentage points more likely to introduce new-to-the-market innovations. This rises to 37.9 percentage points where small firms are collaborating with international universities. Interestingly, where medium-sized firms (with 50 plus employees) collaborate with universities the

estimated effects on the probability of introducing new-to-the-market innovations are positive but not statistically significant.

7. Our analysis suggests there is considerable potential for HEIs generally to raise the level of SME-university interaction with gains to both parties. For universities there is the potential to expand the value of contract income; for small firms in particular there are substantial gains in terms of new-to-the-market innovation. Our results suggest that the innovation benefits to medium-sized firms are smaller.
8. HEI engagement with the SME sector varies substantially between LEP areas. Small firms in some areas are therefore missing out on the potential benefits of an HEI link. It may also be interesting to consider how collaboration might be stimulated between small firms and international universities, collaboration which has a particularly strong innovation effect.

Section 1: Introduction

This report investigates two issues: the extent of university-small and medium-sized enterprise (SME) interaction in the UK and the impact of that interaction on innovation outcomes in SMEs. Drawing on data from the Higher Education-Business and Community Interaction survey (HE-BCI) and the Business Structures Database (BSD) the first section of the report profiles the geographic pattern of SME-university interaction across the 39 Local Enterprise Partnership (LEP) areas of England. Significant variation is evident between areas but the overall picture is of the relatively low proportion of the SME population with which universities are currently engaging.

The second element of the report uses data from the UK Innovation Survey (UKIS) to estimate the effect on innovation where SMEs do interact with higher education institutions (HEIs). University partnerships prove highly significant, particularly in increasing the probability that small firms with ten to 49 employees are able to introduce new-to-the-market innovations in products or services.

Taken together these two results suggest a lost opportunity. Existing levels of SME-university interaction are relatively low; increasing levels of co-operation would help to increase small firms' innovation outputs with positive implications for growth and productivity.

The report is divided into two main sections. Section 2 provides a detailed description and some interpretation of a series of metrics profiling the level of university-SME interaction across England; detailed tables are included in Annex 1. Section 3 provides an overview of the econometric analysis of the contribution of university collaboration to SMEs' innovation activity; detailed results are provided in Annex 4.

Section 2: SME-university engagement - local SME metrics to inform HEIs

2.1 Introduction

In this section we focus on profiling the reported levels of university-SME business engagement across English LEP areas. Following a brief introduction to the data sources used (Section 2.2) our analysis is divided into four parts:

- Section 2.3: HEI development priorities at a LEP area level;
- Section 2.4: HEI knowledge exchange activity with SMEs by LEP area;
- Section 2.5: Normalising university-SME engagement across LEP areas by controlling for the number of SMEs in each LEP area;
- Section 2.6: Estimating average and best practice LEP area HEI-SME engagement.

2.2 Data sources

The metrics reported in this section are based on two main datasets: the HE-BCI survey and the BSD which provides information on the size and sectoral composition of the SME population. HE-BCI data was provided by the Higher Education Funding Council for England (HEFCE) for the purposes of this analysis while the BSD was accessed through the UK Secure Data Service. In calculating the performance metrics we also take into account university size and the 'cluster' to which individual HEIs belong (see Section 2.6).

2.2.1 The Higher Education-Business and Community Interaction Survey (HE-BCI)

The HE-BCI survey is the main source of information on knowledge exchange activities in UK universities and is collected by the Higher Education Statistics Agency (HESA)¹. The 2013/14 HE-BCI survey is the 14th year of this mandatory survey of all UK universities and therefore provides a comprehensive profile of engagement activities. The survey focuses on 'specific interactions with external partners, such as contract and collaborative research, consultancy, continuing professional development and intellectual property, rather than attempting to assess the entire contribution of higher education institutions throughout their teaching and research activities'². Data from the HE-BCI survey is used directly to profile the reported levels of university-SME business engagement, and subsequently as part of the examination of how university-business engagement influences the probability of business innovation.

One potentially significant issue with the levels of HEI-business interaction reflected in the HE-BCI data is the influence of European Union (EU) regeneration funding. This is likely to increase the relative level of interaction in specific areas where EU funding is concentrated. Due to the administrative burden it would place on universities responding to the HE-BCI survey no split between EU-funded and other activity is available.

2.2.2 The Business Structure Database (BSD)

The BSD represents the business register for all firms registered for VAT and/or PAYE in the UK, and is essentially a collection of annual snapshots of the Inter-Departmental Business Register (IDBR), the administrative database of business records held by the Office of National Statistics (ONS). The BSD contains approximately two million records annually and represents the snapshot of the IDBR taken at a date in March. Data on the IDBR (and hence BSD) are sourced from the VAT and PAYE records of firms as well as from other ONS surveys and include mainly turnover and employment variables.

¹ https://www.hesa.ac.uk/index.php?option=com_studrec&Itemid=232&mnl=14032

² <http://www.hefce.ac.uk/pubs/year/2014/201410/#d.en.87367>

Two versions of the BSD are produced: one at firm level and one at local unit level. The firm-level version contains one record per firm and includes employment, turnover, birth, death, sector (Standard Industrial Classification (SIC) code), and postcode variables. Importantly, the postcode variable relates to the location of the firm's head office in the UK thus all of the firm's employment (and turnover) is recorded at this location in the database regardless of where the actual employment (or turnover) is located. This is not an issue for most firms in the UK as they are single-plant firms; however it becomes an issue for firms with multiple locations, particularly if they are spread throughout the country. In these cases analysis at a geographical level becomes difficult.

The local unit version of the BSD solves this issue, in that it contains one record per local unit of the firm (otherwise known as a plant, industrial site or office). The postcode for each local unit represents its actual location so firms with multiple sites are represented on the database at each of the locations. Geographical analysis is more accurate using this version of the database as employment is recorded at its exact location. The local unit version of the BSD contains almost exactly the same variables as the firm-level version, with one key exception, that of turnover, which is excluded. As a result any geographical analysis containing turnover data must be done using the firm-level version.

The Enterprise Research Centre (ERC) have put together the annual snapshots of the BSD to produce a longitudinal dataset covering the 1997-2014 period. The dataset is restricted to the private sector and includes employer enterprises only, that is, firms with at least one employee. Birth and death variables have also been re-created, with birth regarded as the first year in which a firm records an employee. It is this dataset which is used to examine the concentration of HEI knowledge exchange activities relative to the local (LEP) geographical context in which they are located.

2.2.3 HEIs and Local Enterprise Partnership areas

To profile the reported levels of university-SME business engagement, analysis is conducted at the level of the LEP area. In some LEPs this means that a number of HEIs are undertaking knowledge exchange activities while for others there is only one or a few HEIs. All English LEPs have one or more HEI with the exception of Swindon LEP area and therefore Swindon is excluded from the results. A full list of HEIs located in each LEP area is reported in Annex 2.

HEI-business and community interaction activity is allocated to the main campus of the HEI. In four cases the main campus covers two LEP areas and therefore the values recorded for these HEIs are reported for both LEPs. HEIs and LEP areas to which this applies are:

The University of Northampton:	Northamptonshire LEP and South East Midland LEP
The University of York:	York and North Yorkshire LEP and Leeds City Region LEP
The University of Winchester:	Solent LEP and Enterprise M3 LEP
York St John University:	York and North Yorkshire LEP and Leeds City Region LEP

Values recorded for these HEIs are reported for both LEP areas. Where totals or averages are shown at the bottom of data tables these have been adjusted to remove the double counting, hence totals shown will not equal the sum of the numbers above.

Throughout the analysis the definition of SMEs is that used by HESA in the HE-BCI survey. SMEs are classified as enterprises which:

- employ fewer than 250 employees worldwide (including partners and executive directors), and
- have either an annual turnover not exceeding 50m euros, or an annual balance sheet total not exceeding 43m euros, and
- conforms to the following independence criteria:

An enterprise is considered independent unless 25% or more of the capital or of the voting rights is owned by an enterprise falling outside the definition of an SME whichever may apply, or jointly by several such enterprises. (This ceiling may be exceeded if the enterprise is held by public investment corporations, venture capital companies or organisational investors, provided no control is exercised either individually or jointly, or if the capital is spread in such a way that it is not possible to determine by whom it is held). SMEs include micro, small and medium enterprises, and sole traders³.

Metrics on knowledge exchange activity draw on Section B of the HE-BCI survey for 2013-14. It should be noted that while HEIs report the scale of each of these activities, the geography of the SME partners is not defined. In other words, HEIs report only the extent of knowledge exchange that they have conducted with SMEs, with no account of where these SMEs are located. However, prior research⁴ has demonstrated that where SMEs cooperate with universities for the purposes of innovation this tends to be restricted by distance, meaning that most SME interactions will occur with nearby HEIs.

2.3 HEIs' development priorities by LEP area

Here, the question being examined is: 'What do HEIs perceive as their main contributions to economic development?'⁵ This is of interest as it allows us to analyse how HEI priorities vary across LEP areas. For example some may place much greater emphasis on working with SMEs or meeting local skills needs than in other LEP areas. This therefore provides a supply side perspective on the channels through which HEIs identify their wider economic impact and the identification of disparities in these priorities across LEPs. The different channels that we examine include (i) graduate retention in local region, (ii) support for SMEs, (iii) research collaboration with industry, (iv) management development, and (v) meeting regional skills needs.

Obviously where an LEP area has more than one university then there is a greater likelihood of a broader range of development priorities being reported for the LEP. In our reporting we highlight only where a specific development priority is identified in the LEP area irrespective of the number of HEIs in the LEP area which are specifying that priority.

Metric	Development priorities of HEIs by LEP area
Source	Table A1.1
Definition	Data here are derived from Section A, Question 1 of the HE-BCI survey: Q1. In which areas do you see your HEI as a whole making the greatest contribution to economic development?
Remarks	Indicators reported in this section focus on the key development areas

³ See

https://www.hesa.ac.uk/index.php?option=com_studrec&task=show_file&mnf=14032&href=HEBCI_B_Table_1.html

⁴ Hewitt-Dundas, N. 2013 "The role of proximity in University-business cooperation for innovation." *Journal of Technology Transfer*, 36, 2, 93-115.

⁵ Economic development is defined as the development of economic wealth of regions for the well-being of their inhabitants, including both wealth creation and social development or quality of life for the community. The emphasis is on external impact (outside the HEI), however such activities are also likely to support the development of teaching and research missions. (HE-BCI questionnaire guidance, <https://www.hesa.ac.uk/component/content/article?id=2228>)

identified by HEIs to support local economic development and SMEs. HEIs were asked in the HE-BCI survey to rank the importance of 16 channels through which they could contribute to economic development. They then stated the three most important from this list. These three key indicators are used here to assess their development priorities.

In Table A1.1 shading is used to indicate where a development priority was identified by at least one HEI in the LEP area. Five of the 16 development priorities are examined here⁶. These five priorities were selected as being most relevant to efforts to promote the development of local SMEs.

The most commonly cited development priority across the LEP areas was to support SMEs with this being reported in 26 of the 38 LEPs⁷. This was followed by efforts by HEIs to meet regional skills needs (20 LEPs), followed by efforts to ensure graduate retention in the local region (15 LEPs), undertaking research collaboration with industry (nine LEPs) and management development (five LEPs).

This local profile may however over-estimate the extent to which these development priorities were identified by HEIs. For example, although supporting SMEs was identified in HEIs across 68.4% of LEP areas, as a proportion of HEIs, this was only identified by 31.8% of HEIs. Similarly, meeting regional skills needs was only reported by 23.3% of HEIs across England, 16.3% for graduate retention in the local region, 7.8% for research collaboration and similarly, 7.8% for management development efforts.

It is interesting to note that no statistical correlation was found between the probability of supporting SMEs and research collaboration efforts. This is likely to reflect the nature of knowledge exchange with SMEs, most of which are unable to engage in research intensive activities. Instead research collaboration efforts are undertaken mainly with large enterprises.

This table demonstrates the significant variability in development across the LEPs. It is worth noting that in four LEP areas none of the development priorities examined here was identified by HEIs: Greater Cambridge and Greater Peterborough, Hertfordshire, Sheffield City Region and The Marches. In these LEPs other priorities were noted outside those included here.

⁶ The full list of development priorities included in the survey were as follows: widening participation/access, graduate retention in local region, knowledge exchange, supporting small and medium-sized enterprises, helping with student and graduate enterprises, provision of incubator support, attracting inward investment to the region, support for community development, developing local partnerships, management development, meeting regional skills needs, meeting national skills needs, commercialisation (e.g. spin-off activity/licensing) and facilitating networks.

⁷ Swindon LEP is excluded throughout the analysis due to the absence of an HEI.

2.4 HEI knowledge exchange activity with SMEs by LEP area

This group of metrics reflects levels of knowledge exchange by HEIs with SMEs across each of the LEP areas. The channels through which SMEs engage with HEIs include: (i) contract research contracts, (ii) consultancy contracts, (iii) the use of HEI facilities and provision of equipment-related services, (iv) continuing professional development and continuing education (CPD and CE), (v) sale of licenses (software and non-software) and (vi) other market exchanges involving the transfer of intellectual property (IP). Our objective here is to profile the geographic pattern of each SME engagement channel across LEP areas rather than focussing on the contrasting levels of, say, contract management and consultancy in any specific LEP area⁸.

Metric	HEI Contract Research Contracts with SMEs by LEP area
Source	Table A1.2.1
Definition⁹	Contract research is undertaken to meet the specific research needs of external partners. This excludes grant income from research councils or other collaborative research income. This metric measures only the number of contract research contracts and total value of contract research income from engagement with SMEs.
Remarks	<p>The number and value of contract research contracts undertaken by HEIs with SMEs varied markedly across the LEPs. In one LEP area no contracts were reported (Cheshire and Warrington) while in seven LEP areas more than 100 were reported in 2013-14. The highest performing region was London with 303 contract research contracts with SMEs and the highest value from contract research contracts was also recorded for London LEP area at £8,668k. The total number of all contract research contracts with SMEs in 2013-14 across the LEP areas was 1,936, equivalent to £31,446k.</p> <p>The average value of contract research contracts with SMEs is also reported in this table. This suggests that in some LEP areas, such as London, despite high performance in the total number and value of contracts, the average value is slightly lower (£28.61k) than in some other LEP areas, e.g. Lancashire at £30k and Coast to Capital at £35.42k per contract research contract. On average, across the LEPs, the average contract research contract with SMEs was worth £16.24k.</p>
Metric	HEI Consultancy Contracts with SMEs by LEP area
Source	Table A1.2.2
Definition	Consultancy is defined as the provision of expert advice and work, which, while it may involve a high degree of analysis, measurement or testing, is crucially dependent on a high degree of intellectual input from the organisation to the client (commercial or non-commercial)

⁸ This type of comparison is perhaps best done at the level of the individual HEI rather than the LEP area, the majority of which include more than one HEI.

⁹ For this and all other knowledge exchange activities, definitions are those used in the HE-BCI survey: see

https://www.hesa.ac.uk/index.php?option=com_studrec&task=show_file&mdl=13031&href=HEBCI_B_Table_2.html

without the creation of new knowledge. Consultancy may be carried out either by academic staff or by members of staff who are not on academic contracts, such as senior university managers or administrative/support staff.

Values presented are for the number and value of consultancy contracts undertaken by HEIs with SMEs and reported for each LEP area.

Remarks

The total number of consultancy contracts with SMEs reported by English HEIs in 2013-14 was 47,281. This equated to £54,521k with the average consultancy contract being relatively small at only £1.15k. Variation is found across the LEP areas with York and North Yorkshire reporting only seven consultancy contracts by its HEIs with SMEs. For Cumbria, while 66 consultancy contracts with SMEs were reported, the value of these contracts was not provided by the HEIs and this is recorded as 'na' in the table.

Liverpool City Region recorded the highest number and value of consultancy contracts by HEIs at 15,102 contracts worth £10,284k; however, on average these contracts were smaller than the English average i.e. £0.68k as compared to £1.15k. The South East is an outlier in terms of the average value of consultancy contracts with SMEs. Here, 112 contracts were reported, equivalent to £7,131k suggesting an average contract value of £63.67k. This is extremely high with the next highest average value of consultancy contracts with SMEs being £18.94k in Greater Lincolnshire.

Metric

HEI Facilities and Equipment (F&E) Services with SMEs by LEP area

Source

Table A1.2.3

Definition

HEIs may generate income from the use by external individuals and organisations of their physical academic resources. In collecting this data, HESA outline examples of these services to *include*:

- aerospace company use of HEI's wind tunnel,
- media company use of digital media suite,
- community theatre use of stage and studio space.

Yet, services *excluded* from this category would include:

- use of F&E by another HEI,
- simple trading activities, such as the commercial hire of conference facilities that could be obtained from another non-HE provider,
- academic conferences.

This metric presents the number of F&E services as well as the value of these services from SMEs. This information, collected for each HEI is reported at the level of the LEP area.

Remarks

This is a very diverse metric covering a broad array of possible

activities provided by HEIs to SMEs. However, across the English LEP areas, the total number of F&E services provided to SMEs as reported in 2013-14 was 16,128, equivalent to total income of £48,973k. HEIs across the LEP areas reported activity for this mechanism of knowledge exchange with SMEs, with the exception of The Marches LEP.

In relation to the number of F&E services provided in LEP areas, Leeds City Region LEP is an outlier with over five times the number of services provided (at 9,222 in 2013-14) than the next highest LEP, London, at 1,776 F&E services to SMEs. It is unclear why this is the case, however the average value of these F&E services were relatively small at £0.61k and well below the English average of £3.04k. In contrast F&E services to SMEs in London generated £7,041k with the average value being £3.96k.

The highest average value of F&E services to SMEs was recorded in Solent at £83.53k with this followed by Hertfordshire at £52.06k. Clearly F&E services worth less than £3k are likely to be markedly different to those in excess of £50k, again reflecting the diversity of F&E activities captured through this metric.

Metric **HEI Continuing Professional Development (CPD) and Continuing Education (CE) Provision by LEP area**

Source **Table A1.2.4**

Definition CPD courses are defined as: 'Training programmes for learners already in work who are undertaking the course for purposes of professional development/upskilling/workforce development.'

In addition to CPD, CE is also included in this table as it is likely that small business owners and staff may undertake courses to develop/enhance specific employability or professional skills independent of the business.

This metric captures the income from SMEs for CPD as well as income from Individuals for CPD/CE activities. The sum of activity is calculated for each HEI and reported at the level of the LEP area.

Remarks In total, English HEIs generated approximately £225,022k from the provision of CPD to SMEs and CE to individuals in 2013-14. The majority of this income came from the provision of CE to individuals (93.1%), equivalent to £209,599k.

New Anglia and Cornwall and the Isles of Scilly LEP areas reported no CPD income from SMEs, with Cornwall and the Isles of Scilly also reporting no CE income either during the period. In addition Buckinghamshire Thames Valley while undertaking CPD with SMEs, reported no CE from individuals.

Perhaps unsurprisingly, London LEP area recorded the highest revenue generated from CPD with SMEs at £2,766k followed by the

South East Midlands at £2,397k. Similarly London LEP area had also the highest CE revenue at £86,592k, equivalent to over five times the CE income generated by the next highest earning LEP area, Oxfordshire LEP, at £16,595k.

Metric **HEI IP Income from SMEs: Software licenses, Non-software licenses, Non-License IP Income and Total IP Income by LEP area**

Source **Table A1.2.5**

Definition Four metrics of IP knowledge exchange are reported here with all relating specifically to income from SMEs. The first two metrics are income from the issue of software and non-software licenses (non-exclusive and exclusive) to SMEs by HEIs. The third metric is other IP income from SMEs which excludes license income but includes IP income associated with patents, copyright, design registration and trade-marks. The final metric is a sum of the first three IP income metrics and excludes income acquired through the sale of shares.

All IP income metrics were reported by each HEI and reported here as the sum of IP income from SMEs in each LEP area.

Remarks In 2013-14 total license income received by HEIs from SMEs in England amounted to £47,028k of which 84.7% was derived from non-software licenses equivalent to £39,853k.

Across the LEP areas license income from SMEs varies markedly. In relation to income from non-software licenses to SMEs the highest performing LEP area was Oxfordshire at £2,289k followed by London at £1,556k and almost half of this value in Greater Cambridge and Greater Peterborough LEP area at £846k.

The dominance of Oxfordshire LEP area was surpassed by London in relation to software license income from SMEs. Here London LEP area reported income of £24,834k compared to £7,055 in Oxfordshire LEP. Overall these two LEP areas, combined with Greater Cambridge and Greater Peterborough LEP account for 82.64% of all license income from SMEs with this share being slightly higher for software licenses (85.74%) than non-software licenses (65.38%).

£5,101k was generated in 2013-14 from SMEs for other IP interactions (excluding licenses). Around half of all LEP areas did not report any income from this activity, with Oxfordshire LEP area again recording the highest revenue (£1,443k) followed by the South East Midlands LEP area (£1,084k) and slightly less by London LEP area (£748k).

2.5 Concentration of University-SME engagement across LEP areas by SME population

In this set of metrics account is taken of the size of the local SME population and how this affects the reported scale of knowledge exchange activity. This we refer to as the knowledge exchange 'concentration' measure, capturing not only the scale of HEI activity reported in each LEP area, but also the local SME demand.

Concentration measures are calculated by relating each of the university-SME interaction metrics to the number of SMEs with between five and 250 employees in each LEP area.

Metric	Concentration of Contract Research Contracts by LEP area
Source	Table A1.3.1
Definition	<p>This metric is derived as follows: For each HEI the number of contract research contracts was reported in 2013-14. Calculating the sum of these contracts across all HEIs in each LEP area, the concentration of research contracts is calculated as the total contract research contracts relative to the LEP area population of SMEs with between five and 249 employees. That is, the total number of contract research contracts divided by the number of SMEs (five to 249 employees).</p> <p>This data is also presented in terms of the penetration of contract research contracts. That is, how many SMEs are present in an LEP area per contract research contract.</p>
Remarks	<p>Across the LEP areas, on average 0.0043 contract research contracts are being undertaken for each SME. In other words, for the 446,643 SMEs with between five and 249 employees across the LEP areas, 1,936 contract research contracts were being conducted with SMEs by English HEIs in 2013-14.</p> <p>To present this another way, on average, one contract research contract by English HEIs with SMEs is being conducted for every 231 SMEs.</p> <p>For Cheshire and Warrington LEP area and Cornwall and the Isles of Scilly LEP area no research contracts were recorded and therefore concentration measures are reported as 'na'.</p> <p>Highest concentration levels were recorded in Leicester and Leicestershire LEP area with one contract research contract per 39 SMEs. In contrast lowest concentrations were in Buckinghamshire Thames Valley LEP area at one contract per 5,129 SMEs, Thames Valley Berkshire LEP area (one per 2,541 SMEs) and Cumbria LEP area (one per 2,311 SMEs).</p>
Metric	Concentration of Consultancy Contracts by LEP area
Source	Table A1.3.2
Definition	<p>This metric is derived as follows: For each HEI the number of consultancy contracts was reported in 2013-14. Calculating the sum of these contracts across all HEIs in each LEP area, the concentration of consultancy contracts is calculated as the total number of consultancy</p>

contracts relative to the LEP area population of SMEs with between five and 249 employees. That is, the total number of contract research contracts divided by the number of SMEs (five to 249 employees).

Remarks The total number of contracts conducted by HEIs with SMEs is substantially greater at 47,281 than the number of contract research contracts at 1,936. As a result, the ratio of consultancy contracts to the population of SMEs is significantly lower at 1:9.4. To put this another way, on average across the LEP areas there were 0.106 consultancy contracts conducted per SME.

Coventry and Warwickshire LEP area had the highest concentration of consultancy contracts relative to the population of SMEs at 0.52 SMEs per consultancy contract. In other words, there were approximately two consultancy contracts undertaken for every SME in the LEP area. This was closely followed by Liverpool City Region LEP area and Northamptonshire LEP area with 1.66 and 1.41 consultancy contracts per SME, respectively.

Metric **Number of Facilities and Equipment Contracts per SME in each LEP area**

Source **Table A1.3.3**

Definition This metric is derived as follows: For each HEI the number of F&E services was reported in 2013-14. Calculating the sum of these service agreements across all HEIs in each LEP area, the concentration of F&E services is calculated as the total number of F&E services relative to the LEP area population of SMEs with between five and 249 employees. That is, the total number of F&E services divided by the number of SMEs (five to 249 employees) in each LEP area.

Remarks In total 16,128 F&E service contracts were reported by English HEIs in 2013-14. Based on an SME population (five to 249 employees) of 446,643 this suggests that on average there was one F&E service contract conducted per 27.69 SMEs. Alternatively, relative to the population of SMEs, 0.036 F&E contracts were conducted per SME.

Again significant variability is evident in the extent to which F&E services are provided across the LEP areas to SMEs. The highest performing area is Leeds City Region LEP area with one F&E services contract conducted for every 2.2 SMEs. This is followed by Liverpool City Region LEP area with one F&E contract for every 10.53 SMEs. At the other extreme Gloucestershire LEP area only reported two F&E service contracts, equivalent to one contract per 2,936 SMEs.

No F&E service contracts were reported in The Marches LEP area.

Metric **Income from CPD and CE activities per SME in each LEP area (£)**

Source **Table A1.3.4**

Definition This metric differs to that for contract research, consultancy and F&E

service contracts, in that it measures the *income* from CPD and CE rather than the *number* of individuals or courses. The metric is derived as follows: For each HEI, income acquired from CPD and CE was reported in 2013-14. Calculating the total income from CPD and CE across all HEIs in each LEP area, the concentration of CPD and CE services is determined as the total value of CPD and CE divided by the LEP area population of SMEs with between five and 249 employees. That is, the total value of CPD and CE services divided by the number of SMEs (five to 249 employees) in each LEP area. This produces an average value per LEP area SME in £ sterling.

Remarks Total income generated by HEI across the English LEP areas from CPD and CE provided to SMEs and individuals in 2013-14 amounted to £225,022k or an average value per SME of £503.81.

Cornwall and the Isles of Scilly LEP area reported no income from CPD and CE activities to SMEs and individuals in 2013-14. With the exception of this LEP income per SME ranged from £17.81 in Humber LEP area to highs of £1,814.18 in Leicester and Leicestershire LEP area and £2,695.14 in Oxfordshire LEP area.

Metric **IP Income from licenses, other IP sources and total IP per SME in each LEP area (£)**

Source **Table A1.3.5**

Definition As for CPD and CE, this metric measures the *income* from SMEs for IP. The metric is derived as follows: For each HEI, income acquired from the exchange of IP with SMEs was reported in 2013-14. This is reported here as income from SMEs for licenses (software and non-software), other IP sources (excluding licenses) and total IP income from SMEs. For each of these three IP sources we calculated the IP income across all HEIs in each LEP area. The concentration of IP income is determined as the total value of IP (by source) divided by the LEP area population of SMEs with between five and 249 employees. That is, the total value of IP income (by source) from SMEs, divided by the number of SMEs (five to 249 employees) in each LEP area. This produces an average value per LEP area SME in £ sterling.

Remarks Across all LEP areas, average IP-related income per SME equates to £116.71. This is relatively small and reflects the fact that only a small proportion of all SMEs are acquiring IP from HEIs and contributing to these values. License income accounts for the majority of IP income from SMEs (£105.29 of the total £116.71) with 84.7% of this attributed to software licenses.

Oxfordshire LEP area consistently outperforms other LEP areas in IP-generated income from SMEs whether through licenses (£1,480.59 per SME), other non-license sources (£228.65) and total IP income from SMEs (£1,709.24).

2.6 Estimating average and best practice LEP area HEI-SME engagement.

The set of metrics in this section controls for differences that might exist between HEIs in terms of (i) their size and (ii) their research and knowledge exchange characteristics, both of which may impact on the reported current levels of knowledge exchange activity¹⁰.

By controlling for differences in the size of HEIs and their characteristics, this enables us to calculate for each HEI the **average** level of knowledge exchange and the **upper quartile limit** level of knowledge exchange that is being undertaken by similar HEIs. Aggregating this to the LEP area level means that we are able to identify if current levels of knowledge exchange are below or above the average of what might be expected given the size and characteristics of HEIs located in the LEP area.

To control for differences in the size of HEIs we use the number of Full Time Equivalent (FTE) academic staff employed in each HEI in 2013-14¹¹.

In relation to the research and knowledge exchange characteristics of HEIs, all HEIs were classified into one of five groups. These groups were derived through principal component analysis and cluster analysis, based on a range of research quality and knowledge exchange characteristics in a knowledge exchange funding evaluation in 2009¹². A full list of HEIs by cluster is presented in Appendix 3. The clusters are:

- Group 1 – Main research HEIs
- Group 2 – High research intensity HEIs
- Group 3 – Medium research intensity HEIs
- Group 4 – Low research intensity HEIs
- Group 5 – HEIs with a strong focus on Creative Arts and Design

In calculating the average value of knowledge exchange activity that would be expected in each LEP area, based on current levels across the HEI sector the following steps were taken:

1. For each HEI, 2013-14 reported levels of knowledge exchange were calculated per academic FTE.
2. Each HEI was assigned a cluster grouping (as derived from prior HEFCE work – see note above).
3. Average (median) values were calculated for each knowledge exchange metric, according to cluster.
4. For each HEI, new 'expected average' levels of knowledge exchange were calculated, reflecting their size and the cluster to which they were assigned.
5. HEI 'expected average' levels were aggregated to LEP area level.
6. Comparisons were made between reported actual levels of knowledge exchange activity and the 'expected average' levels for each LEP area.

¹⁰ This analysis builds on work conducted elsewhere on differences within the HEI sector. The classification and grouping of HEIs follows that developed previously for HEFCE by PACEC and the Centre for Business Research, University of Cambridge. HEFCE (2007) Evaluation of the effectiveness of HEFCE/DIUS Third Stream Funding: A cluster analysis to identify case study HEIs. November. Ref: H:/0702/19HEFCE/Rep/HEI Clusters and Case Studies2.doc Available from HEFCE on request.

¹¹ This data was provided directly to the researchers by HEFCE.

¹² The derivation of the clusters are described in detail on page 48 (section 2.2.9) of

http://www.cbr.cam.ac.uk/fileadmin/user_upload/centre-for-business-research/downloads/special-reports/specialreport-evaluationeffectivenesshefce.pdf

A similar process was repeated – from step 3 to 6 – to calculate the upper quartile limit values of knowledge exchange for each LEP area, i.e.:

3. Upper quartile limit values were calculated for each knowledge exchange metric, according to cluster.
4. For each HEI, new ‘expected upper quartile limit’ levels of knowledge exchange were calculated, reflecting their size and the cluster to which they were assigned.
5. HEI ‘expected upper quartile limit’ levels were aggregated to LEP area level.
6. Comparisons were made between reported actual levels of knowledge exchange activity and the ‘expected upper quartile limit’ levels for each LEP area.

Metric	Actual Contract Research Engagement with SMEs compared to Expected Average and Upper Quartile Limit Levels (No. and £000)
Source	Table A1.4.1
Definition	Actual reported levels of contract research contracts as reported by HEIs in 2013-14 are controlled along two dimensions: (i) the size of the HEI in terms of the number of academic staff and (ii) the research and other HEI characteristics. These actual levels are compared to the expected average levels (and upper quartile limit expected level) of contract research contracts and the gap in performance at the LEP area level reported here. Shaded boxes denote LEP areas where current levels of contract research contracts (whether in terms of number or value) are below that which would be expected given the size and profile of the HEIs located in the LEP area.
Remarks	<p>Here we estimate that if the actual 1,936 contract research contracts with SMEs undertaken by all HEIs across the LEP areas in 2013-14 were to be normalised by the size of HEI and the university’s characteristics, then the average number of contracts with SMEs would equate to 921. To draw on an example from the table to illustrate, the HEI sector in Thames Valley Berkshire LEP area reported that it undertook three contract research contracts with SMEs in 2013-14. Based on the size (number of academic FTE staff and the HEI’s characteristics, this would suggest that the average expected number of contract research contracts in this LEP area should be 12.69. In other words, 9.69 fewer contracts were conducted in 2013-14 than would be expected.</p> <p>Taking this a step further, if Thames Valley Berkshire LEP area performed at the upper quartile level then it would have undertaken 35.16 contract research contracts with SMEs in 2013-14, that is, 32.16 more than was reported.</p> <p>Overall, in relation to the value of contract research contracts with SMEs in 2013-14, actual income was £31,446k as compared to an estimated (based on median level) value of £18,051k and an upper quartile value of £36,758k. In other words, there is an estimated gap of £5,312k between actual income generated from SMEs in 2013-14 and the upper quartile potential value.</p>

Metric	Actual consultancy engagement with SMEs compared to Expected Average and Upper Quartile Limit Levels (No. and £000)
Source	Table A1.4.2
Definition	Actual reported levels of consultancy contracts undertaken with SMEs were reported by HEIs in 2013-14. The number and value of these contracts are controlled along two dimensions: (i) the size of the HEI in terms of the number of academic staff and (ii) the research and other HEI characteristics. These actual levels are compared to the expected average levels (and upper quartile limit expected level) of consultancy contracts and the gap in performance at the LEP area level reported here. Shaded boxes denote LEP areas where current levels of consultancy contracts (whether in terms of number or value) are below that which would be expected given the size and profile of the HEIs located in the LEP area.
Remarks	<p>Reported actual number and income from consultancy contracts with SMEs in 2013-14 of 47,281 contracts worth £54,521k compares very favourably to the average predicted value for the English LEP areas. Average expected number of consultancy contracts with SMEs is estimated at 3,754, worth £14,503k.</p> <p>Clearly some LEP areas are significantly outperforming the sector as evident in Coventry and Warwickshire LEP area (with 12,939 <i>more</i> contracts than would be estimated based on the average profile of HEIs in the LEP area, and generating £744k more than would be expected). Other LEP areas with HEIs significantly outperforming the sector are Liverpool City Region and Northamptonshire.</p> <p>It is interesting to note that although the South East LEP area is performing at approximately the average for the number of consultancy contracts with SMEs, these contracts appear to be significantly larger than the average with the total value being approximately £6,771k above what would be expected.</p>

Metric	Actual Facilities and Equipment services engagement with SMEs compared to Expected Average and Upper Quartile Limit Levels (No. and £000)
Source	Table A1.4.3
Definition	Actual reported levels of F&E services undertaken with SMEs were reported by HEIs in 2013-14. The number and value of F&E services are controlled along two dimensions: (i) the size of the HEI in terms of the number of academic staff and (ii) the research and other HEI characteristics. These actual levels are compared to the expected average levels (and upper quartile limit expected level) of F&E services and the gap in performance at the LEP area level reported here. Shaded boxes denote LEP areas where current levels of F&E services (whether in terms of number or value) are below that which would be expected given the size and profile of the

HEIs located in the LEP area.

Remarks F&E service contracts numbering 16,128 were reported by English HEIs in 2013-14. Based on average characteristics this was significantly above the average expected number of 2,431 contracts. A notable outlier was Leeds City Region LEP area with 9,087 more F&E services contracts than would have been expected.

In relation to the income generated from F&E services, again the actual value was £38,097k higher than would be expected for the HEI average. Again Leeds City Region LEP area generated £5,594k compared to an expected average of £703k, i.e. £4,891k above what would have been anticipated if the LEP area's HEIs were operating at the average for their size and characteristics. Yet, perhaps more interesting in relation to Leeds City Region LEP area is that when this is examined in relation to the average value of F&E service contracts to SMEs it appears that these are on average £4.60k smaller than would have been expected for the average HEI. As such, despite the large number and value of F&E services, this is coupled with higher costs of administering these services.

Metric **Actual CPD and CPD & CE engagement with SMEs and individuals compared to Expected Average and Upper Quartile Limit Levels (£000)**

Source **Table A1.4.4**

Definition Actual reported levels of CPD & CE undertaken with SMEs were reported by HEIs in 2013-14. The value of CPD & CE services provided is controlled along two dimensions: (i) the size of the HEI in terms of the number of academic staff and (ii) the research and other HEI characteristics. Actual levels are compared to the expected average levels (and upper quartile limit expected level) of CPD & CE services and the gap in performance at the LEP area level reported here. Shaded boxes denote LEP areas where current levels of CPD & CE services by value are below that which would be expected given the size and profile of the HEIs located in the LEP area.

Remarks As outlined earlier (Table 1.2.4) the majority of income from CPD & CE activities comes from the CE component. Here we see that the total income from CPD engagement with SMEs in English HEIs amounted to £15,423k in 2013-14 which was £9,425k above the average value that would have been expected in the sector. Yet, based on the upper quartile levels being conducted this suggests a potential increase of £619k from £15,423k to £16,042k.

For the combined value of CPD to SMEs and CE to individuals in 2013-14 of £225,022k this was £101,514k above the average expected level for the population of HEIs.

Relative to the upper quartile level, a gap of £60,555k exists across the sector. In other words if all HEIs performed at the upper quartile level for their size and university characteristics this would increase

income from CPD & CE from £225,022k to £285,577k.

Of note is Coventry and Warwickshire LEP area where the actual reported income from SMEs' CPD was slightly below the expected average (by £7.28k). However, this was counteracted by substantial over-performance on the combined CPD & CE income measure, where actual income was £6,788k above the expected average.

Metric	Actual IP Income from SMEs compared to Expected Average and Upper Quartile Limit Levels (£000)
Source	Table A1.4.5
Definition	Actual reported levels of IP income from SMEs were reported by HEIs in 2013-14. The value of IP income – licensing, other non-license IP income and total IP income from SMEs – was controlled along two dimensions: (i) the size of the HEI in terms of the number of academic staff and (ii) the research and other HEI characteristics. These actual levels are compared to the expected average levels (and upper quartile limit expected level) of IP income from SMEs and the gap in performance at the LEP area level reported here. Shaded boxes denote LEP areas where current levels of IP income from SMEs are below that which would be expected given the size and profile of the HEIs located in the LEP area.
Remarks	<p>Expected average and upper quartile values for income from SMEs' acquisition of HEI IP across the LEP areas suggest that current levels are significantly below the average for non-software licenses yet above the average for software licenses. In relation to non-software licenses, current reported income in 2013-14 of £7,175k is £19,149k below what would be expected for the HEI sector average. In contrast, current income from software licenses of £39,853k is £30,480k above the sector average.</p> <p>Based on these calculations, if all HEIs were operating at the upper quartile level of IP income generation with SMEs, this would lead to the following increases:</p> <p>Non-Software licenses: from £7,175k to £7,833k</p> <p>Other (non-license) IP income: from £5,101k to £5,964k</p> <p>Total IP income: from £52,129k to £73,003k.</p> <p>It is also interesting to note that the current level of income from software licenses to SMEs (£39,853k) is above the sector upper quartile level (£19,239k) reflecting the fact that a few universities are receiving disproportionately high income from this source relative to others in the sector.</p> <p>Across the LEP areas significant variation is evident in the levels of IP income relative to the expected average. What is most interesting is that performance (above or below average) is inconsistent across the metrics with above average income in one IP metric often countered by below average for another IP metric (e.g.</p>

Leicester and Leicestershire LEP area recorded above average income for non-software licenses and below average for software and total IP income).

Section 3: University-SME interaction – its effects on innovation outputs

3.1 Introduction

Earlier sections of this report deal with the extent and intensity of university–SME interaction across different parts of England. This section of the report provides some insight into the effects of this interaction on SMEs' ability to innovate. In particular we use some of the measures developed in the first stage of the analysis to help to model econometrically the link between SMEs' university links and innovation outputs. Our analysis is based on UK IS and relates only to SMEs in England. We also provide separate analysis for small firms (ten to 50 employees) and medium-firms (50 to 250 employees).

We focus only on innovating SMEs (as only these firms provided information on their university connections) and address two specific research questions:

- (a) Did cooperating with a university as part of their innovation activity increase the ability of SMEs to introduce new-to-the-market innovations?
- (b) Did cooperating with a university help SMEs to introduce more successful new-to-the-market innovations?

The focus of our analysis is 'new-to-the-market' innovations in goods or services. This type of innovation provides SMEs with potential 'first mover' advantages and creates wider potential for technological development and consumer benefit.

The analysis we report here links into wider debates about 'open innovation' – the idea that firms often innovate in partnership with others. Innovating through partnering – seeking knowledge and resources outside the firm – may, for example, be one way of offsetting innovation risks. For example, openness in innovation may reduce risk in the innovation process, accelerating or upgrading the quality of the innovations made, and signalling the quality of firms' innovation activities¹³. External innovation linkages may also increase firms' access to external resources and technology developed elsewhere and the probability of obtaining useful knowledge from outside of the firm¹⁴. Empirical evidence also points to the conclusion that knowledge gained from alternative sources tends to be complementary with firms' internal knowledge in shaping innovation performance. However, open innovation poses particular challenges for SMEs because of their relative lack of capacity to both seek and absorb external knowledge. Despite this it is clear that some SMEs do purposively engage in open innovation and that the prevalence of open innovation among SMEs has increased in recent years¹⁵.

3.2 Data – the pooled UK Innovation Survey

The principal dataset used in our analysis is the UKIS. This is an official survey conducted every two years by the ONS on behalf of the Department for Business Innovation & Skills (BIS), and is part of the EU Community Innovation Survey (CIS). We use pooled data from Waves Four to Eight of the UKIS, covering the periods 2002-04, 2004-06, 2006-08, 2008-10 and 2010-12. In each case the UKIS instrument was sent to around 28,000 enterprises with

¹³ Powell, W. W. 1998. "Learning from Collaboration: Knowledge and Networks in the Biotechnology and Pharmaceutical Industries." *California Management Review*, 40(3), 228-40.

¹⁴ Leiponen, A. and Helfat, C. E. 2010. "Innovation Objectives, Knowledge Sources, and the Benefits of Breadth." *Strategic Management Journal*, 31, 224-36.

¹⁵ Van de Vrande, V., de Jong, J.P.J., Vanhaverbeke, W. and de Rochemont, M. 2009. "Open Innovation in SMEs: Trends, Motives and Management Challenges." *Technovation*, 29(6-7), 423–37.

ten or more employees, with response rates ranging from 50 to 58%¹⁶. Our analysis focuses on responses from SMEs (with ten to 250 employees) in England.

The UKIS data used for this study were made available via the UK Secure Data Service with limited geographical reference data to preserve confidentiality. In order to match the UKIS data with relevant spatial data at both Local Authority District (LAD) and LEP area level, a data-matching exercise was undertaken. Each observation in the UKIS has a common reference number which allows it to be linked anonymously to other government surveys and datasets. Using these common reference numbers, UKIS observations were matched with postcode data mainly derived from the BSD, itself derived from the IDBR, which is a live register of data collected by HM Revenue and Customs via tax and employment records¹⁷. Once each UKIS respondent had been allocated a postcode these were then matched into LDAs and these, in turn, were matched into the larger LEP areas. This allows each firm-level observation to be linked to the level of university-SME activity in its locality.

The UKIS provides a number of indicators of firms' innovation outputs and we focus on two measures here. First, we use a simple binary measure indicating whether SMEs had introduced new-to-the-market innovations in the previous three years (as opposed to purely new-to-the-firm innovations). Around 40 per cent of innovating SMEs reported introducing new-to-the-market innovations (Table 3.1 below). Second, we use a measure of innovative sales defined as the proportion of firms' sales at the time of the survey derived from new-to-the-market innovations introduced during the previous three years¹⁸. This variable has been widely used as an indicator of firms' innovation output and reflects not only firms' ability to introduce new products or services to the market but also their short-term commercial success. Across those elements of the UKIS used in the current analysis, 2.8 per cent of SMEs sales were derived from newly introduced products or services (Table 3.1).

¹⁶ Details of the UKIS sampling methodology and response rates can be found at: <https://www.gov.uk/government/statistics/uk-innovation-survey-2011-statistical-annex-revised>

¹⁷ This matching was possible where firms were single plants. In the relatively small number of cases where multi-plants were recorded we matched using Business Enterprise Research and Development (BERD) data.

¹⁸ Roper, S, Du, J. and Love, J.H. 2008. "Modelling the Innovation Value Chain." *Research Policy*, 37(6-7), 961-77.

Table 3.1: Sample descriptives: Innovative SMEs in England – 2002-12

Variable	Observations	Mean	Standard Deviation
New-to-the-market innovation (% firms)	12,677	39.9	0.490
Sales from new-to-the-market innovation (log)	9,345	2.8	2.982
Employment (log)	12,677	3.1	1.011
R&D investment for innovation (% firms)	12,545	60.7	0.488
Design investment for innovation (% firms)	12,528	38.3	0.486
Science and Engineering graduates (% workforce)	11,836	10.9	20.895
Other graduates (% workforce)	12,075	13.5	22.763
Exporting firm (% firms)	12,677	45.0	0.498
Non-university partnerships (average number)	12,677	1.338	1.780
Regional university partnerships (% firms)	12,677	5.7	0.231
National UK university partnerships (% firms)	12,677	6.7	0.250
International university partnerships (% firms)	12,677	2.6	0.158

To measure the extent of firms' partnering activity we define a measure which relates to the number of innovation partner types with which each firm was working other than universities¹⁹. In the UKIS we find the following question: 'Which types of cooperation partner did you use and where were they located?' Seven partner types are identified²⁰. We use this data to define an indicator for the number of non-university partnerships in which SMEs were involved. Our indicator of the extent of firms' interactive knowledge search therefore takes values between zero, where firms had no innovation collaboration, and six, where firms were collaborating with all partner types identified. On average firms were working with an average of 1.338 partner types (Table 3.1).

We also use this data to define a series of three indicators of whether SMEs were working with universities regionally, nationally (i.e. elsewhere within the UK) or internationally. This enables us to identify the impact of each of these types of university links on new-to-the-market innovation by SMEs. On average 5.7 per cent of innovative SMEs reported having a regional university partnership, 6.7 per cent reported having a national university partnership and 2.6 per cent reported having an international university partnership (Table 3.1).

The UKIS also provides information on a number of other firm characteristics which previous studies have linked to innovation outputs and which we use as control variables here. For example, plants' in-house research and development (R&D) activities are routinely linked to innovation performance in econometric studies with suggestions that the innovation-R&D relationship reflects both knowledge creation and absorptive capacity effects²¹. Design

¹⁹ This measure of the 'breadth' of search activity has been used extensively in studies of the determinants of innovation and in prior studies of the determinants of 'openness'.

²⁰ These are: other enterprises within the group; suppliers of equipment, materials, services or software; clients or customers; competitors within the industry or elsewhere; consultants, commercial labs or private R&D institutes; universities or other HEIs; government or public research institutes.

²¹ Harris, R.I.D. and Trainor, M. 1995. "Innovation and R&D in Northern Ireland Manufacturing: A Schumpeterian Approach." *Regional Studies*, 29, 593-604. Griffith, R, Redding, S. and Van Reenan,

spending has also been linked to innovative outputs and we therefore include a dummy variable which takes Value 1 where an SME was investing in design²². We also include in the analysis as controls a group of variables which give an indication of the quality of firms' in-house knowledge base – e.g. skills, plant size, and whether or not a firm was exporting. Skill levels are reflected in the proportion of each plant's workforce with a degree level qualification (in Science or another subject) to reflect potential labour quality impacts on innovation or absorptive capacity.

3.3 Methodology – estimating university 'treatment' effects

Our general approach here is based on the notion of an innovation production function which relates knowledge sourced through R&D or external search to innovations. Universities – regional, national or international – may enhance the knowledge available to SMEs and hence their innovation outputs. In algebraic terms we might write our estimating equation as:

$$INNOV_i = \varphi_0 + \varphi_1 RUNI_i + \varphi_2 NUNI_i + \varphi_3 IUNI_i + \chi_1 CONT + \mu_i$$

Where $INNOV_i$ is an innovation output measure from Firm i ; $RUNI_i$ is a dummy variable taking Value 1 if the SME is collaborating with a regional university; $NUNI_i$ is a similar variable for national university and $IUNI_i$ for an international university. $CONT_i$ is a vector of firm level controls including non-university partnerships, R&D and design investment, skills etc.

A well-known issue with modelling the impact of university partnerships in this type of model is that SMEs' engagement with universities involves a degree of self-selection, i.e. these relationships are not randomly allocated across the population of SMEs. Those firms selecting to have university relationships may have very different characteristics to those not selecting university relationships, and it may be these differences in characteristics rather than the university links which are driving differences in innovation behaviour between the two groups. It is possible, however, to use multivariate econometric analysis to filter out or control for differences in characteristics between the groups of SMEs with and without university relationships as part of their innovation activity. This type of approach is typically used to calibrate the impact of public policy initiatives on groups of recipient and non-recipient organisations.

In technical terms we treat relationships with universities as a 'treatment', i.e. something which is common to the SMEs with university relationships but from which other SMEs are excluded. This allows us to control both for other influences on innovation aside from SMEs' university relationships and also for the potential for university relationship to be selected by specific groups of SMEs which share certain characteristics (a 'selection' effect). The key here is whether having allowed for this selection effect and the effect of other influences on innovation, having a university partnership still has a positive and significant innovation effect. This is reflected in the significance of a measure called the 'average treatment' effect.

The issues involved have been widely discussed in the research literature on policy evaluation. The focus of much of this literature has been the notion of 'selection bias' i.e. the idea that SMEs choosing to develop university relationships may differ in some other systematic way from other SMEs aside from their university relationship. They may for example be younger organisations or be more ambitious. This has led to the development and widespread application of econometric approaches which can control for potential

J. 2003. "R&D and Absorptive Capacity: Theory and Empirical Evidence." *Scandinavian Journal of Economics*, 105(1), 99-118.

²² Love, J.H., Roper, S. and Bryson, J. 2011. "Knowledge, Openness, Innovation and Growth in UK Business Services." *Research Policy*, 40(10), 1438-52.

selection biases by either implicitly or explicitly modelling the probability that an organisation will be in the treatment rather than the control group and then estimating the impact of the treatment controlling for any selection biases²³.

Here we use an approach called augmented inverse probability weighting (AIPW) which provides a robust approach to modelling selection effects and allows us to model both binary (i.e. innovate or not) and continuous (innovative revenue) output measures. We implement both measures using the effects module in software called Stata 13.

Key to the success of this type of modelling is our ability to identify variables which might influence the probability that an SME develops a university relationship but not influence directly a firm's innovation output. This is the link between this section of the report and earlier sections. We use two variables from the early section as predictors of whether an SME will form a university relationship. The argument is that if an SME is located in an LEP area which has a greater intensity of university-SME interaction then the SME itself is more likely to develop a relationship with a university for innovation. We use two variables reported in the earlier sections: the intensity of local research partnerships and the proportion of local SMEs involved in CPD relationships with universities (see Section 2.5). In addition – reflecting the role of intermediaries in brokering university-SME relationships – we also use a variable which reflects whether SMEs have links to regional, national or international consultants as a predictor of university relationships.

The complete estimated models are included in Annex 4 and here we only report a brief summary of the average treatment effect results which provide an indication of the innovation results of SME-university interaction.

3.4 Results – the innovation effects of SME-university interaction

Tables 3.2, 3.3 and 3.4 report summaries of the estimation results included in full in Annex 4. Positive numbers here indicate that having a university link – controlling for other factors – is increasing the probability of innovation or innovative sales. Asterisks are used to indicate where these effects are statistically significant with ‘***’ indicating a significant effect at the conventional five per cent level and ‘****’ a stronger one per cent effect.

For all SMEs, having a regional linkage increases the probability of new-to-the-market innovation by 9.8 percentage points. This rises to 16.3 percentage points for national universities and 31.1 percentage points for an international university. More simply put, SMEs with a link to an international university are around a third more likely to be introducing new-to-the-market innovations. Impacts on innovative sales are also statistically significant – although weaker. Here, the scale of the effect is more difficult to interpret. This suggests two main conclusions:

- (a) For all SMEs, having a university link does significantly improve the probability of new-to-the-market innovation;
- (b) International links have the biggest innovation effect – three times the size of the effect of having a link to a local university.

Tables 3.3 and 3.4 provide the same results for small firms and all SMEs respectively. For small firms we see a very similar pattern to that for all SMEs. University links matter both for the probability of undertaking new-to-the-market innovation but also for innovative sales. For medium-sized firms there are no significant effects on the probability of new-to-the-market

²³ Bratberg, E., Grasdal, A. and Risa, A.E. 2002. “Evaluating Social Policy by Experimental and Non-experimental Methods.” *Scandinavian Journal of Economics*, 104(1), 147-71. Imbens, G.W. and Wooldridge, J.M. 2009. “Recent Developments in the Econometrics of Program Evaluation.” *Journal Of Economic Literature*, 47(1), 5-86.

innovation and only a negative and significant effect on innovative sales. The implication is that university connections matter for innovation but primarily for smaller SMEs.

Table 3.2: Innovation effects of university relationships – average treatment effects for all SMEs

	Regional	National	Inter-national
Impact on the probability of new-to-the-market innovation	0.098** (0.039)	0.163*** (0.046)	0.311*** (0.061)
Impact on innovative sales	0.427* (0.229)	0.291 (0.288)	1.286** (0.644)

Table 3.3: Innovation effects of university relationships – average treatment effects for small firms (ten to 49 employees)

	Regional	National	Inter-national
Impact on the probability of new-to-the-market innovation	0.094** (0.043)	0.173*** (0.055)	0.379*** (0.042)
Impact on innovative sales	0.496** (0.238)	0.426 (0.333)	1.833*** (0.567)

Table 3.4: Innovation effects of university relationships – average treatment effects for medium-sized firms with 50-250 employees

	Regional	National	Inter-national
Impact on the probability of new-to-the-market innovation	0.111 (0.098)	0.063 (0.075)	-0.118 (0.171)
Impact on innovative sales	0.326 (0.694)	0.138 (0.564)	-4.076** (1.624)

Section 4: Implications for HEIs and LEP areas

Comparing information on the number of research, consultancy and training contracts with SMEs reported by HEIs in England with the overall population of SMEs provides an indication of the penetration or concentration of the HEI sector into this potential market. In fact we find that (Section 2.5):

- HEIs are undertaking one contract research contract for every 231 SMEs in England (with five to 250 employees)
- HEIs reported one consultancy contract for every 9.4 SMEs in England;
- HEIs reported one F&E service contract for every 27.69 SMEs in England.

These proportions vary widely however between LEP areas depending on the presence of HEIs in the locality and their level of engagement with the SME sector.

For example, in terms of research contracts the highest concentration levels were recorded in Leicester and Leicestershire LEP area (1:39.2 SMEs) with the lowest in Buckinghamshire Thames Valley (1:5,129 SMEs). In terms of consultancy contracts, the highest concentration rates were in Coventry and Warwickshire where there were approximately two consultancy contracts undertaken per SME. This is possible as more than one contract may have been concluded with an individual SME and some contracts may have been conducted with SMEs outside the local area.

To illustrate the potential gains from spreading best practice (as estimated at the upper quartile level) in university-SME engagement we calculate the number of potential contracts which would be taking place if each university was matching the upper quartile level (75%) within its cluster and controlling for the number of academic staff in each HEI (see Section 2.6 for details). This suggests (Section 2.6): A potential increase in the number of contract research contracts from 1,936 to 2,357 – or a move from 1:231 SMEs to 1:189 SMEs.

These simulations will overstate the scale of any potential increase in the extent of university-SME collaboration due to potential competition among HEIs for SME contracts. However, they do give an indication of the potential for the HEI sector to increase its impact on England's SMEs.

The importance of increasing the level of university-SME interaction is suggested by our analysis of the impact of such interaction on innovation. Small firms collaborating with universities as part of their innovation activity – which may involve either research, consultancy or F&E services contracts – are on average 9.4-17.3 percentage points more likely to introduce new-to-the-market innovations. This rises to 37.9 percentage points where small firms are collaborating with international universities. Interestingly, the innovation effects of university collaboration for medium-sized firms (with 50 plus employees) are positive but less statistically significant. The implication being that the largest innovation gains from university collaboration accrue to small rather than medium-sized firms.

There is considerable potential for HEIs generally to raise the level of SME-university interaction with gains to both parties. For universities there is the potential to expand the value of contract income; for small firms in particular there are substantial gains in the probability and success of innovation. There is little innovation gain from promoting higher levels of engagement between universities and medium-sized firms.

HEI engagement with the SME sector varies substantially across LEP areas. Small firms in some areas are therefore missing out on the benefits of an HEI link. It may also be

interesting to consider how collaboration might be stimulated between small firms and international universities which has a particularly strong innovation effect.

Annex 1: Data tables

Table A1.1 Development Priorities of HEAs by LEP area, 2013-14

	Graduate retention in local region	Supporting SMEs	Research collaboration with industry	Management Development	Meeting regional skills needs
Black Country					
Buckinghamshire Thames Valley					
Cheshire and Warrington					
Coast to Capital					
Cornwall and the Isles of Scilly					
Coventry and Warwickshire					
Cumbria					
Derby, Derbyshire, Nottingham and Nottinghamshire					
Dorset					
Enterprise M3					
Gloucestershire					
Greater Birmingham and Solihull					
Greater Cambridge & Greater Peterborough					
Greater Lincolnshire					
Greater Manchester					
Heart of the South West					
Hertfordshire					
Humber					
Lancashire					
Leeds City Region					
Leicester and Leicestershire					
Liverpool City Region					
London					
New Anglia					
North Eastern					
Northamptonshire					
Oxfordshire LEP					
Sheffield City Region					
Solent					
South East					
South East Midlands					
Stoke-on-Trent and Staffordshire					
Tees Valley					
Thames Valley Berkshire					
The Marches					
West of England					
Worcestershire					
York and North Yorkshire					

Table A1.2.1 HEI Contract research contracts with SMEs by LEP area, 2013-14

	Number of Research Contracts	Total Value of Research Contracts £000s	Average value of Research Contracts £000s
Black Country	4	20	5.00
Buckinghamshire Thames Valley	1	1	1.00
Cheshire and Warrington	0	0	0.00
Coast to Capital	12	425	35.42
Cornwall and the Isles of Scilly	0	0	0.00
Coventry and Warwickshire	104	896	8.62
Cumbria	2	6	3.00
Derby, Derbyshire, Nottingham and Nottinghamshire	109	1,604	14.72
Dorset	5	39	7.80
Enterprise M3	31	609	19.65
Gloucestershire	6	89	14.83
Greater Birmingham and Solihull	131	1,576	12.03
Greater Cambridge & Greater Peterborough	13	335	25.77
Greater Lincolnshire	12	95	7.92
Greater Manchester	65	1,307	20.11
Heart of the South West	66	321	4.86
Hertfordshire	8	124	15.50
Humber	13	355	27.31
Lancashire	8	240	30.00
Leeds City Region	158	2,218	14.04
Leicester and Leicestershire	214	1,509	7.05
Liverpool City Region	91	1,770	19.45
London	303	8,668	28.61
New Anglia	7	80	11.43
North Eastern	67	773	11.54
Northamptonshire	4	44	11.00
Oxfordshire LEP	90	1,933	21.48
Sheffield City Region	102	2,615	25.64
Solent	87	1,287	14.79
South East	46	411	8.93
South East Midlands	96	1,227	12.78
Stoke-on-Trent and Staffordshire	8	53	6.63
Tees Valley	10	109	10.90
Thames Valley Berkshire	3	50	16.67
The Marches	5	22	4.40
West of England	38	595	15.66
Worcestershire	24	101	4.21
York and North Yorkshire	3	57	19.00
Total	1,936	31,446	16.24

Table A1.2.2 HEI consultancy contracts with SMEs by LEP area, 2013-14

	Number of Consultancy contracts	Total Value of consultancy contracts £000s	Average value of consultancy contracts £000s
Black Country	989	493	0.5
Buckinghamshire Thames Valley	18	38	2.11
Cheshire and Warrington	90	98	1.09
Coast to Capital	25	158	6.32
Cornwall and the Isles of Scilly	42	15	0.36
Coventry and Warwickshire	13,070	1,119	0.09
Cumbria	66	na	na
Derby, Derbyshire, Nottingham and Nottinghamshire,	137	764	5.58
Dorset	73	211	2.89
Enterprise M3	73	325	4.45
Gloucestershire	46	233	5.07
Greater Birmingham and Solihull	76	355	4.67
Greater Cambridge & Greater Peterborough	262	2,335	8.91
Greater Lincolnshire	18	341	18.94
Greater Manchester	1,404	1,107	0.79
Heart of the South West	274	1,182	4.31
Hertfordshire	214	2,788	13.03
Humber	56	88	1.57
Lancashire	1,035	8,946	8.64
Leeds City Region	475	1,194	2.51
Leicester and Leicestershire	236	762	3.23
Liverpool City Region	15,102	10,284	0.68
London	2,783	5,291	1.9
New Anglia	42	345	8.21
North Eastern	295	1,256	4.26
Northamptonshire	8,205	745	0.09

Oxfordshire LEP	356	1,441	4.05
Sheffield City Region	153	606	3.96
Solent	198	2,167	10.94
South East	112	7,131	63.67
South East Midlands	8,276	1,360	0.16
Stoke-on-Trent and Staffordshire	97	259	2.67
Tees Valley	78	90	1.15
Thames Valley Berkshire	2	8	4
The Marches	10	93	9.3
West of England	1,030	1,700	1.65
Worcestershire	99	10	0.1
York and North Yorkshire	7	40	5.71
Total	47,281	54,521	1.15

Table A1.2.3 HEI Facilities and Equipment (F&E) services with SMEs by LEP area, 2013-14

	Number of Facilities & Equipment contracts	Total Value of facilities & equipment contract £000s	Average value of facilities & equipment contracts £000s
Black Country	365	2,301	6.30
Buckinghamshire Thames Valley	292	883	3.02
Cheshire and Warrington	223	44	0.20
Coast to Capital	14	470	33.57
Cornwall and the Isles of Scilly	60	15	0.25
Coventry and Warwickshire	231	3,829	16.58
Cumbria	8	25	3.13
Derby, Derbyshire, Nottingham and Nottinghamshire,	170	3,633	21.37
Dorset	18	56	3.11
Enterprise M3	198	4,807	24.28
Gloucestershire	2	1	0.50
Greater Birmingham and Solihull	82	152	1.85
Greater Cambridge & Greater Peterborough	91	325	3.57
Greater Lincolnshire	109	218	2.00
Greater Manchester	759	1,205	1.59
Heart of the South West	277	1,860	6.71
Hertfordshire	32	1,666	52.06
Humber	39	103	2.64
Lancashire	123	544	4.42
Leeds City Region	9,222	5,594	0.61
Leicester and Leicestershire	74	657	8.88
Liverpool City Region	862	389	0.45
London	1,776	7,041	3.96
New Anglia	8	7	0.88
North Eastern	109	912	8.37
Northamptonshire	3	105	35.00
Oxfordshire LEP	250	734	2.94
Sheffield City Region	52	252	4.85
Solent	74	6,181	83.53
South East	91	448	4.92
South East Midlands	9	360	40.00
Stoke-on-Trent and Staffordshire	27	88	3.26
Tees Valley	114	165	1.45
Thames Valley Berkshire	92	2,758	29.98
The Marches	0	0	0
West of England	244	1,176	4.82
Worcestershire	44	87	1.98

York and North Yorkshire	653	3,538	5.42
Total	16,128	48,973	3.04

Table A1.2.4 HEI Continuing Professional Development (CPD) & Continuing Education (CE) Provision by LEP area, 2013-14

	CPD Income from SMEs £000s	CE Income from Individuals £000s	Total CPD income from SMEs and CE from Individuals £000s
Black Country	5	353	358
Buckinghamshire Thames Valley	158	0	158
Cheshire and Warrington	132	568	700
Coast to Capital	218	320	538
Cornwall and the Isles of Scilly	0	0	0
Coventry and Warwickshire	136	9,808	9,944
Cumbria	0	637	637
Derby, Derbyshire, Nottingham and Nottinghamshire,	215	7,037	7,252
Dorset	5	826	831
Enterprise M3	21	1,482	1,503
Gloucestershire	58	237	295
Greater Birmingham and Solihull	536	6,939	7,475
Greater Cambridge & Greater Peterborough	463	2,722	3,185
Greater Lincolnshire	317	49	366
Greater Manchester	1,370	13,449	14,819
Heart of the South West	545	80	625
Hertfordshire	200	3,172	3,372
Humber	31	72	103
Lancashire	730	588	1,318
Leeds City Region	665	4,601	5,266
Leicester and Leicestershire	193	15,028	15,221
Liverpool City Region	210	3,877	4,087
London	2,766	86,592	89,358
New Anglia	0	700	700
North Eastern	292	1,048	1,340
Northamptonshire	40	711	751
Oxfordshire LEP	414	16,595	17,009
Sheffield City Region	74	1,389	1,463
Solent	672	10,989	11,661
South East	1,373	6,035	7,408
South East Midlands	2,397	6,061	8,458
Stoke-on-Trent and Staffordshire	287	580	867
Tees Valley	388	846	1,234
Thames Valley Berkshire	60	1,336	1,396
The Marches	236	299	535
West of England	223	5,272	5,495

Worcestershire	33	91	124
York and North Yorkshire	204	896	1,100
Total	15,423	209,599	225,022

Table A1.2.5 HEI IP Income from SMEs: Software licenses, Non-software licenses, Non-License IP Income and Total IP Income by LEP area, 2013-14

	Non Software License Income SMEs £000s	Software License Income SMEs £000s	Total License Income SMEs £000s	IP Income SMEs £000s	Total IP Income SMEs £000s
Black Country	2	0	2	0	2
Buckinghamshire Thames Valley	0	0	0	0	0
Cheshire and Warrington	0	0	0	0	0
Coast to Capital	124	0	124	0	124
Cornwall and the Isles of Scilly	0	0	0	0	0
Coventry and Warwickshire	84	71	155	16	171
Cumbria	0	0	0	0	0
Derby, Derbyshire, Nottingham and Nottinghamshire,	193	131	324	132	456
Dorset	4	0	4	0	4
Enterprise M3	12	206	218	0	218
Gloucestershire	0	0	0	0	0
Greater Birmingham and Solihull	286	732	1,018	15	1,033
Greater Cambridge & Greater Peterborough	846	2,282	3,128	332	3,460
Greater Lincolnshire	0	0	0	0	0
Greater Manchester	70	827	897	875	1,772
Heart of the South West	81	131	212	0	212
Hertfordshire	2	0	2	4	6
Humber	102	5	107	0	107
Lancashire	1	189	190	0	190
Leeds City Region	144	331	475	41	516
Leicester and Leicestershire	162	17	179	71	250
Liverpool City Region	96	33	129	19	148
London	1,556	24,834	26,390	748	27,138
New Anglia	45	25	70	143	213
North Eastern	187	457	644	111	755
Northamptonshire	0	0	0	0	0
Oxfordshire LEP	2,289	7,055	9,344	1,443	10,787
Sheffield City Region	22	416	438	18	456
Solent	531	106	637	3	640
South East	12	46	58	0	58
South East Midlands	68	1,398	1,466	1,084	2,550
Stoke-on-Trent and Staffordshire	10	89	99	1	100
Tees Valley	3	0	3	0	3
Thames Valley Berkshire	103	0	103	0	103
The Marches	0	0	0	0	0
West of England	140	472	612	48	660
Worcestershire	0	0	0	0	0
York and North Yorkshire	2	0	2	0	2

Total	7,175	39,853	47,028	5,101	52,129
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Table A1.3.1 Concentration of Contract Research Contracts by LEP area, 2013-14

	Number of Contract Research Contracts per SME	No. of SMEs per Research contract
Black Country	0.0005	1,915
Buckinghamshire Thames Valley	0.0002	5,129
Cheshire and Warrington	0	na
Coast to Capital	0.0008	1,239
Cornwall and the Isles of Scilly	0	na
Coventry and Warwickshire	0.0153	65
Cumbria	0.0004	2,311
Derby, Derbyshire, Nottingham and Nottinghamshire,	0.0084	119
Dorset	0.0007	1,338
Enterprise M3	0.0024	424
Gloucestershire	0.001	979
Greater Birmingham and Solihull	0.0114	87
Greater Cambridge & Greater Peterborough	0.0013	792
Greater Lincolnshire	0.0017	603
Greater Manchester	0.0033	301
Heart of the South West	0.0045	221
Hertfordshire	0.001	992
Humber	0.0022	445
Lancashire	0.0007	1,427
Leeds City Region	0.0078	128
Leicester and Leicestershire	0.0255	39
Liverpool City Region	0.0100	100
London	0.0037	270
New Anglia	0.0005	1,848
North Eastern	0.0056	179
Northamptonshire	0.0007	1,453
Oxfordshire LEP	0.0143	70
Sheffield City Region	0.0103	97
Solent	0.0087	114
South East	0.0015	673
South East Midlands	0.0069	145
Stoke-on-Trent and Staffordshire	0.0011	891
Tees Valley	0.0028	358
Thames Valley Berkshire	0.0004	2,541
The Marches	0.0008	1,206
West of England	0.0042	236
Worcestershire	0.0048	210

York and North Yorkshire	0.0004	2,581
Average	0.0043	231

Table A1.3.2 Concentration of Consultancy Contracts by LEP area, 2013-14

	Number of Consultancy Contracts per SME	No. of SMEs per Consultancy contract
Black Country	0.1291	7.75
Buckinghamshire Thames Valley	0.0035	284.94
Cheshire and Warrington	0.0112	89.17
Coast to Capital	0.0017	594.88
Cornwall and the Isles of Scilly	0.0081	122.86
Coventry and Warwickshire	1.9283	0.52
Cumbria	0.0143	70.03
Derby, Derbyshire, Nottingham and Nottinghamshire,	0.0106	94.39
Dorset	0.0109	91.62
Enterprise M3	0.0056	179.89
Gloucestershire	0.0078	127.65
Greater Birmingham and Solihull	0.0066	150.75
Greater Cambridge & Greater Peterborough	0.0255	39.29
Greater Lincolnshire	0.0025	402.17
Greater Manchester	0.0717	13.95
Heart of the South West	0.0188	53.12
Hertfordshire	0.027	37.08
Humber	0.0097	103.29
Lancashire	0.0907	11.03
Leeds City Region	0.0234	42.67
Leicester and Leicestershire	0.0281	35.55
Liverpool City Region	1.6634	0.60
London	0.034	29.44
New Anglia	0.0032	308.02
North Eastern	0.0246	40.58
Northamptonshire	1.412	0.71
Oxfordshire LEP	0.0564	17.73
Sheffield City Region	0.0154	64.80
Solent	0.0199	50.31
South East	0.0036	276.33
South East Midlands	0.5955	1.68
Stoke-on-Trent and Staffordshire	0.0136	73.47
Tees Valley	0.0218	45.95
Thames Valley Berkshire	0.0003	3,811.50
The Marches	0.0017	603.00
West of England	0.115	8.69
Worcestershire	0.0197	50.79

York and North Yorkshire	0.0009	1,106.29
Average	0.106	9.40

Table A1.3.3 Number of Facilities and Equipment Contracts per SME in each LEP area, 2013-14

	Number of F&E Contracts per SME	Number of SMEs per F&E Contract
Black Country	0.0476	20.99
Buckinghamshire Thames Valley	0.0569	17.57
Cheshire and Warrington	0.0278	35.99
Coast to Capital	0.0009	1,062.29
Cornwall and the Isles of Scilly	0.0116	86.00
Coventry and Warwickshire	0.0341	29.34
Cumbria	0.0017	577.75
Derby, Derbyshire, Nottingham and Nottinghamshire,	0.0131	76.06
Dorset	0.0027	371.56
Enterprise M3	0.0151	66.32
Gloucestershire	0.0003	2,936.00
Greater Birmingham and Solihull	0.0072	139.72
Greater Cambridge & Greater Peterborough	0.0088	113.12
Greater Lincolnshire	0.0151	66.41
Greater Manchester	0.0387	25.81
Heart of the South West	0.019	52.55
Hertfordshire	0.004	248.00
Humber	0.0067	148.31
Lancashire	0.0108	92.80
Leeds City Region	0.455	2.20
Leicester and Leicestershire	0.0088	113.38
Liverpool City Region	0.0949	10.53
London	0.0217	46.13
New Anglia	0.0006	1,617.13
North Eastern	0.0091	109.83
Northamptonshire	0.0005	1,937.00
Oxfordshire LEP	0.0396	25.24
Sheffield City Region	0.0052	190.65
Solent	0.0074	134.61
South East	0.0029	340.10
South East Midlands	0.0006	1,544.22
Stoke-on-Trent and Staffordshire	0.0038	263.96
Tees Valley	0.0318	31.44
Thames Valley Berkshire	0.0121	82.86
The Marches	0.0000	0.00

West of England	0.0273	36.69
Worcestershire	0.0088	114.27
York and North Yorkshire	0.0843	11.86
Average	0.0361	27.69

Table A1.3.4 Income from CPD & CE activities per SME in each LEP area (£), 2013-14

	Average Income from CPD & CE per SME (£)
Black Country	46.73
Buckinghamshire Thames Valley	30.81
Cheshire and Warrington	87.23
Coast to Capital	36.18
Cornwall and the Isles of Scilly	0.00
Coventry and Warwickshire	1,467.10
Cumbria	137.82
Derby, Derbyshire, Nottingham and Nottinghamshire,	560.82
Dorset	124.25
Enterprise M3	114.45
Gloucestershire	50.24
Greater Birmingham and Solihull	652.44
Greater Cambridge & Greater Peterborough	309.40
Greater Lincolnshire	50.56
Greater Manchester	756.50
Heart of the South West	42.94
Hertfordshire	424.90
Humber	17.81
Lancashire	115.46
Leeds City Region	259.83
Leicester and Leicestershire	1,814.18
Liverpool City Region	450.16
London	1,090.73
New Anglia	54.11
North Eastern	111.93
Northamptonshire	129.24
Oxfordshire LEP	2,695.14
Sheffield City Region	147.57
Solent	1,170.67
South East	239.36
South East Midlands	605.70
Stoke-on-Trent and Staffordshire	121.65
Tees Valley	344.31
Thames Valley Berkshire	183.13
The Marches	88.72
West of England	613.76
Worcestershire	24.66

York and North Yorkshire	142.05
Average per SME	503.81

Table A1.3.5 IP Income from licenses, other IP sources and total IP per SME in each LEP area (£), 2013-14

	Licenses income per SME (£)	Other IP income per SME (£)	Total IP income per SME (£)
Black Country	0.26	0.00	0.26
Buckinghamshire Thames Valley	0.00	0.00	0.00
Cheshire and Warrington	0.00	0.00	0.00
Coast to Capital	8.34	0.00	8.34
Cornwall and the Isles of Scilly	0.00	0.00	0.00
Coventry and Warwickshire	22.87	2.36	25.23
Cumbria	0.00	0.00	0.00
Derby, Derbyshire, Nottingham and Nottinghamshire,	25.06	10.21	35.26
Dorset	0.60	0.00	0.60
Enterprise M3	16.60	0.00	16.60
Gloucestershire	0.00	0.00	0.00
Greater Birmingham and Solihull	88.85	1.31	90.16
Greater Cambridge & Greater Peterborough	303.87	32.25	336.12
Greater Lincolnshire	0.00	0.00	0.00
Greater Manchester	45.79	44.67	90.46
Heart of the South West	14.56	0.00	14.56
Hertfordshire	0.25	0.50	0.76
Humber	18.50	0.00	18.50
Lancashire	16.64	0.00	16.64
Leeds City Region	23.44	2.02	25.46
Leicester and Leicestershire	21.33	8.46	29.80
Liverpool City Region	14.21	2.09	16.30
London	322.12	9.13	331.25
New Anglia	5.41	11.05	16.46
North Eastern	53.79	9.27	63.06
Northamptonshire	0.00	0.00	0.00
Oxfordshire LEP	1,480.59	228.65	1,709.24
Sheffield City Region	44.18	1.82	46.00
Solent	63.95	0.30	64.25
South East	1.87	0.00	1.87
South East Midlands	105.48	78.00	183.48
Stoke-on-Trent and Staffordshire	13.89	0.14	14.03
Tees Valley	0.84	0.00	0.84
Thames Valley Berkshire	13.51	0.00	13.51
The Marches	0.00	0.00	0.00
West of England	68.36	5.36	73.72

Worcestershire	0.00	0.00	0.00
York and North Yorkshire	0.26	0.00	0.26
Average per SME	105.29	11.42	116.71

Table A1.4.1 Actual Contract Research Engagement with SMEs compared to Expected Average and Upper Quartile Limit Levels (No. and £000) - 2013-14

	Actual Contract Research Contracts No.	Expected Average Research Contracts No.	Gap to Average No.	Expected UQL Contract Research Contracts No.	Gap to UQL	Actual Contract Research Contracts £000	Expected Average Research Contracts £000	Gap to Average £000	Expected UQL Contract Research Contracts £000	Gap to UQL	Actual Average Contract Value £000s	Expected Average Contract Value £000s	Gap to Average Contract Value £000
Black Country	4.00	0.65	3.35	5.51	-1.51	20.00	0.00	20.00	39.65	-19.65	5.00	0.00	5.00
Buckinghamshire Thames Valley	1.00	0.29	0.71	2.45	-1.45	1.00	0.00	1.00	17.61	-16.61	1.00	0.00	1.00
Cheshire and Warrington	0.00	0.44	-0.44	3.74	-3.74	0.00	0.00	0.00	26.92	-26.92	0.00	0.00	0.00
Coast to Capital	12.00	19.26	-7.26	48.27	-36.27	425.00	293.70	131.30	698.30	-273.30	35.42	15.25	20.17
Cornwall and the Isles of Scilly	0.00	0.14	-0.14	1.18	-1.18	0.00	0.00	0.00	8.46	-8.46	0.00	0.00	0.00
Coventry and Warwickshire	104.00	33.02	70.98	82.44	21.56	896.00	525.20	370.80	1,229.58	-333.58	8.62	15.91	-7.29
Cumbria	2.00	0.28	1.72	2.35	-0.35	6.00	0.00	6.00	16.87	-10.87	3.00	0.00	3.00
Derby, Derbyshire, Nottingham and Nottinghamshire,	109.00	36.65	72.35	111.68	-2.68	1,604.00	624.03	979.97	1,597.42	6.58	14.72	17.03	-2.31
Dorset	5.00	0.59	4.41	4.98	0.02	39.00	0.00	39.00	35.78	3.22	7.80	0.00	7.80
Enterprise M3	31.00	18.95	12.05	54.24	-23.24	609.00	333.74	275.26	814.84	-205.84	19.65	17.61	2.04
Gloucestershire	6.00	0.37	5.63	3.16	2.84	89.00	0.00	89.00	22.72	66.28	14.83	0.00	14.83
Greater Birmingham and Solihull	131.00	34.10	96.90	96.03	34.97	1,576.00	570.29	1,005.71	1,404.64	171.36	12.03	16.72	-4.69
Greater Cambridge & Greater Peterborough	13.00	32.82	-19.82	72.86	-59.86	335.00	1,154.27	-819.27	1,539.42	-1,204.42	25.77	35.17	-9.40
Greater Lincolnshire	12.00	0.64	11.36	5.39	6.61	95.00	0.00	95.00	38.74	56.26	7.92	0.00	7.92
Greater Manchester	65.00	49.81	15.19	104.80	-39.80	1,307.00	1,259.86	47.14	1,899.58	-592.58	20.11	25.29	-5.19
Heart of the South West	66.00	26.73	39.27	67.17	-1.17	321.00	422.85	-101.85	995.18	-674.18	4.86	15.82	-10.96
Hertfordshire	8.00	8.24	-0.24	16.04	-8.04	124.00	98.09	25.91	216.33	-92.33	15.50	11.90	3.60
Humber	13.00	7.33	5.67	14.28	-1.28	355.00	87.30	267.70	192.53	162.47	27.31	11.91	15.40
Lancashire	8.00	13.30	-5.30	46.22	-38.22	240.00	208.72	31.28	598.04	-358.04	30.00	15.69	14.31
Leeds City Region	158.00	55.63	102.37	151.82	6.18	2,218.00	909.02	1,308.98	2,217.21	0.79	14.04	16.34	-2.30
Leicester and Leicestershire	214.00	35.49	178.51	92.95	121.05	1,509.00	596.08	912.92	1,408.29	100.71	7.05	16.80	-9.74
Liverpool City Region	91.00	34.99	56.01	91.25	-0.25	1,770.00	572.19	1,197.81	1,360.33	409.67	19.45	16.35	3.10
London	303.00	186.05	116.95	450.68	-147.68	8,668.00	4,412.06	4,255.94	7,590.27	1,077.73	28.61	23.71	4.89
New Anglia	7.00	13.96	-6.96	38.67	-31.67	80.00	249.83	-169.83	596.10	-516.10	11.43	17.90	-6.47

North Eastern	67.00	55.59	11.41	142.30	-75.30	773.00	909.74	-136.74	2,140.20	-1,367.20	11.54	16.37	-4.83
Northamptonshire	4.00	3.97	0.03	7.73	-3.73	44.00	47.24	-3.24	104.20	-60.20	11.00	11.90	-0.90
Oxfordshire LEP	90.00	45.96	44.04	100.33	-10.33	1,933.00	1,472.04	460.96	2,027.55	-94.55	21.48	32.03	-10.55
Sheffield City Region	102.00	42.15	59.85	106.69	-4.69	2,615.00	680.97	1,934.03	1,598.53	1,016.47	25.64	16.16	9.48
Solent	87.00	37.93	49.07	102.75	-15.75	1,287.00	611.31	675.69	1,491.75	-204.75	14.79	16.12	-1.32
South East	46.00	30.32	15.68	83.09	-37.09	411.00	498.08	-87.08	1,215.48	-804.48	8.93	16.43	-7.49
South East Midlands	96.00	20.28	75.72	48.93	47.07	1,227.00	274.78	952.22	559.98	664.17	12.78	13.55	-0.77
Stoke-on-Trent and Staffordshire	8.00	12.17	-4.17	29.50	-21.50	53.00	187.13	-134.13	435.48	-382.48	6.63	15.38	-8.75
Tees Valley	10.00	5.55	4.45	10.80	-0.80	109.00	66.01	42.99	145.58	-36.58	10.90	11.89	-0.99
Thames Valley Berkshire	3.00	12.69	-9.69	35.16	-32.16	50.00	227.15	-177.15	542.00	-492.00	16.67	17.90	-1.23
The Marches	5.00	0.12	4.88	1.05	3.95	22.00	0.00	22.00	7.55	14.45	4.40	0.00	4.40
West of England	38.00	48.26	-10.26	127.96	-89.96	595.00	806.68	-211.68	1,921.73	-1,326.73	15.66	16.72	-1.06
Worcestershire	24.00	0.36	23.64	3.09	20.91	101.00	0.00	101.00	22.21	78.79	4.21	0.00	4.21
York and North Yorkshire	3.00	12.93	-9.93	37.09	-34.09	57.00	227.36	-170.36	556.14	-499.14	19.00	17.58	1.42
England	1,936.00	920.80	1,015.20	2,357.22	-421.22	31,446.00	18,051.12	13,394.88	36,758.54	-5,312.54	16.24	19.60	-3.36

Table A1.4.2 Actual consultancy engagement with SMEs compared to Expected Average and Upper Quartile Limit Levels (No. and £000) - 2013-14

	Actual Consultancy Contracts No.	Expected Average Consultancy Contracts No.	Gap to Average No.	Expected UQL Consultancy Contracts No.	Gap to UQL	Actual Consultancy Contracts (£000)	Expected Average Consultancy Contracts £000s	Gap to Average £000	Expected UQL Consultancy Contracts £000s	Gap to UQL	Actual average Consultancy contract Value £000	Expected average consultancy contract value £000s	Gap between actual and expected average value £000
Black Country	989.00	17.25	971.75	86.27	902.73	493.00	62.37	430.63	220.50	272.50	0.50	3.62	-3.12
Buckinghamshire Thames Valley	18.00	7.66	10.34	38.32	-20.32	38.00	27.70	10.30	97.93	-59.93	2.11	3.62	-1.51
Cheshire and Warrington	90.00	11.71	78.29	58.59	31.41	98.00	42.36	55.64	149.74	-51.74	1.09	3.62	-2.53
Coast to Capital	25.00	90.00	-65.00	193.81	-168.81	158.00	251.78	-93.78	765.28	-607.28	6.32	2.80	3.52
Cornwall and the Isles of Scilly	42.00	3.68	38.32	18.42	23.58	15.00	13.31	1.69	47.07	-32.07	0.36	3.62	-3.26
Coventry and Warwickshire	13,070.00	131.19	12,938.81	255.36	12,814.64	1,119.00	374.84	744.16	1,101.60	17.40	0.09	2.86	-2.77
Cumbria	66.00	7.34	58.66	36.71	29.29	na	26.54	na	93.82	na	na	3.62	na
Derby, Derbyshire, Nottingham and Nottinghamshire,	137.00	122.11	14.89	384.97	-247.97	764.00	463.23	300.77	1,370.52	-606.52	5.58	3.79	1.78
Dorset	73.00	15.57	57.43	95.88	-22.88	211.00	56.30	154.70	211.02	-0.02	2.89	3.62	-0.73
Enterprise M3	73.00	48.13	24.87	150.25	-77.25	325.00	185.64	139.36	533.60	-208.60	4.45	3.86	0.59
Gloucestershire	46.00	9.88	36.12	49.44	-3.44	233.00	35.74	197.26	126.36	106.64	5.07	3.62	1.45
Greater Birmingham and Solihull	76.00	116.73	-40.73	323.92	-247.92	355.00	398.10	-43.10	1,180.28	-825.28	4.67	3.41	1.26
Greater Cambridge & Greater Peterborough	262.00	105.30	156.70	201.42	60.58	2,335.00	897.30	1,437.70	1,696.75	638.25	8.91	8.52	0.39
Greater Lincolnshire	18.00	16.85	1.15	84.30	-66.30	341.00	60.94	280.06	215.44	125.56	18.94	3.62	15.33
Greater Manchester	1,404.00	253.38	1,150.62	490.22	913.78	1,107.00	1,149.33	-42.33	2,671.65	-1,564.65	0.79	4.54	-3.75
Heart of the South West	274.00	109.06	164.94	219.64	54.36	1,182.00	312.46	869.54	924.63	257.37	4.31	2.87	1.45
Hertfordshire	214.00	62.92	151.08	120.98	93.02	2,788.00	142.51	2,645.49	462.73	2,325.27	13.03	2.26	10.76
Humber	56.00	56.00	0.00	107.67	-51.67	88.00	126.83	-38.83	411.82	-323.82	1.57	2.26	-0.69
Lancashire	1,035.00	68.58	966.42	267.50	767.50	8,946.00	255.24	8,690.76	812.99	8,133.01	8.64	3.72	4.92
Leeds City Region	475.00	208.06	266.94	512.59	-37.59	1,194.00	666.84	527.16	1,976.49	-782.49	2.51	3.21	-0.69
Leicester and Leicestershire	236.00	112.03	123.97	219.50	16.50	762.00	355.86	406.14	1,003.65	-241.65	3.23	3.18	0.05
Liverpool City Region	15,102.00	126.22	14,975.78	268.25	14,833.75	10,284.00	386.64	9,897.36	1,125.82	9,158.18	0.68	3.06	-2.38
London	2,783.00	817.22	1,965.78	1,994.01	788.99	5,291.00	3,804.29	1,486.71	9,218.94	-3,927.94	1.90	4.66	-2.75
New Anglia	42.00	30.00	12.00	69.19	-27.19	345.00	117.15	227.85	313.60	31.40	8.21	3.91	4.31

North Eastern	295.00	197.34	97.66	385.28	-90.28	1,256.00	592.86	663.14	1,708.10	-452.10	4.26	3.00	1.25
Northamptonshire	8,205.00	30.31	8,174.69	58.27	8,146.73	745.00	68.64	676.36	222.88	522.12	0.09	2.26	-2.17
Oxfordshire LEP	356.00	174.90	181.10	335.00	21.00	1,441.00	1,194.17	246.83	2,403.48	-962.48	4.05	6.83	-2.78
Sheffield City Region	153.00	157.75	-4.75	307.55	-154.55	606.00	462.71	143.29	1,345.72	-739.72	3.96	2.93	1.03
Solent	198.00	150.10	47.90	362.09	-164.09	2,167.00	470.41	1,696.59	1,402.34	764.66	10.94	3.13	7.81
South East	112.00	111.05	0.95	269.06	-157.06	7,131.00	359.54	6,771.46	1,058.49	6,072.51	63.67	3.24	60.43
South East Midlands	8,276.00	128.97	8,147.03	297.55	7,978.45	1,360.00	337.28	1,022.72	1,076.17	283.83	0.16	2.62	-2.46
Stoke-on-Trent and Staffordshire	97.00	54.30	42.70	105.40	-8.40	259.00	147.82	111.18	443.06	-184.06	2.67	2.72	-0.05
Tees Valley	78.00	42.34	35.66	81.41	-3.41	90.00	95.90	-5.90	311.39	-221.39	1.15	2.26	-1.11
Thames Valley Berkshire	2.00	27.28	-25.28	54.24	-52.24	8.00	106.52	-98.52	279.36	-271.36	4.00	3.90	0.10
The Marches	10.00	3.29	6.71	16.44	-6.44	93.00	11.89	81.11	42.01	50.99	9.30	3.61	5.69
West of England	1,030.00	157.82	872.18	330.01	699.99	1,700.00	505.10	1,194.90	1,441.38	258.62	1.65	3.20	-1.55
Worcestershire	99.00	9.66	89.34	48.33	50.67	10.00	34.94	-24.94	123.52	-113.52	0.10	3.62	-3.52
York and North Yorkshire	7.00	33.23	-26.23	83.96	-76.96	40.00	128.07	-88.07	355.44	-315.44	5.71	3.85	1.86
England	47,281.00	3,753.63	43,527.37	8,799.26	38,481.74	54,521.00	14,503.30	40,044.24	38,264.26	16,350.56	1.15	3.86	-2.71

Table A1.4.3 Actual Facilities & Equipment services engagement with SMEs compared to Expected Average and Upper Quartile Limit Levels (No. and £000) , 2013-14

	Actual F&E contracts No.	Expected Average F&E Contracts No.	Gap to Average No.	Expected UQL F&E Services No.	Gap to UQL	Actual F&E contracts £000s	Expected Average F&E contracts £000s	Gap to Average £000	Expected UQL F&E Services £000s	Gap to UQL	Actual Average F&E Contracts value £000s	Expected Average F&E Contracts value £000s	Gap Between actual and expected average value £000
Black Country	365.00	18.51	346.49	78.53	286.48	2,301.00	52.79	2,248.21	247.44	2,053.56	6.30	2.85	3.45
Buckinghamshire Thames Valley	292.00	8.22	283.78	34.88	257.13	883.00	23.45	859.55	109.90	773.11	3.02	2.85	0.17
Cheshire and Warrington	223.00	12.57	210.43	53.33	169.68	44.00	35.85	8.15	168.03	-124.03	0.20	2.85	-2.65
Coast to Capital	14.00	39.64	-25.64	132.13	-118.13	470.00	192.79	277.21	759.88	-289.88	33.57	4.86	28.71
Cornwall and the Isles of Scilly	60.00	3.95	56.05	16.76	43.24	15.00	11.27	3.73	52.82	-37.82	0.25	2.85	-2.60
Coventry and Warwickshire	231.00	56.41	174.59	179.32	51.68	3,829.00	320.32	3,508.68	1,197.72	2,631.28	16.58	5.68	10.90
Cumbria	8.00	7.87	0.13	33.41	-25.41	25.00	22.46	2.54	105.29	-80.29	3.13	2.85	0.27
Derby, Derbyshire, Nottingham and Nottinghamshire,	170.00	106.62	63.38	400.59	-230.59	3,633.00	566.96	3,066.04	2,093.87	1,539.13	21.37	5.32	16.05
Dorset	18.00	35.50	-17.50	173.39	-155.39	56.00	94.15	-38.15	447.21	-391.21	3.11	2.65	0.46
Enterprise M3	198.00	70.18	127.82	308.30	-110.30	4,807.00	328.79	4,478.21	1,249.62	3,659.95	24.28	4.68	19.60
Gloucestershire	2.00	10.61	-8.61	45.00	-43.00	1.00	30.25	-29.25	141.80	-140.80	0.50	2.85	-2.35
Greater Birmingham and Solihull	82.00	105.11	-23.11	423.89	-341.89	152.00	507.23	-355.23	1,934.07	-1,782.07	1.85	4.83	-2.97
Greater Cambridge & Greater Peterborough	91.00	89.00	2.00	186.57	-95.57	325.00	323.34	1.66	469.21	-144.21	3.57	3.63	-0.06
Greater Lincolnshire	109.00	18.08	90.92	76.73	32.28	218.00	51.58	166.42	241.77	-23.77	2.00	2.85	-0.85
Greater Manchester	759.00	122.33	636.67	304.67	454.33	1,205.00	395.05	809.95	1,040.33	164.67	1.59	3.23	-1.64
Heart of the South West	277.00	48.15	228.85	155.74	121.26	1,860.00	264.79	1,595.21	999.13	860.87	6.71	5.50	1.22
Hertfordshire	32.00	15.77	16.23	46.41	-14.41	1,666.00	39.90	1,626.10	226.52	1,439.48	52.06	2.53	49.53
Humber	39.00	14.03	24.97	41.31	-2.31	103.00	35.51	67.49	201.60	-98.60	2.64	2.53	0.11
Lancashire	123.00	65.42	57.58	260.27	-137.27	544.00	274.52	269.48	1,098.26	-554.26	4.42	4.20	0.23
Leeds City Region	9,222.00	135.07	9,086.93	494.45	8,727.55	5,594.00	702.65	4,891.35	2,645.54	2,948.46	0.61	5.20	-4.60
Leicester and Leicestershire	74.00	59.00	15.00	191.11	-117.11	657.00	382.68	274.32	1,356.65	-699.65	8.88	6.49	2.39
Liverpool City Region	862.00	69.07	792.93	238.63	623.37	389.00	389.25	-0.25	1,439.07	-1,050.07	0.45	5.64	-5.18
London	1,776.00	652.40	1,123.60	2,292.29	-516.29	7,041.00	2,357.96	4,683.04	7,824.36	-783.36	3.96	3.61	0.35
New Anglia	8.00	32.36	-24.36	128.63	-120.63	7.00	193.78	-186.78	685.78	-678.78	0.88	5.99	-5.11
North Eastern	109.00	93.63	15.37	300.55	-191.55	912.00	570.37	341.63	2,072.46	-1,160.46	8.37	6.09	2.28

Northamptonshire	3.00	7.59	-4.59	22.36	-19.36	105.00	19.22	85.78	109.11	-4.11	35.00	2.53	32.47
Oxfordshire LEP	250.00	119.67	130.33	260.92	-10.92	734.00	421.70	312.30	738.78	-4.78	2.94	3.52	-0.59
Sheffield City Region	52.00	71.45	-19.45	228.34	-176.34	252.00	421.73	-169.73	1,552.04	-1,300.04	4.85	5.90	-1.06
Solent	74.00	86.44	-12.44	302.97	-228.97	6,181.00	454.94	5,726.06	1,715.90	4,465.10	83.53	5.26	78.26
South East	91.00	67.53	23.47	236.93	-145.93	448.00	371.30	76.70	1,376.47	-928.47	4.92	5.50	-0.58
South East Midlands	9.00	52.52	-43.52	180.69	-171.69	360.00	192.81	167.19	856.45	-496.45	40.00	3.67	36.33
Stoke-on-Trent and Staffordshire	27.00	21.13	5.87	66.43	-39.43	88.00	110.21	-22.21	427.30	-339.30	3.26	5.22	-1.96
Tees Valley	114.00	10.61	103.39	31.23	82.77	165.00	26.85	138.15	152.44	12.56	1.45	2.53	-1.08
Thames Valley Berkshire	92.00	20.38	71.62	67.64	24.36	2,758.00	153.82	2,604.18	515.85	2,242.15	29.98	7.55	22.43
The Marches	0.00	3.53	-3.53	14.96	-14.96	0.00	10.06	-10.06	47.15	-47.15	0.00	2.85	-2.85
West of England	244.00	87.08	156.92	289.48	-45.48	1,176.00	539.06	636.94	1,933.75	-757.75	4.82	6.19	-1.37
Worcestershire	44.00	10.37	33.63	43.99	0.01	87.00	29.57	57.43	138.61	-51.61	1.98	2.85	-0.87
York and North Yorkshire	653.00	26.77	626.23	94.71	558.29	3,538.00	172.12	3,365.88	601.41	2,936.59	5.42	6.43	-1.01
England	16,128.00	2,431.56	13,696.44	8,283.77	7,844.23	48,973.00	10,875.10	38,097.90	38,147.46	10,825.54	3.04	4.47	-4.43

Table A1.4.4 Actual CPD and CPD & CE engagement with SMEs and individuals compared to Expected Average and Upper Quartile Limit Levels (£000) - 2013-14

	Actual CPD Contracts £000	Expected Average CPD Contracts £000s	Gap to Average £000	Expected UQL Value of CPD £000s	Gap to UQL Value of CPD £000s		Actual CPD & CE contracts £000s	Expected Average CPD & CE contracts £000s	Gap to Average £000	Expected UQL Value of CPD & CE £000s	Gap to UQL £000s Value of CPD & CE £000s
Black Country	5.00	53.76	-48.76	186.92	-181.92		358.00	353.00	5.00	1,497.07	-1,139.07
Buckinghamshire Thames Valley	158.00	23.87	134.13	83.02	74.98		158.00	156.78	1.22	664.89	-506.89
Cheshire and Warrington	132.00	36.50	95.50	126.94	5.06		700.00	239.72	460.28	1,016.64	-316.64
Coast to Capital	218.00	114.79	103.21	346.67	-128.67		538.00	2,073.24	-1,535.24	4,816.40	-4,278.40
Cornwall and the Isles of Scilly	0.00	11.47	-11.47	39.90	-39.90		0.00	75.35	-75.35	319.58	-319.58
Coventry and Warwickshire	136.00	143.28	-7.28	426.45	-290.45		9,944.00	3,155.94	6,788.06	7,174.42	2,769.58
Cumbria	0.00	22.87	-22.87	79.54	-79.54		637.00	150.20	486.80	637.01	-0.01
Derby, Derbyshire, Nottingham and Nottinghamshire,	215.00	198.68	16.32	701.48	-486.48		7,252.00	3,308.44	3,943.56	10,567.24	-3,315.24
Dorset	5.00	48.52	-43.52	179.69	-174.69		831.00	414.14	416.86	2,721.19	-1,890.19
Enterprise M3	21.00	52.74	-31.74	207.49	-186.49		1,503.00	1,578.42	-75.42	6,462.75	-4,959.75
Gloucestershire	58.00	30.81	27.19	107.12	-49.12		295.00	202.29	92.71	857.92	-562.92
Greater Birmingham and Solihull	536.00	155.74	380.26	536.32	-0.32		7,475.00	3,182.15	4,292.85	10,433.69	-2,958.69
Greater Cambridge & Greater Peterborough	463.00	316.14	146.86	463.17	-0.17		3,185.00	8,330.46	-5,145.46	13,534.08	-10,349.08
Greater Lincolnshire	317.00	52.52	264.48	182.64	134.36		366.00	344.91	21.09	1,462.75	-1,096.75
Greater Manchester	1,370.00	489.16	880.84	996.56	373.44		14,819.00	10,522.44	4,296.56	18,059.48	-3,240.48
Heart of the South West	545.00	124.39	420.61	373.53	171.47		625.00	2,608.02	-1,983.02	6,012.06	-5,387.06
Hertfordshire	200.00	83.05	116.95	229.85	-29.85		3,372.00	1,257.16	2,114.84	2,313.74	1,058.26
Humber	31.00	73.91	-42.91	204.56	-173.56		103.00	1,118.86	-1,015.86	2,059.20	-1,956.20
Lancashire	730.00	152.90	577.10	535.23	194.77		1,318.00	1,674.24	-356.24	5,941.92	-4,623.92
Leeds City Region	665.00	271.66	393.34	886.15	-221.15		5,266.00	5,283.17	-17.17	14,640.52	-9,374.52
Leicester and Leicestershire	193.00	108.61	84.39	339.86	-146.86		15,221.00	2,941.07	12,279.93	7,208.16	8,012.84
Liverpool City Region	210.00	140.97	69.03	441.17	-231.17		4,087.00	3,188.70	898.30	8,075.04	-3,988.04
London	2,766.00	1,599.34	1,166.66	3,755.39	-989.39		89,358.00	34,076.81	55,281.19	76,144.77	13,213.23
New Anglia	0.00	20.68	-20.68	81.97	-81.97		700.00	988.54	-288.54	3,316.13	-2,616.13

North Eastern	292.00	204.38	87.62	621.76	-329.76	1,340.00	4,946.83	-3,606.83	11,669.27	-10,329.27
Northamptonshire	40.00	40.00	0.00	110.71	-70.71	751.00	605.53	145.47	1,114.45	-363.45
Oxfordshire LEP	414.00	445.43	-31.43	733.98	-319.98	17,009.00	11,037.00	5,972.00	18,135.34	-1,126.34
Sheffield City Region	74.00	167.69	-93.69	504.65	-430.65	1,463.00	3,877.33	-2,414.33	8,989.25	-7,526.25
Solent	672.00	200.23	471.77	642.51	29.49	11,661.00	3,697.84	7,963.16	9,671.20	1,989.80
South East	1,373.00	144.26	1,228.74	469.45	903.55	7,408.00	2,812.93	4,595.07	7,505.33	-97.33
South East Midlands	2,397.00	189.44	2,207.56	568.39	1,828.61	8,458.00	2,748.53	5,709.47	5,263.21	3,194.79
Stoke-on-Trent and Staffordshire	287.00	62.13	224.87	181.50	105.50	867.00	1,255.83	-388.83	2,747.82	-1,880.82
Tees Valley	388.00	55.89	332.11	154.68	233.32	1,234.00	846.00	388.00	1,557.01	-323.01
Thames Valley Berkshire	60.00	18.81	41.19	69.25	-9.25	1,396.00	852.87	543.13	2,356.15	-960.15
The Marches	236.00	10.24	225.76	35.62	200.38	535.00	67.26	467.74	285.26	249.74
West of England	223.00	167.35	55.65	531.48	-308.48	5,495.00	4,109.22	1,385.78	10,331.43	-4,836.43
Worcestershire	33.00	30.11	2.89	104.71	-71.71	124.00	197.74	-73.74	838.62	-714.62
York and North Yorkshire	204.00	37.31	166.69	133.59	70.41	1,100.00	975.04	124.96	2,873.10	-1,773.10
England	15,423.00	5,997.21	9,425.79	16,042.27	-619.27	225,022.00	123,508.57	101,513.43	285,577.33	-60,555.33

Table A1.4.5 Actual IP Income from SMEs compared to Expected Average and Upper Quartile Limit Levels (£000) - 2013-14

	Actual Non-software licenses £000	Expected Average non-software licenses £000	Non-Software Gap to Average £000	Expected UQL Value of non-software licenses £000s	Non-software Gap to UQL £000s		Actual Software licenses £000	Expected Average software licenses £000	Software Licenses Gap to Average £000	Expected UQL Value of software licenses £000s	Software Licenses Gap to UQL £000s
Black Country	2.00	0.00	2.00	0.00	2.00		0.00	0.00	0.00	0.00	0.00
Buckinghamshire Thames Valley	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Cheshire and Warrington	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Coast to Capital	124.00	26.57	97.43	71.66	52.34		0.00	36.11	-36.11	147.03	-147.03
Cornwall and the Isles of Scilly	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Coventry and Warwickshire	84.00	52.24	31.76	137.50	-53.50		71.00	71.00	0.00	286.08	-215.08
Cumbria	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Derby, Derbyshire, Nottingham and Nottinghamshire,	193.00	82.63	110.37	204.09	-11.09		131.00	112.30	18.70	440.57	-309.57
Dorset	4.00	0.00	4.00	0.00	4.00		0.00	0.00	0.00	0.00	0.00
Enterprise M3	12.00	44.19	-32.19	109.15	-97.15		206.00	60.06	145.94	235.62	-29.62
Gloucestershire	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Greater Birmingham and Solihull	286.00	69.08	216.92	173.77	112.23		732.00	93.88	638.12	371.12	360.88
Greater Cambridge & Greater Peterborough	846.00	4,502.42	-3,656.42	846.05	-0.05		2,282.00	1,389.11	892.89	2,281.98	0.02
Greater Lincolnshire	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Greater Manchester	70.00	3,932.95	-3,862.95	755.35	-685.35		827.00	1,213.41	-386.41	2,007.84	-1,180.84
Heart of the South West	81.00	41.80	39.20	110.20	-29.20		131.00	56.82	74.18	229.08	-98.08
Hertfordshire	2.00	0.00	2.00	6.36	-4.36		0.00	0.00	0.00	5.65	-5.65
Humber	102.00	0.00	102.00	5.66	96.34		5.00	0.00	5.00	5.03	-0.03
Lancashire	1.00	27.64	-26.64	68.26	-67.26		189.00	37.56	151.44	147.36	41.64
Leeds City Region	144.00	103.17	40.83	263.23	-119.23		331.00	140.21	190.79	557.56	-226.56
Leicester and Leicestershire	162.00	68.66	93.34	174.60	-12.60		17.00	93.31	-76.31	370.54	-353.54
Liverpool City Region	96.00	62.60	33.40	161.05	-65.05		33.00	85.07	-52.07	339.49	-306.49
London	1,556.00	11,373.91	-9,817.91	2,469.42	-913.42		24,834.00	3,645.69	21,188.31	6,423.46	18,410.54
New Anglia	45.00	33.08	11.92	81.70	-36.70		25.00	44.96	-19.96	176.38	-151.38
North Eastern	187.00	98.09	88.91	253.22	-66.22		457.00	133.31	323.69	532.73	-75.73
Northamptonshire	0.00	0.00	0.00	3.06	-3.06		0.00	0.00	0.00	2.72	-2.72
Oxfordshire LEP	2,289.00	5,454.13	-3,165.13	1,029.67	1,259.33		7,055.00	1,682.73	5,372.27	2,768.59	4,286.41
Sheffield City Region	22.00	70.87	-48.87	184.50	-162.50		416.00	96.32	319.68	386.28	29.72

Solent	531.00	67.20	463.80	172.70	358.30		106.00	91.32	14.68	364.27	-258.27
South East	12.00	57.24	-45.24	145.64	-133.64		46.00	77.79	-31.79	308.98	-262.98
South East Midlands	68.00	16.02	51.98	49.54	18.46		1,398.00	21.77	1,376.23	94.28	1,303.72
Stoke-on-Trent and Staffordshire	10.00	16.69	-6.69	45.19	-35.19		89.00	22.69	66.31	92.53	-3.53
Tees Valley	3.00	0.00	3.00	4.28	-1.28		0.00	0.00	0.00	3.80	-3.80
Thames Valley Berkshire	103.00	30.08	72.92	74.29	28.71		0.00	40.88	-40.88	160.37	-160.37
The Marches	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
West of England	140.00	93.07	46.93	236.60	-96.60		472.00	126.48	345.52	502.20	-30.20
Worcestershire	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
York and North Yorkshire	2.00	30.11	-28.11	74.36	-72.36		0.00	40.91	-40.91	160.52	-160.52
England	7,175.00	26,324.33	19,149.33	7,833.68	-658.68		39,853.00	9,372.78	30,480.22	19,238.82	20,614.18

	Actual Other IP Income from SMEs £000	Expected Average Other IP Income from SMEs £000	Other IP Income Gap to Average £000	Expected UQL Value of other IP Income from SMEs £000s	Gap to UQL		Actual Total IP Income from SMEs £000	Expected Average IP Income from SMEs £000	Gap to Average £000	Expected UQL Value of IP Income from SMEs £000s	Gap to UQL Total IP Income from SMEs £000s
Black Country	0.00	0.00	0.00	0.00	0.00		2.00	0.00	2.00	4.75	-2.75
Buckinghamshire Thames Valley	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	2.11	-2.11
Cheshire and Warrington	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	3.22	-3.22
Coast to Capital	0.00	0.00	0.00	8.33	-8.33		124.00	244.22	-120.22	721.90	-597.90
Cornwall and the Isles of Scilly	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	1.01	-1.01
Coventry and Warwickshire	16.00	0.00	16.00	16.39	-0.39		171.00	468.10	-297.10	1,350.07	-1,179.07
Cumbria	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	2.02	-2.02
Derby, Derbyshire, Nottingham and Nottinghamshire,	132.00	0.00	132.00	25.92	106.08		456.00	692.59	-236.59	1,887.47	-1,431.47
Dorset	0.00	0.00	0.00	0.00	0.00		4.00	0.00	4.00	21.66	-17.66
Enterprise M3	0.00	0.00	0.00	13.86	-13.86		218.00	370.40	-152.40	1,033.89	-815.89
Gloucestershire	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	2.72	-2.72
Greater Birmingham and Solihull	15.00	0.00	15.00	21.67	-6.67		1,033.00	590.24	442.76	1,658.65	-625.65
Greater Cambridge & Greater Peterborough	332.00	332.48	-0.48	1,001.53	-669.53		3,460.00	2,418.73	1,041.27	7,582.47	-4,122.47
Greater Lincolnshire	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	4.64	-4.64
Greater Manchester	875.00	290.43	584.57	874.85	0.15		1,772.00	2,170.96	-398.96	6,944.81	-5,172.81
Heart of the South West	0.00	0.00	0.00	13.11	-13.11		212.00	375.17	-163.17	1,084.27	-872.27
Hertfordshire	4.00	0.00	4.00	0.00	4.00		6.00	22.67	-16.67	123.80	-117.80
Humber	0.00	0.00	0.00	0.00	0.00		107.00	20.18	86.82	110.18	-3.18

Lancashire	0.00	0.00	0.00	8.67	-8.67	190.00	231.65	-41.65	638.93	-448.93
Leeds City Region	41.00	0.00	41.00	32.36	8.64	516.00	894.76	-378.76	2,522.92	-2,006.92
Leicester and Leicestershire	71.00	0.00	71.00	21.53	49.47	250.00	593.41	-343.41	1,655.43	-1,405.43
Liverpool City Region	19.00	0.00	19.00	19.63	-0.63	148.00	547.66	-399.66	1,551.35	-1,403.35
London	748.00	830.31	-82.31	2,541.89	1,793.89	27,138.00	7,256.51	19,881.49	22,749.93	4,388.07
New Anglia	143.00	0.00	143.00	10.38	132.62	213.00	277.27	-64.27	759.62	-546.62
North Eastern	111.00	0.00	111.00	30.76	80.24	755.00	861.23	-106.23	2,438.46	-1,683.46
Northamptonshire	0.00	0.00	0.00	0.00	0.00	0.00	10.92	-10.92	59.63	-59.63
Oxfordshire LEP	1,443.00	402.76	1,040.24	1,213.23	229.77	10,787.00	2,947.05	7,839.95	9,278.35	1,508.65
Sheffield City Region	18.00	0.00	18.00	22.23	-4.23	456.00	627.74	-171.74	1,791.73	-1,335.73
Solent	3.00	0.00	3.00	21.08	-18.08	640.00	587.24	52.76	1,661.67	-1,021.67
South East	0.00	0.00	0.00	17.95	-17.95	58.00	494.97	-436.97	1,386.19	-1,328.19
South East Midlands	1,084.00	0.00	1,084.00	5.02	1,078.98	2,550.00	169.84	2,380.16	502.27	2,047.73
Stoke-on-Trent and Staffordshire	1.00	0.00	1.00	5.24	-4.24	100.00	154.04	-54.04	455.77	-355.77
Tees Valley	0.00	0.00	0.00	0.00	0.00	3.00	15.26	-12.26	83.31	-80.31
Thames Valley Berkshire	0.00	0.00	0.00	9.43	-9.43	103.00	252.11	-149.11	682.33	-579.33
The Marches	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	-0.90
West of England	48.00	0.00	48.00	29.19	18.81	660.00	804.08	-144.08	2,244.19	-1,584.19
Worcestershire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.66	-2.66
York and North Yorkshire	0.00	0.00	0.00	9.44	-9.44	2.00	252.34	-250.34	684.60	-682.60
England	5,101.00	1,855.98	3,245.02	5,964.25	-863.25	52,129.00	24,088.07	28,040.93	73,003.08	-20,874.08

Annex 2: Higher Education Institutions by LEP Area

	HEI name
Black Country	The University of Wolverhampton
Buckinghamshire Thames Valley	Buckinghamshire New University
Cheshire and Warrington	University of Chester
Coast to Capital	University of Sussex
	University of Brighton
	The University of Chichester
Cornwall and the Isles of Scilly	Falmouth University
Coventry and Warwickshire	The University of Warwick
	Coventry University
Cumbria	University of Cumbria
Derby, Derbyshire, Nottingham and Nottinghamshire	The University of Nottingham
	University of Derby
	Nottingham Trent University
Dorset	Bournemouth University
	The Arts University Bournemouth
Enterprise M3	Royal Holloway, University of London
	The University of Surrey
	University for the Creative Arts
	University of Winchester
Gloucestershire	The Royal Agricultural University
	University of Gloucestershire
Greater Birmingham and Solihull	The University of Birmingham
	Aston University
	Newman University
	Birmingham City University
	University College Birmingham
Greater Cambridge & Greater Peterborough	University of Cambridge
Greater Lincolnshire	Bishop Grosseteste University
	University of Lincoln
Greater Manchester	The University of Manchester
	The University of Bolton
	The University of Salford
	Manchester Metropolitan University
	Royal Northern College of Music
Heart of the South West	University of Exeter
	University of Plymouth
	University of St Mark & St John
Hertfordshire	University of Hertfordshire
Humber	The University of Hull
Lancashire	The University of Lancaster
	Edge Hill University
	University of Central Lancashire

Leeds City Region	The University of York The University of Leeds The University of Bradford The University of Huddersfield Leeds Trinity University Leeds Beckett University Leeds College of Art York St John University
Leicester and Leicestershire	Loughborough University The University of Leicester De Montfort University
Liverpool City Region	Liverpool School of Tropical Medicine The University of Liverpool Liverpool John Moores University Liverpool Hope University The Liverpool Institute for Performing Arts
London	King's College London Imperial College London University College London University of London London Business School The Royal Veterinary College Institute of Education, University of London St. George's, University of London The Institute of Cancer Research London School of Hygiene and Tropical Medicine The London School of Economics and Political Science Queen Mary University of London The School of Oriental and African Studies Roehampton University Goldsmiths' College Birkbeck College London South Bank University The City University The University of Westminster Brunel University London University of Greenwich Heythrop College St Mary's University, Twickenham The University of West London University of East London London Metropolitan University Middlesex University Kingston University Courtauld Institute of Art Rose Bruford College Ravensbourne The Royal Central School of Speech and Drama The Royal College of Music The Royal Academy of Music Trinity Laban Conservatoire of Music and Dance Ltd The Royal College of Art Guildhall School of Music & Drama The Conservatoire for Dance and Drama University of the Arts, London
New Anglia	The University of East Anglia Norwich University of the Arts
North Eastern	University of Durham

	University of Newcastle Upon Tyne
	University of Sunderland
	University of Northumbria at Newcastle
Northamptonshire	The University of Northampton
Oxfordshire LEP	University of Oxford
	Oxford Brookes University
Sheffield City Region	The University of Sheffield
	Sheffield Hallam University
Solent	The University of Southampton
	University of Portsmouth
	University of Winchester
	Southampton Solent University
South East	The University of Essex
	The University of Kent
	Anglia Ruskin University
	Writtle College
	Canterbury Christ Church University
South East Midlands	Cranfield University
	The Open University
	University of Bedfordshire
	The University of Northampton
Stoke-on-Trent and Staffordshire	The University of Keele
	Staffordshire University
Tees Valley	Teesside University
Thames Valley Berkshire	The University of Reading
The Marches	Harper Adams University
West of England	The University of Bath
	University of Bristol
	University of the West of England, Bristol
	Bath Spa University
Worcestershire	University of Worcester
York and North Yorkshire	York St John University
	The University of York

Note: Data for HEI-business and community interaction is allocated to the main campus of the HEI. In four cases the main campus covers two LEP areas and therefore the values recorded for these HEIs are reported for both LEPs. HEIs and LEP areas to which this applies are as follows:

The University of Northampton: Northamptonshire LEP and South East Midland LEP
The University of York: York and North Yorkshire LEP and Leeds City Region LEP
The University of Winchester: Solent LEP and Enterprise M3 LEP
York St John University: York and North Yorkshire LEP and Leeds City Region LEP

Values recorded for these HEIs are reported for both LEP areas. Where totals or averages are shown at the bottom of data tables these have been adjusted to remove the double counting, hence totals shown will not equal the sum of the numbers above.

Annex 3: Higher Education Institutions by Cluster

HEI Name	Cluster
Anglia Ruskin University	3
Aston University	3
Bath Spa University	4
Birkbeck College	3
Birmingham City University	4
Bishop Grosseteste University	4
Bournemouth University	4
Brunel University	3
Buckinghamshire New University	4
Canterbury Christ Church University	4
Central School of Speech and Drama	5
Conservatoire for Dance and Drama	5
Courtauld Institute of Art	5
Coventry University	3
Cranfield University	2
De Montfort University	3
Edge Hill University	4
Falmouth University	4
Goldsmiths College	3
Guildhall School of Music and Drama	5
Harper Adams University	4
Heythrop College	6
Imperial College of Science, Technology and Medicine	1
Institute of Education	2
King's College London	1
Kingston University	4
Leeds College of Art	5
Leeds College of Music	5
Leeds Metropolitan University	4
Leeds Trinity University	4
Liverpool Hope University	4
Liverpool John Moores University	3
London Business School	2
London Metropolitan University	4
London School of Economics and Political Science	2
London School of Hygiene and Tropical Medicine	2
London South Bank University	3
Loughborough University	2
Middlesex University	4

HEI Name	Cluster
The University of Bath	2
The University of Birmingham	2
The University of Bolton	3
The University of Bradford	3
The University of Brighton	3
The University of Bristol	2
The University of Buckingham	6
The University of Cambridge	1
The University of Central Lancashire	4
The University of Chichester	4
The University of East Anglia	2
The University of East London	4
The University of Essex	2
The University of Exeter	2
The University of Greenwich	3
The University of Huddersfield	3
The University of Hull	3
The University of Keele	2
The University of Kent	2
The University of Lancaster	2
The University of Leeds	2
The University of Leicester	2
The University of Lincoln	4
The University of Liverpool	2
The University of Manchester	1
The University of Newcastle-upon-Tyne	2
The University of Northampton	3
The University of Northumbria at Newcastle	3
The University of Nottingham	2
The University of Oxford	1
The University of Plymouth	3
The University of Portsmouth	3
The University of Reading	2
The University of Salford	3
The University of Sheffield	2
The University of Southampton	2
The University of Sunderland	3
The University of Surrey	2
The University of Sussex	2

Newman University	4
Norwich University of the Arts	5
Oxford Brookes University	3
Queen Mary University of London	2
Ravensbourne	5
Roehampton University	3
Rose Bruford College	5
Royal Academy of Music	5
Royal Agricultural University	6
Royal College of Art	5
Royal College of Music	5
Royal Holloway and Bedford New College	2
Royal Northern College of Music	5
Sheffield Hallam University	3
Southampton Solent University	4
St George's Hospital Medical School	2
St Mary's University College, Twickenham	4
Staffordshire University	3
Teesside University	3
The Arts University Bournemouth	5
The City University	3
The Institute of Cancer Research	2
The Liverpool Institute for Performing Arts	5
The Manchester Metropolitan University	3
The Nottingham Trent University	4
The Open University	3
The Royal Veterinary College	2
The School of Oriental and African Studies	3

The University of Warwick	2
The University of West London	4
The University of Westminster	3
The University of Winchester	4
The University of Wolverhampton	4
The University of Worcester	4
The University of York	2
Trinity Laban Conservatoire of Music and Dance	5
University Campus Suffolk	6
University College Birmingham	5
University College London	1
University for the Creative Arts	5
University of Bedfordshire	4
University of Chester	4
University of Cumbria	4
University of Derby	4
University of Durham	2
University of Gloucestershire	4
University of Hertfordshire	3
University of London (Institutes and activities)	6
University of St Mark and St John	4
University of the Arts, London	5
University of the West of England, Bristol	3
Writtle College	4
York St John University	4

Annex 4: Estimating the innovation effects of university-SME interaction

In this annex we provided detailed tables relating to the modelling of the innovation effects of university-SME relationships. These relate to SMEs in England only. The tables are as follows:

Table A4.1 – correlation coefficients between variables used in the estimation

Tables A4.2 and A4.3 relate to all innovative SMEs in England and the impact of universities on the probability of new-to-the-market innovation and innovative sales from these products/services

Tables A4.4 and A4.5 provide similar information for small firms with ten to 49 employees

Tables A4.6 and A4.7 relate to medium-sized firms with 50-250 employees.

In each case we report marginal values derived at variable means. * denotes a variable is significant at the ten per cent level, ** at five per cent and *** at one per cent. All tables are based on pooled data from the UKIS.

Table A4.1: Correlation Matrix (N=8747): Innovative SMEs in England - 2002-12

		1	2	3	4	5	6	7	8	9	10	11	12
New to the market innovation	1	1.000											
Sales from new to the market innovation (log)	2	0.790	1.000										
Employment (log)	3	0.003	0.100	1.000									
R&D investment for innovation	4	0.292	0.264	0.055	1.000								
Design investment for innovation	5	0.242	0.233	0.041	0.389	1.000							
Science and Engineering graduates	6	0.163	0.174	-0.031	0.199	0.121	1.000						
Other graduates	7	0.018	0.040	-0.033	0.048	0.038	0.101	1.000					
Exporting firm	8	0.187	0.219	0.177	0.259	0.203	0.222	0.034	1.000				
Non-university partnerships	9	0.206	0.194	0.046	0.202	0.196	0.149	0.043	0.100	1.000			
Regional university partnerships	10	0.090	0.080	0.002	0.118	0.093	0.135	-0.003	0.064	0.330	1.000		
National UK university partnerships	11	0.130	0.134	0.024	0.158	0.123	0.232	0.026	0.149	0.411	0.161	1.000	
International university partnerships	12	0.067	0.071	0.005	0.053	0.035	0.195	0.028	0.094	0.258	0.138	0.297	1.000

Table A4.2: Probit models for new to the market innovation: innovative SMEs in England 2002-12

	(1)	(2)	(3)
	b/se	b/se	b/se
Average treatment effects			
Regional university partnership	0.098**		
	(0.039)		
National university partnership		0.163***	
		(0.046)	
International university partnership			0.311***
			(0.061)
Model among firms without university partnership			
Employment (log)	-0.035***	-0.040***	-0.039***
	(0.012)	(0.012)	(0.011)
R&D investment	0.459***	0.468***	0.462***
	(0.027)	(0.027)	(0.027)
Design investment	0.288***	0.302***	0.301***
	(0.026)	(0.026)	(0.026)
Science and Engineering grads.	0.006***	0.005***	0.006***
	(0.001)	(0.001)	(0.001)
Other grads.	-0.001	-0.001	-0.001**
	(0.001)	(0.001)	(0.001)
Exporting firm	0.201***	0.198***	0.200***
	(0.025)	(0.025)	(0.025)
Non-university partnerships	0.155***	0.147***	0.156***
	(0.022)	(0.022)	(0.021)
Non-university partnerships - sqrd	-0.016***	-0.014***	-0.016***
	(0.004)	(0.005)	(0.004)
Regional university partnership		0.042	0.044
		(0.061)	(0.056)
National university partnership	0.225***		0.229***
	(0.057)		(0.055)
International university partnership	0.023	0.033	
	(0.094)	(0.114)	
Constant term	-0.580***	-0.573***	-0.572***
	(0.043)	(0.043)	(0.042)
Model among firms with university partnership			
Employment (log)	-0.029	0.055	0.147*
	(0.047)	(0.043)	(0.082)
R&D investment	0.438***	0.175	0.245
	(0.134)	(0.133)	(0.198)

Design investment	0.489***	0.293***	0.474***
	(0.103)	(0.095)	(0.170)
Science and Engineering grads.	0.002	0.004**	0.002
	(0.002)	(0.002)	(0.002)
Other grads.	-0.004*	-0.006***	0.002
	(0.002)	(0.002)	(0.004)
Exporting firm	0.09	0.219**	0.172
	(0.116)	(0.103)	(0.190)
Non-university partnerships	-0.06	0.108	-0.745***
	(0.113)	(0.113)	(0.257)
Non-university partnerships - sqrd	0.009	-0.014	0.089***
	(0.016)	(0.015)	(0.032)
Regional university partnership		-0.200*	-0.349*
		(0.118)	(0.186)
National university partnership	0.173		-0.135
	(0.144)		(0.192)
International university partnership	-0.355**	-0.141	
	(0.179)	(0.122)	
Constant term	-0.175	-0.19	0.965*
	(0.249)	(0.276)	(0.557)
Predicting university partnerships			
Employment (log)	0.016	0.059***	-0.013
	(0.018)	(0.018)	(0.029)
Regional consultant partnership	1.594***		
	(0.049)		
National consultant partnership		1.509***	
		(0.042)	
International consultant partnership			2.128***
			(0.067)
Research partnership intensity	0.012***	-0.018***	-0.037***
	(0.005)	(0.005)	(0.008)
CPD partnership intensity	0	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Constant term	-1.935***	-2.097***	-2.409***
	(0.068)	(0.069)	(0.113)
N	11111	11111	11111

Table A4.3: Sales of new to the market innovations (log): innovative SMEs in England 2002-12

	(1)	(2)	(3)
	b/se	b/se	b/se
Average treatment effects			
Regional university partnership	0.427*		
	(0.229)		
National university partnership		0.291	
		(0.288)	
International university partnership			1.286**
			(0.644)
Model among firms without university partnership			
Employment (log)	0.141***	0.102***	0.123***
	(0.030)	(0.031)	(0.030)
R&D investment	0.804***	0.805***	0.813***
	(0.065)	(0.065)	(0.065)
Design investment	0.665***	0.693***	0.673***
	(0.066)	(0.066)	(0.065)
Science and Engineering grads.	0.012***	0.011***	0.012***
	(0.002)	(0.002)	(0.002)
Other grads.	0.002*	0.003**	0.003**
	(0.001)	(0.001)	(0.001)
Exporting firm	0.528***	0.525***	0.536***
	(0.061)	(0.061)	(0.060)
Non-university partnerships	0.355***	0.241***	0.330***
	(0.052)	(0.054)	(0.051)
Non-university partnerships - sqrd	-0.034***	-0.005	-0.029***
	(0.011)	(0.011)	(0.010)
Regional university partnership		-0.069	0.084
		(0.147)	(0.134)
National university partnership	0.073		0.114
	(0.137)		(0.133)
International university partnership	-0.191	-0.354	
	(0.238)	(0.281)	
Constant term	0.610***	0.712***	0.654***
	(0.107)	(0.107)	(0.105)
Model among firms with university partnership			
Employment (log)	-0.092	0.481***	0.457*
	(0.130)	(0.114)	(0.273)
R&D investment	0.5	0.423	-0.537
	(0.373)	(0.361)	(0.512)
Design investment	1.144***	0.826***	1.842***

	(0.259)	(0.229)	(0.454)
Science and Engineering grads.	0.007	0.011***	-0.001
	(0.005)	(0.004)	(0.006)
Other grads.	0.005	-0.001	-0.009
	(0.006)	(0.005)	(0.009)
Exporting firm	0.788***	0.793***	0.565
	(0.291)	(0.259)	(0.521)
Non-university partnerships	-0.253	0.413	-0.951**
	(0.258)	(0.271)	(0.484)
Non-university partnerships - sqrd	0.055	-0.05	0.143**
	(0.037)	(0.036)	(0.066)
Regional university partnership		0.003	-0.135
		(0.299)	(0.449)
National university partnership	0.368		-0.209
	(0.354)		(0.512)
International university partnership	-0.772*	-0.637*	
	(0.449)	(0.333)	
Constant term	2.049***	0.174	2.555**
	(0.630)	(0.700)	(1.244)
Predicting university partnerships			
Employment (log)	0.035*	0.048**	0.022
	(0.021)	(0.020)	(0.033)
Regional consultant partnership	1.575***		
	(0.057)		
National consultant partnership		1.413***	
		(0.047)	
International consultant partnership			2.046***
			(0.076)
Research partnership intensity	0.019***	-0.017***	-0.041***
	(0.005)	(0.005)	(0.010)
CPD partnership intensity	0	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Constant term	-2.005***	-2.050***	-2.556***
	(0.082)	(0.077)	(0.132)
N			
	8587	8587	8587

Table A4.4: Probit models for new to the market innovation: innovative small firms in England 2002-12

	(1)	(2)	(3)
	b/se	b/se	b/se
Average treatment effects			
Regional university partnership	0.094** (0.043)		
National university partnership		0.173*** (0.055)	
International university partnership			0.379*** (0.042)
Model among firms without university partnership			
Employment (log)	-0.011 (0.016)	-0.029* (0.016)	-0.02 (0.016)
R&D investment	0.438*** (0.030)	0.448*** (0.030)	0.440*** (0.030)
Design investment	0.292*** (0.029)	0.313*** (0.029)	0.308*** (0.029)
Science and Engineering grads.	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
Other grads.	0 (0.001)	0 (0.001)	-0.001 (0.001)
Exporting firm	0.183*** (0.028)	0.179*** (0.028)	0.180*** (0.027)
Non-university partnerships	0.152*** (0.024)	0.144*** (0.025)	0.153*** (0.023)
Non-university partnerships - sqrd	-0.016*** (0.005)	-0.014*** (0.005)	-0.016*** (0.005)
Regional university partnership		0.017 (0.068)	0.012 (0.062)
National university partnership	0.262*** (0.066)		0.270*** (0.064)
International university partnership	-0.049 (0.106)	-0.008 (0.125)	
Constant term	-0.616*** (0.052)	-0.576*** (0.051)	-0.596*** (0.050)
Model among firms with university partnership			
Employment (log)	-0.07 (0.063)	0.225*** (0.064)	0.188 (0.120)
R&D investment	0.412*** (0.148)	0.067 (0.153)	0.199 (0.226)
Design investment	0.566***	0.259**	0.573***

	(0.115)	(0.110)	(0.198)
Science and Engineering grads.	0.003	0.002	0.001
	(0.002)	(0.002)	(0.003)
Other grads.	-0.005**	-0.004**	0.010**
	(0.002)	(0.002)	(0.004)
Exporting firm	0.007	0.195*	0.164
	(0.129)	(0.115)	(0.207)
Non-university partnerships	-0.059	0.233*	-1.049***
	(0.126)	(0.134)	(0.309)
Non-university partnerships - sqrd	0.007	-0.030*	0.116***
	(0.018)	(0.018)	(0.038)
Regional university partnership		-0.250*	-0.282
		(0.130)	(0.207)
National university partnership	0.229		-0.296
	(0.162)		(0.226)
International university partnership	-0.432**	-0.201	
	(0.194)	(0.139)	
Constant term	0	-0.678**	1.718**
	(0.283)	(0.336)	(0.724)
Predicting university partnerships			
Employment (log)	0.038	0.081***	0.007
	(0.025)	(0.029)	(0.042)
Regional consultant partnership	1.631***		
	(0.054)		
National consultant partnership		1.524***	
		(0.048)	
International consultant partnership			2.211***
			(0.075)
Research partnership intensity	0.009*	-0.023***	-0.039***
	(0.005)	(0.005)	(0.009)
CPD partnership intensity	0	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Constant term	-1.993***	-2.156***	-2.432***
	(0.081)	(0.088)	(0.138)
N			
	7210	7210	7210

Table A4.5: Sales of new to the market innovations (log): innovative small firms in England 2002-12

	(1)	(2)	(3)
	b/se	b/se	b/se
Average treatment effects			
Regional university partnership	0.496**		
	(0.238)		
National university partnership		0.426	
		(0.333)	
International university partnership			1.833***
			(0.567)
Model among firms without university partnership			
Employment (log)	0.062	0.023	0.042
	(0.039)	(0.039)	(0.038)
R&D investment	0.750***	0.760***	0.764***
	(0.069)	(0.069)	(0.068)
Design investment	0.647***	0.678***	0.661***
	(0.070)	(0.071)	(0.069)
Science and Engineering grads.	0.012***	0.011***	0.012***
	(0.002)	(0.002)	(0.002)
Other grads.	0.004***	0.004***	0.003**
	(0.001)	(0.001)	(0.001)
Exporting firm	0.446***	0.436***	0.448***
	(0.065)	(0.066)	(0.064)
Non-university partnerships	0.359***	0.247***	0.345***
	(0.055)	(0.058)	(0.054)
Non-university partnerships - sqrd	-0.034***	-0.006	-0.032***
	(0.011)	(0.012)	(0.010)
Regional university partnership		-0.063	0.119
		(0.158)	(0.143)
National university partnership	-0.07		0.023
	(0.145)		(0.142)
International university partnership	-0.435*	-0.48	
	(0.236)	(0.292)	
Constant term	0.913***	1.012***	0.961***
	(0.122)	(0.123)	(0.120)
Model among firms with university partnership			
Employment (log)	-0.341**	0.316**	-0.144
	(0.170)	(0.151)	(0.397)
R&D investment	0.598	0.294	-0.854*
	(0.389)	(0.387)	(0.519)

Design investment	1.330***	0.958***	1.861***
	(0.274)	(0.245)	(0.439)
Science and Engineering grads.	0.006	0.010**	0.002
	(0.005)	(0.004)	(0.007)
Other grads.	0	0.005	0.006
	(0.006)	(0.005)	(0.007)
Exporting firm	0.399	0.641**	0.397
	(0.306)	(0.273)	(0.543)
Non-university partnerships	-0.258	0.353	-1.668***
	(0.272)	(0.298)	(0.388)
Non-university partnerships - sqrd	0.051	-0.047	0.229***
	(0.039)	(0.039)	(0.056)
Regional university partnership	0.297	0.235	
	(0.313)	(0.451)	
National university partnership	0.486		-0.476
	(0.379)		(0.544)
International university partnership	-0.741	-0.980***	
	(0.462)	(0.335)	
	(0.388)	(0.354)	(0.541)
Constant term	2.925***	0.827	5.536***
	(0.696)	(0.805)	(1.328)
Predicting university partnerships			
Employment (log)	0.054*	0.089***	0.063
	(0.031)	(0.033)	(0.052)
Regional consultant partnership	1.628***		
	(0.063)		
National consultant partnership		1.417***	
		(0.054)	
International consultant partnership			2.144***
			(0.086)
Research partnership intensity	0.016***	-0.021***	-0.046***
	(0.006)	(0.006)	(0.011)
CPD partnership intensity	0	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Constant term	-2.061***	-2.164***	-2.636***
	(0.102)	(0.103)	(0.175)
N	5533	5533	5533

Table A4.6: Probit models for new to the market innovation: innovative medium firms in England 2002-12

	(1)	(2)	(3)
	b/se	b/se	b/se
Average treatment effects			
Regional university partnership	0.111		
	(0.098)		
National university partnership		0.063	
		(0.075)	
International university partnership			-0.118
			(0.171)
Model among firms without university partnership			
Employment (log)	0.015	-0.01	0.007
	(0.064)	(0.066)	(0.064)
R&D investment	0.550***	0.558***	0.560***
	(0.065)	(0.065)	(0.064)
Design investment	0.268***	0.244***	0.268***
	(0.059)	(0.060)	(0.058)
Science and Engineering grads.	0.005***	0.004**	0.005***
	(0.002)	(0.002)	(0.002)
Other grads.	-0.005***	-0.003**	-0.004***
	(0.001)	(0.001)	(0.001)
Exporting firm	0.274***	0.265***	0.276***
	(0.058)	(0.058)	(0.057)
Non-university partnerships	0.167***	0.145***	0.160***
	(0.050)	(0.052)	(0.048)
Non-university partnerships - sqrd	-0.017*	-0.009	-0.016*
	(0.010)	(0.011)	(0.009)
Regional university partnership		0.138	0.163
		(0.139)	(0.129)
National university partnership	0.076		0.069
	(0.115)		(0.113)
International university partnership	0.338	0.27	
	(0.212)	(0.289)	
Constant term	-0.930***	-0.831***	-0.912***
	(0.298)	(0.303)	(0.294)
Model among firms with university partnership			
Employment (log)	-0.359	0.086	-0.251
	(0.288)	(0.231)	(0.511)
R&D investment	0.592	0.399	0.128
	(0.373)	(0.286)	(0.522)
Design investment	0.158	0.506**	0.227
	(0.248)	(0.205)	(0.450)
Science and Engineering grads.	0.004	0.010**	0.009

	(0.006)	(0.004)	(0.010)
Other grads.	0.001	-0.013***	-0.018**
	(0.007)	(0.005)	(0.008)
Exporting firm	0.403	0.541**	0.136
	(0.294)	(0.259)	(0.556)
Non-university partnerships	-0.077	-0.188	0.521
	(0.277)	(0.241)	(0.651)
Non-university partnerships - sqrd	0.023	0.027	-0.044
	(0.038)	(0.033)	(0.085)
Regional university partnership		-0.029	-0.327
		(0.313)	(0.585)
National university partnership	-0.041		0.442
	(0.344)		(0.487)
International university partnership	0.16	0.351	
	(0.504)	(0.292)	
Constant term	0.885	-0.699	-0.076
	(1.372)	(1.124)	(2.697)
Predicting university partnerships			
Employment (log)	-0.038	0.191*	0.039
	(0.108)	(0.099)	(0.158)
Regional consultant partnership	1.405***		
	(0.126)		
National consultant partnership		1.453***	
		(0.091)	
International consultant partnership			1.830***
			(0.161)
Research partnership intensity	0.029***	0.003	-0.025
	(0.011)	(0.011)	(0.018)
CPD partnership intensity	0	0	0.000***
	(0.000)	(0.000)	(0.000)
Constant term	-1.702***	-2.702***	-2.834***
	(0.492)	(0.461)	(0.756)
N	3901	3901	3901

Table A4.7: Sales of new to the market innovations (log): innovative medium firms in England 2002-12

	(1)	(2)	(3)
	b/se	b/se	b/se
Average treatment effects			
Regional university partnership	0.326 (0.694)		
National university partnership		0.138 (0.564)	
International university partnership			-4.076** (1.624)
Model among firms without university partnership			
Employment (log)	0.373** (0.185)	0.326* (0.188)	0.371** (0.181)
R&D investment	0.997*** (0.178)	0.957*** (0.179)	0.988*** (0.177)
Design investment	0.769*** (0.170)	0.793*** (0.172)	0.775*** (0.166)
Science and Engineering grads.	0.016*** (0.004)	0.015*** (0.005)	0.017*** (0.004)
Other grads.	-0.006 (0.004)	-0.001 (0.004)	-0.002 (0.004)
Exporting firm	0.838*** (0.162)	0.852*** (0.162)	0.867*** (0.159)
Non-university partnerships	0.278** (0.140)	0.177 (0.146)	0.242* (0.135)
Non-university partnerships - sqrd	-0.022 (0.028)	0.003 (0.030)	-0.014 (0.026)
Regional university partnership		-0.088 (0.367)	-0.045 (0.336)
National university partnership	0.53 (0.346)		0.468 (0.332)
International university partnership	0.56 (0.636)	0.295 (0.801)	
Constant term	-0.835 (0.844)	-0.676 (0.854)	-0.873 (0.823)
Model among firms with university partnership			
Employment (log)	-0.309 (0.756)	0.7 (0.599)	0.495 (1.250)
R&D investment	-0.353	0.981	0.471

	(1.031)	(0.856)	(1.082)
Design investment	0.724	0.729	1.462
	(0.631)	(0.559)	(1.113)
Science and Engineering grads.	0.021	0.024***	0.004
	(0.015)	(0.009)	(0.024)
Other grads.	0.050***	-0.033**	-0.077***
	(0.019)	(0.014)	(0.024)
Exporting firm	2.449***	1.585**	2.298
	(0.707)	(0.729)	(1.643)
Non-university partnerships	-0.474	0.205	4.962***
	(0.681)	(0.591)	(1.884)
Non-university partnerships - sqrd	0.092	-0.008	-0.576**
	(0.093)	(0.082)	(0.242)
Regional university partnership		-0.536	1.56
		(0.775)	(1.983)
National university partnership	0.293		-0.182
	(0.875)		(1.500)
International university partnership	-1.23	0.709	
	(1.436)	(0.796)	
Constant term	2.283	-1.635	-9.067
	(3.601)	(2.888)	(7.662)
Predicting university partnerships			
Employment (log)	-0.037	0.255**	0.113
	(0.117)	(0.111)	(0.168)
Regional consultant partnership	1.360***		
	(0.141)		
National consultant partnership		1.423***	
		(0.102)	
International consultant partnership			1.735***
			(0.178)
Research partnership intensity	0.032***	0.004	-0.021
	(0.012)	(0.012)	(0.019)
CPD partnership intensity	-0.000*	0	0.000**
	(0.000)	(0.000)	(0.000)
Constant term	-1.661***	-3.024***	-3.139***
	(0.536)	(0.520)	(0.809)
N	3054	3054	3054

List of abbreviations

AIPW	Augmented inverse probability weighting
BERD	Business Enterprise Research and Development
BIS	Department for Business Innovation & Skills
BSD	Business Structures Database
CE	Continuing education
CIS	Community Innovation Survey
CPD	Continuing professional development
ERC	Enterprise Research Council
F&E	Facilities and equipment
FTE	Full-time equivalent
HEFCE	Higher Education Funding Council for England
HE-BCI	Higher Education-Business and Community Interaction
HEI	Higher education institution
HESA	Higher Education Statistics Agency
IDBR	Inter-Departmental Business Register
IP	Intellectual property
LAD	Local Authority District
LEP	Local Enterprise Partnership
ONS	Office for National Statistics
R&D	Research and development
SIC	Standard Industrial Classification
SME	Small and medium-sized enterprise N.B. For the purposes of this document, SMEs include micro, small and medium enterprises and sole traders.
UKIS	UK Innovation Survey