

**R&D and innovation after Covid-19:
What can we expect? A review of
trends after the financial crisis**

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R&D and innovation after Covid-19: What can we expect? A review of trends after the financial crisis

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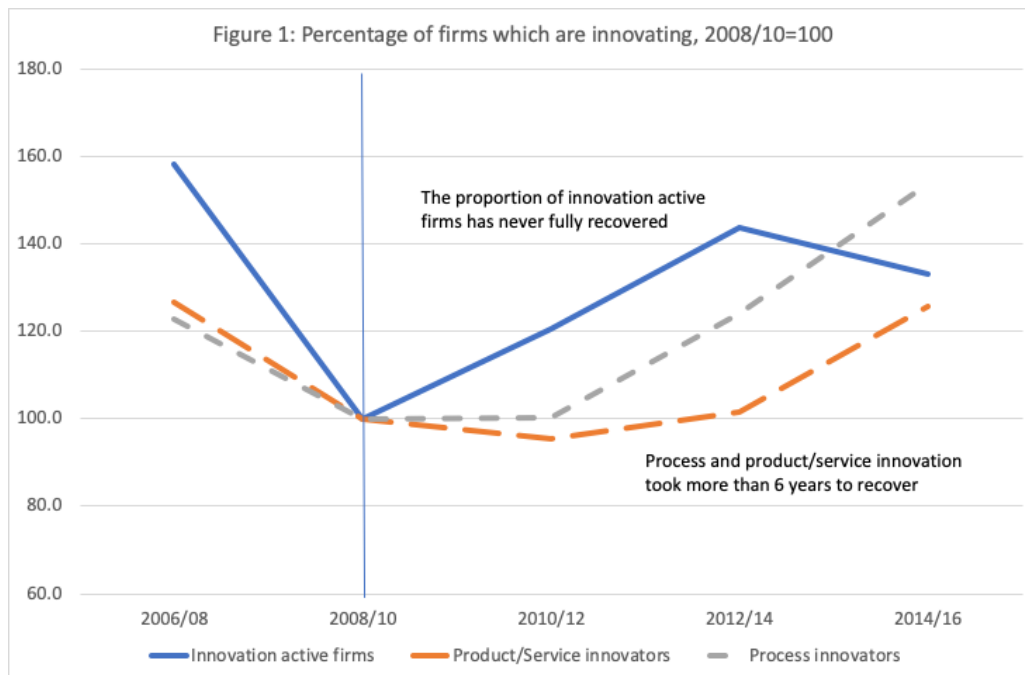
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EXECUTIVE SUMMARY

Innovation

Data from successive UK Innovation Surveys suggests that the proportion of innovation active firms fell 58 per cent during the last recession (2008-10) with parallel falls in product/service innovation (26.6 per cent), process innovation (22.6 per cent). The percentage of firms engaging in less financially demanding wider innovation – e.g. in marketing or strategy – increased by 14 per cent to the recession period.

Recovery speeds varied (Figure 1). The pre-recession proportion of innovation active firms was never fully regained and the proportion of firms doing product/service innovation and process innovation took more than six years to recover pre-recession levels. The percentage of firms doing wider innovation grew throughout the post-recession period.



The primary sector and North East stand out in terms of a lack of any 'bounce back' from the recession in terms of innovation activity and product/service innovation.

R&D activity – extensive margin

The proportion of firms undertaking R&D halved during the recession period and had only recovered around a fifth of this loss by 2014-16. The fall in levels of R&D activity

during the recession period was greater in smaller firms. Recovery in the North East was slow and levels of R&D activity in the region fell sharply post 2012-14.

Other innovation investments – extensive margin

The proportion of firms purchasing advanced machinery for innovation fell markedly (53 per cent) during the recession period and recovered its pre-recession level only in 2014-16. The proportion of firms investing in design fell by around 70 per cent during the recession period. By 2014-16 only around a quarter of this recession effect had been recovered.

Real R&D spending by UK businesses

In aggregate, real business R&D spending (BERD) varied little during the great recession, falling only 4 per cent from 2007-2010 before rising quickly to surpass its pre-recession level by 2011. Increases have been consistent since then with aggregate real business R&D spend a third higher in 2018 than its recession level.

Movements in aggregate business R&D spend hide significant sectoral volatility and we can distinguish four broad profiles of recession and recovery (Table 1):

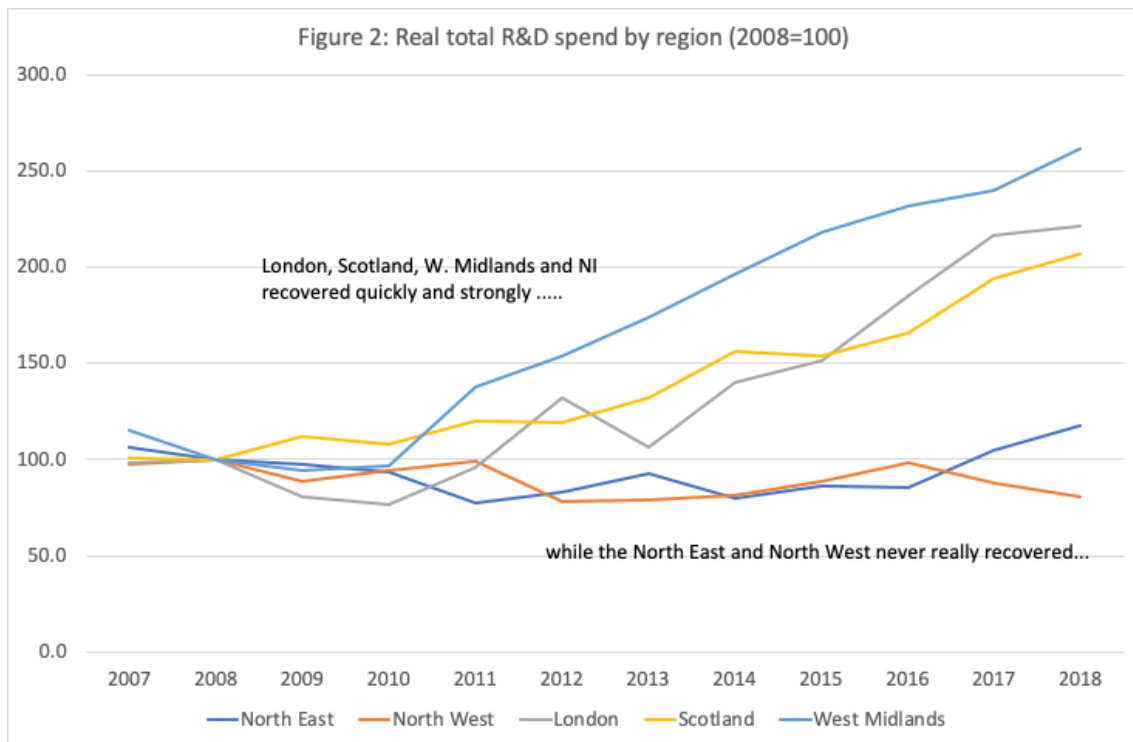
- 1. Recession dip and sharp volume increase** – sectors which experienced a fall in real R&D investment during the recession (2008-10) but which recovered quickly and have since seen real R&D spend grow significantly faster than the national average.
- 2. Recession dip and steady recovery** – sectors which experienced a short dip in R&D spend during the recession period (2008-10) but subsequently recovered in line with the aggregate trend.
- 3. Recession dip and slower recovery** – sectors which experienced a much longer recession dip in real R&D spending but in which spending has subsequently recovered to above-recession levels.
- 4. Continued real terms falls in spending** – sectors in which real R&D spending has remained consistently below recession levels (2008) in the period through to 2018.

Table 1: Sectoral trends in R&D spend post the 2008-10 recession

<p><i>1. Recession dip and sharp volume increase</i></p>	<p><i>3. Recession dip and slower recovery</i></p>
<p>Rubber and plastic products Fabricated metal products Computers and peripheral equipment Motor vehicles and parts Other transport equipment Shipbuilding Other manufactured goods Electricity, gas and water supply Construction Wholesale and retail trade Transport and storage Miscellaneous business activities Research and development services Public administration</p>	<p>Textiles, clothing and leather products Pulp, paper and paper products; Printing; Wood and straw products Refined petroleum products and coke oven products</p>
<p><i>2. Recession dip and steady recovery</i></p>	<p><i>4. Continued real terms falls in spending</i></p>
<p>Agriculture, hunting and forestry; Fishing Extractive Industries Food products and beverages, Tobacco Chemicals and chemical products Machinery and equipment Computer programming and information service activities</p>	<p>Pharmaceuticals Other non-metallic mineral products Casting of iron and steel Non-ferrous metals Electrical equipment Consumer electronics Precision instruments and optical Aerospace Telecommunications</p>

The same diversity of post-recession growth in real R&D spend is also evident across regions (Figure 2):

- ***Recession dip and sharp volume increase*** – The West Midlands, London, Scotland and Northern Ireland.
- ***Recession dip and steady recovery*** –The South East, the East Midlands, Wales, Yorkshire and the Humber.
- ***Recession dip and slower recovery*** –The East of England, the South West, the North East
- ***Continued real terms falls in spending*** – The North West



Implications

The 2008-10 crisis suggests four key lessons for the current crisis:

- First, we should expect sharp falls (perhaps a third) in the proportion of innovating firms. Recovery to previous levels will be slow – 4-6 years perhaps.
- Second, firms' willingness to invest in intangibles will fall sharply with implications for future innovation and growth. Again, recovery is likely to be slow.
- Third, while these short-term effects will be evident across almost all sectors and regions, recovery will be highly skewed by region and sector. Based on firms' engagement with wider innovation, recovery is likely to be stronger in services and larger firms.
- Fourth, regional recovery in R&D spending will be strongly shaped by clusters of industrial activity. Where recent growth has been slowest, recovery is likely to be weaker. This applies to the East of England, the South West, the North East and the North West. A strong concentration of R&D activity in a particular sector (automotive) also makes recovery more vulnerable to sectoral conditions in the West Midlands.

1. INTRODUCTION

Innovation – the introduction of new products, services and ways of doing business – will be a critical element of the recovery post-Covid-19. Undertaking R&D and innovation is always risky, however, with uncertain technical and commercial outcomes. Post-covid, firms with less financial slack may be less willing to make such risky investments. Weak market demand, and potentially volatility, may also reduce the incentives to innovate.

The importance of innovation to future recovery has been recognised by the UK government in its announcement of a £1.5bn loan and grant package for the UK's most innovative companies¹. Fast-growing, equity backed firms will be able to access matched loan funding, while firms already in receipt of Innovate UK funding will be able to access additional loan and grant finance. A group of 1200 other innovating firms will also be able to access additional funding.

This targeted initiative is welcome and will help support innovation in what the OECD calls 'frontier firms' – some of the most innovative and best performing firms in the country². What of the other firms in the economy – the non-frontier firms? How will they adapt their innovation activity in the period post-Covid? Which sectors and types of firms may be most vulnerable post-crisis? And, how long will it take before firms get back to 'normal'?

Here, we look back to the financial crisis of 2008-10 and examine its impact on R&D, other innovation related intangible investments, and firms' innovation outputs. We draw on two survey datasets which provide different information on R&D and innovation trends:

- (a) The UK Innovation Survey aims to be representative of the whole population of UK firms (with more than 10 employees). We use this to help us understand the effects of recession on the spread of R&D, intangible investments for

¹ See <https://www.gov.uk/government/news/billion-pound-support-package-for-innovative-firms-hit-by-coronavirus>.

² OECD (2015). The Future of Productivity. Paris.

innovation and innovation across the whole population of firms – the extensive margin.

(b) The Business Expenditure on R&D survey provides detailed information on the group of (around 4,500) UK-based firms which are investing in R&D. This we use to understand how the recession of 2008-10 influenced the scale and timing of R&D spending across sectors and regions – the intensive margin.

2. RECESSION EFFECTS ON THE EXTENSIVE MARGIN OF R&D, INTANGIBLE INVESTMENT AND INNOVATION

The UK Innovation Survey (UKIS) is the primary source of data on innovation in UK firms. The survey is conducted every two years³. Each wave of the survey relates to innovation activity in the previous three years. One wave of the UKIS covered the period 2008-10, the great recession period, with the previous wave covering the pre-recession 2006-08 period. Subsequent waves of the survey provide an overview of post-recession behaviour. Note that all of the indicators presented here relate to **the extensive margin**, i.e. how the percentage of firms engaged in each activity varied before, during and after the great recession.

The UK Innovation Survey provides three main groups of indicators relating to the extent of innovation activity across the population of UK firms, the extent of investment in R&D by UK firms and the extent of other intangible investments related to innovation. The initial columns in each table provide the percentage of firms undertaking each activity and the later columns provide an indexed form of the data using the recession period 2008-10 as the baseline (2008-10=100). Green cells represent above recession level; red cells below recession levels. In terms of innovation metrics the UKIS suggests:

- The **percentage of innovation active firms** (Table 1) – those either innovating or investing in innovation – fell sharply from 2006-08 (58.2 per cent) to the

³ Department for Business, Innovation and Skills, Office for National Statistics, Northern Ireland. Department of Enterprise, Trade and Investment. (2018). *UK Innovation Survey, 1994-2016: Secure Access*. [data collection]. 6th Edition. UK Data Service. SN: 6699, <http://doi.org/10.5255/UKDA-SN-6699-6>.

recession period (36.8 per cent). In 2014-16 aggregate levels of innovation activity on this metric had not recovered their pre-recession levels (49.0 per cent). This was true of almost all sectors and regions as well as smaller firms. By 2014-16 levels of innovation activity in larger firms was marginally above that in the pre-recession period (Table 1). The recovery in innovation levels post-recession was slower in manufacturing than services (Table 1). Levels of innovation activity in the primary sector and North East remained particularly weak throughout the post-recession period until 2014-16 (Table 1).

- Around 1:5 UK firms report **product or service innovation** over a three-year period (Table 2). The proportion fell by 26.6 per cent to the recession and had only recovered this level of activity by 2014-16, 6 years after the recession. In part this reflects a continued fall in the proportion of innovating firms in the years immediately following the recession (Table 2). This post-recession fall was evident in all sizes of firms with innovation recovering most quickly in larger and small (10-49 employee firms). A number of regions also experienced further falls in levels of product/service innovation after the recession with the picture in the North East and the Primary sector being particularly weak (Table 2).
- **Process innovation** is typically reported by around 1:6 UK firms (Table 3). Levels of process innovation activity dropped by around a fifth between 2006-08 and 2008-10 and recovered steadily thereafter. By 2014-16 activity levels were well above their pre-recession level. In this sense process innovation re-bounded significantly more quickly than product or service innovation. Process innovation increased more rapidly in smaller firms post-recession and by 2014-16 levels of activity were higher than the pre-recession level in most sectors and regions. The primary sector and the North East are again notable exceptions (Table 3).
- **Wider innovation** represents changes in firms' marketing activity, strategy or partnerships (Table 4). This type of innovation actually increased during the 2008-10 recession period and has increased steadily since, peaking in 2012-14. This pattern is consistent across all regions except the North East and for smaller firms (Table 4). Levels of wider innovation in the primary sector remain below recession levels and those in manufacturing have recovered only weakly.

Turning to firms' investments in R&D activity:

- Around 1:6 firms report **undertaking in-house R&D** with this rising to around 1:3 among larger firms with 250 plus employees (Table 5). The proportion of firms undertaking R&D halved during the recession period and had only recovered around a fifth of this loss by 2014-16 (Table 5). The fall in levels of R&D activity during the recession period was greater in smaller firms but no group of firms had returned to pre-recession levels of activity by 2014-16 (Table 5). The post-recession bounce-back in R&D activity variable between regions with the West Midlands, the South East and Wales only achieving above-recession activity levels in 2014-16. Recovery in the North East was slow and levels of R&D activity in the region fell sharply post 2012-14.
- Around 1:11 UK firms were **buying in external R&D services** prior to the recession of 2008-10. This proportion fell sharply (down 78 per cent) to the recession period and only reached above-recession levels again in 2014-16 (Table 6). Medium and large firms in particular seem to have significantly reduced their levels of bought-in R&D services during the whole post-recession period. This pattern perhaps reflecting a change in R&D strategy post-recession by many firms is also evident across a number of regions with Wales, Scotland the South East and East of England never recovering above recession levels of bought in R&D.

And, finally in terms of other intangible innovation-related investments:

- The proportion of firms **purchasing advanced machinery** for innovation fell markedly (53 per cent) during the recession period and recovered its pre-recession level only in 2014-16 (Table 7). This recovery was relatively uniform across firm sizebands and regions although in the primary sector and diverse other services sector levels of investment activity remained consistently below the recessionary level (Table 7).
- Around a third of firms were **investing in computer hardware** for innovation in the 2006-08 period but this more than halved to 16.2 per cent (Table 8). Recovery post-recession was uniform across firm sizebands, sector and regions with the exception (again) of the primary sector. Investment declined again in the 2012-

14 period. An essentially similar profile is evident in terms of **investments in computer software** (Table 9).

- The percentage of firms **investing in external knowledge for innovation** halved during the recession (Table 10) and remained below recessionary levels for the whole period through to 2014-16. This may reflect similar changes in behaviour to the failure of bought-in R&D to recover after the recession, another signal of a potential change in firms' innovation strategies.
- The percentage of firms **investing in training** shows a similar decline to the recession period but a general recovery across almost all sectors and sizebands (Table 11). By 2014-16 levels of activity had regained around half of the ground lost during the recessionary period.
- The proportion of firms **investing in design** fell by around 70 per cent during the recession period. By 2014-16 only around a quarter of this recession effect had been recovered (Table 12). The proportion of larger firms investing in design remained at recessionary levels in 2012-14 although smaller firms were more likely to have increased their investment. Regional and sectoral patterns were mixed with design investment in construction and retail particularly strong and that in manufacturing below recessionary levels.

3. RECESSION EFFECTS ON REAL R&D SPENDING

The annual Business Expenditure on R&D (BERD) survey provides an in-depth view of R&D spending and staffing in R&D active businesses across the UK. The targeting of the survey on this group of firms is intended to reduce the burden of form filling on non-R&D active firms while still providing an accurate indicator of aggregate R&D spending. The most recent data covers the period 2007 to 2018. Prior to 2007 a different industrial classification was used making direct comparisons with previous periods difficult. Here, we use a national GDP deflator to obtain real value series (at 2018 prices) for sectors and regions. Table 13 and Table 14 report the real value time series at 2018 prices for sectors and regions, with the GDP deflator included at the foot of Table 14.

We focus – for the moment – on the absolute value of (real) business R&D spend relative to the start of the great recession in 2008 and in Tables 15 and 16 we index real values so 2008=100. Green cells again represent values higher than that in 2008 and red lower. In aggregate, real business R&D spending varied little during the great recession falling only 4 per cent from 2007-2010 before rising quickly to surpass its pre-recession level by 2011. Increases have been consistent since then with aggregate business R&D spend a third higher in 2018 than its recession level (Table 15).

The moderate movements in aggregate business R&D spend hide significant sectoral volatility and very different patterns of post-recession growth and recovery. Although sectoral patterns vary we can distinguish four broad profiles of recession and recovery:

1. Recession dip and sharp volume increase – sectors which experienced a fall in real R&D investment during the recession (2008-10) but which recovered quickly and have since seen real R&D spend grow significantly faster than the national average. This group includes:

- Rubber and plastic products
- Fabricated metal products except machinery and equipment
- Computers and peripheral equipment
- Motor vehicles and parts
- Other transport equipment
- Shipbuilding
- Other manufactured goods

- Electricity, gas and water supply; Waste management
- Construction
- Wholesale and retail trade
- Transport and storage, incl. postal and courier activities
- Miscellaneous business activities; Technical testing and analysis
- Research and development services
- Public administration

2. Recession dip and steady recovery – sectors which experienced a short dip in R&D spend during the recession period (2008-10) but subsequently recovered in line with the aggregate trend. This includes:

- Agriculture, hunting and forestry; Fishing
- Extractive Industries
- Food products and beverages; Tobacco products
- Chemicals and chemical products
- Machinery and equipment
- Computer programming and information service activities

3. Recession dip and slower recovery – sectors which experienced a much longer recession dip in real R&D spending but in which spending has subsequently recovered to above-recession levels. This includes:

- Textiles, clothing and leather products
- Pulp, paper and paper products; Printing; Wood and straw products
- Refined petroleum products and coke oven products

4. Continued real terms falls in spending – sectors in which real R&D spending has remained consistently below recession levels (2008) in the period through to 2018. This includes:

- Pharmaceuticals
- Other non-metallic mineral products
- Casting of iron and steel
- Non-ferrous metals
- Electrical equipment

- Consumer electronics and communication equipment
- Precision instruments and optical products; photographic equipment
- Aerospace
- Telecommunications

The same diversity of post-recession growth in real R&D spend is also evident across regions reflecting the regional clustering of different industries, for example, automotive in the West Midlands, Aerospace in the North West. Regional trends may also reflect differences in support regimes across the devolved territories in the UK. In Northern Ireland, for example, a sharp increase in R&D spend has been driven in part by increasing capital investment. Following the same categorisation as before we can group regions into four categories:

- ***Recession dip and sharp volume increase*** – regions which experienced a fall in real R&D investment during the recession (2008-10) but which recovered quickly and have since seen real R&D spend grow significantly faster than the national average. This group includes: the West Midlands, London, Scotland and Northern Ireland.
- ***Recession dip and steady recovery*** – regions which experienced a short dip in R&D spend during the recession period (2008-10) but subsequently recovered in line with the aggregate trend. This includes: the South East, the East Midlands, Wales, Yorkshire and the Humber.
- ***Recession dip and slower recovery*** – sectors which experienced a much longer recession dip in real R&D spending but in which spending has subsequently recovered to above-recession levels. This includes: the East of England, the South West, the North East
- ***Continued real terms falls in spending*** – sectors in which real R&D spending has remained consistently below recession levels (2008) in the period through to 2018. This applies only to the North West where R&D spend remains around 20 per cent below its recession level (Table 15).

4. LOOKING BEYOND THE COVID-19 CRISIS

The Covid-19 crisis shares two significant similarities to the 2008-10 recession. First, both were exogenous shocks rather than business cycle fluctuations. Secondly, both have impacted firms through sharply reduced liquidity – the 2008-10 recession through a sharp reduction in the availability of commercial finance and the Covid-19 crisis through sharply reduced turnover. In both cases financial stringency has forced, and will be forcing, firms to make rapid strategic decisions about areas of spend and potential savings.

The 2008-10 crisis suggests four key lessons for the current crisis:

- First, we should expect sharp falls (perhaps a third) in the proportion of innovating firms. Recovery to previous levels will be slow – 4-6 years perhaps.
- Second, firms' willingness to invest in intangibles will fall sharply with implications for future innovation and growth. Again, recovery is likely to be slow.
- Third, while these short-term effects will be evident across almost all sectors and regions, recovery will be highly skewed by region and sector. Based on firms' engagement with wider innovation, recovery is likely to be stronger in services and larger firms.
- Fourth, regional recovery in R&D spending will be strongly shaped by clusters of industrial activity. Where recent growth has been slowest, recovery is likely to be weaker. This applies to the East of England, the South West, the North East and the North West. A strong concentration of R&D activity in a particular sector (automotive) also makes recovery more vulnerable to sectoral conditions in the West Midlands.

Table 1: Percentage of innovation active firms

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	58.2	36.8	44.4	53.0	49.0	158.0	100.0	120.5	143.8	133.0
A. Sizeband										
Small (10-49)	57.3	35.4	43.1	52.0	47.3	161.9	100.0	121.9	147.1	133.9
S/M (50-99)		42.1	50.4	57.9	53.8		100.0	119.6	137.4	127.7
Medium (100-249)	62.5	46.4	50.7	54.5	58.9		100.0	109.2	117.4	126.9
Large (250+)	61.2	42.7	50.4	61.3	63.1	143.4	100.0	118.0	143.7	147.9
B. Region										
North East	59.5	40.0	46.6	52.8	42.0	148.7	100.0	116.5	132.1	104.9
North West	56.3	32.2	41.8	52.6	48.7	175.0	100.0	130.0	163.6	151.5
Yorkshire and The Humber	60.7	35.6	43.0	64.7	49.3	170.6	100.0	120.8	181.8	138.5
East Midlands	55.5	38.9	48.8	56.3	51.6	142.6	100.0	125.3	144.6	132.4
West Midlands	58.7	38.0	43.4	55.0	52.0	154.3	100.0	114.0	144.6	136.6
East of England	59.1	41.2	46.0	56.4	51.6	143.4	100.0	111.6	136.9	125.2
London	55.8	32.8	42.2	48.0	46.9	170.1	100.0	128.7	146.4	143.0
South East	63.3	41.2	45.8	56.9	51.1	153.8	100.0	111.2	138.2	124.3
South West	57.8	38.3	47.2	43.4	52.5	150.9	100.0	123.3	113.3	137.0
Wales	58.6	40.6	46.6	50.8	46.5	144.2	100.0	114.8	124.9	114.4
Scotland	54.8	33.3	43.3	50.4	45.0	164.3	100.0	129.8	151.2	134.9
Northern Ireland	54.8	31.8	39.4	44.7	38.8	172.3	100.0	123.9	140.7	122.1
C. Technology										
High tech manufacturing		53.1	58.4	65.7	67.5		100.0	110.1	123.8	127.1
Low tech manufacturing		46.7	52.6	62.9	56.9		100.0	112.6	134.6	121.9
Other industries		34.1	42.2	50.8	46.9		100.0	124.0	149.1	137.5
D. Main sector										
Primary Sector		52.4	41.1	47.1	43.2		100.0	78.4	89.8	82.4
Engineering-based manufacturing		58.6	60.8	71.0	72.6		100.0	103.7	121.1	123.8
Other manufacturing		45.2	52.7	62.3	57.0		100.0	116.7	137.9	126.2
Construction		30.6	41.2	45.8	44.2		100.0	134.8	149.7	144.7
Retail & distribution		35.4	42.2	51.3	48.2		100.0	119.3	145.1	136.2
Knowledge intensive services		45.7	52.0	64.6	65.6		100.0	113.8	141.3	143.6
Other services		31.5	40.3	48.6	42.6		100.0	128.1	154.6	135.4

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 2: Product/service innovators: percentage of firms

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	23.9	18.9	18.0	19.2	23.7	126.6	100.0	95.3	101.6	125.7
A. Sizeband										
Small (10-49)	23.0	18.0	17.2	18.4	23.1	127.9	100.0	95.6	102.5	128.6
S/M (50-99)		21.5	20.8	21.4	26.4		100.0	96.6	99.4	122.9
Medium (100-249)	28.5	25.1	22.7	23.2	25.7		100.0	90.3	92.3	102.6
Large (250+)	31.5	23.7	23.5	26.8	29.3	132.7	100.0	99.2	112.9	123.4
B. Region										
North East	21.0	21.2	19.2	16.4	20.1	98.9	100.0	90.3	77.2	94.5
North West	22.7	18.2	18.9	15.9	23.0	124.5	100.0	103.6	87.1	125.9
Yorkshire and The Humber	24.1	18.0	15.6	25.3	24.0	133.9	100.0	86.5	140.6	133.2
East Midlands	24.5	21.4	19.8	23.8	26.7	114.4	100.0	92.2	111.0	124.6
West Midlands	25.1	18.6	17.0	21.9	26.0	135.0	100.0	91.4	117.8	140.0
East of England	23.6	20.8	17.3	20.2	25.7	113.6	100.0	83.3	97.3	123.6
London	22.9	17.0	17.2	19.1	21.5	134.6	100.0	101.4	112.1	126.6
South East	27.8	21.8	20.1	17.1	26.5	127.3	100.0	92.1	78.4	121.4
South West	25.6	19.4	19.8	15.1	25.3	132.1	100.0	102.3	77.7	130.4
Wales	24.4	20.1	17.9	21.3	21.0	121.4	100.0	88.8	105.8	104.2
Scotland	21.3	15.2	16.1	19.8	20.5	139.9	100.0	105.9	130.2	134.5
Northern Ireland	16.8	13.0	14.6	13.6	17.3	129.1	100.0	111.9	104.4	133.3
C. Technology										
High tech manufacturing		37.6	35.2	33.7	39.3		100.0	93.7	89.6	104.6
Low tech manufacturing		28.9	25.5	29.9	29.0		100.0	88.0	103.3	100.2
Other industries		15.9	15.7	16.8	22.1		100.0	98.7	105.6	139.0
D. Main sector										
Primary Sector		23.3	20.9	14.8	13.1		100.0	89.6	63.4	56.0
Engineering-based manufacturing		43.6	39.8	43.8	46.0		100.0	91.1	100.3	105.4
Other manufacturing		27.4	25.3	28.5	28.6		100.0	92.5	104.1	104.5
Construction		9.6	10.7	13.0	18.7		100.0	111.2	136.2	194.9
Retail & distribution		17.0	15.7	16.0	23.9		100.0	92.5	94.0	140.4
Knowledge intensive services		30.3	28.7	31.5	39.1		100.0	94.9	104.2	129.0
Other services		13.9	13.8	14.8	18.3		100.0	99.6	106.5	132.4

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 3: Process innovators: percentage of firms

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	12.6	10.3	10.3	12.8	15.8	122.6	100.0	100.3	124.1	153.8
A. Sizeband										
Small (10-49)	12.0	9.6	9.4	11.9	14.9	125.6	100.0	98.6	125.0	155.5
S/M (50-99)		10.7	14.0	15.8	19.0		100.0	130.0	147.2	177.2
Medium (100-249)	15.4	16.0	15.1	16.4	21.8		100.0	94.8	102.7	136.3
Large (250+)	18.9	17.6	15.4	20.2	22.5	107.4	100.0	87.5	114.7	128.2
B. Region										
North East	11.7	12.9	9.5	13.6	10.5	90.7	100.0	73.7	105.6	81.5
North West	10.6	9.5	11.6	12.7	16.9	112.0	100.0	122.1	134.1	178.1
Yorkshire and The Humber	13.1	10.3	9.8	12.1	18.7	126.7	100.0	95.1	116.7	180.6
East Midlands	11.9	10.8	11.0	13.1	19.3	110.1	100.0	101.6	121.4	178.6
West Midlands	12.9	10.8	10.2	16.1	17.1	119.2	100.0	94.0	149.2	157.9
East of England	13.7	12.7	10.5	12.5	15.1	108.2	100.0	83.0	98.5	118.9
London	13.2	8.8	10.2	9.5	14.4	150.2	100.0	116.3	107.6	163.7
South East	14.2	11.9	10.8	16.9	16.4	119.6	100.0	90.8	142.5	138.4
South West	11.2	9.5	12.3	10.4	15.7	118.5	100.0	130.0	109.7	165.9
Wales	13.1	11.5	9.0	13.8	15.0	113.8	100.0	78.4	119.4	130.7
Scotland	12.5	8.1	7.2	12.5	14.5	154.0	100.0	89.1	153.9	178.4
Northern Ireland	10.6	6.9	8.4	9.2	10.3	153.1	100.0	121.8	133.4	148.1
C. Technology										
High tech manufacturing		19.4	15.8	20.5	24.2		100.0	81.7	106.0	124.9
Low tech manufacturing		17.9	18.0	21.1	23.7		100.0	100.5	118.1	132.7
Other industries		8.4	8.9	11.1	14.3		100.0	105.1	132.3	169.8
D. Main sector										
Primary Sector		17.2	12.0	18.9	14.0		100.0	69.7	110.0	81.4
Engineering-based manufacturing		22.3	18.0	25.9	26.4		100.0	80.4	116.1	118.3
Other manufacturing		17.1	17.0	20.6	23.6		100.0	99.4	120.6	137.7
Construction		6.8	5.3	8.7	14.6		100.0	77.1	127.2	213.8
Retail & distribution		8.0	7.6	10.7	14.5		100.0	94.9	133.4	180.1
Knowledge intensive services		16.7	16.4	20.9	22.8		100.0	98.1	125.1	136.0
Other services		7.0	8.6	9.3	12.2		100.0	122.3	132.4	174.2

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 4: Wider innovators: percentage of firms

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	26.5	30.8	36.9	42.0	36.0	86.1	100.0	119.7	136.4	117.1
A. Sizeband										
Small (10-49)	24.5	29.7	36.2	41.6	35.0	82.6	100.0	121.9	140.1	118.1
S/M (50-99)		35.8	41.4	44.6	39.9		100.0	115.6	124.7	111.5
Medium (100-249)	36.5	36.7	39.1	42.7	40.4		100.0	106.6	116.4	110.3
Large (250+)	39.0	34.8	38.6	44.9	44.4	112.2	100.0	111.0	129.2	127.8
B. Region										
North East	23.8	34.9	37.6	44.7	29.5	68.1	100.0	107.5	127.9	84.4
North West	24.3	26.2	34.2	41.2	36.0	92.6	100.0	130.5	156.9	137.3
Yorkshire and The Humber	28.0	28.5	35.6	45.3	34.1	98.4	100.0	124.9	159.2	119.7
East Midlands	25.4	33.0	39.6	42.4	38.4	76.9	100.0	119.8	128.5	116.4
West Midlands	24.6	31.0	36.3	39.2	38.7	79.4	100.0	117.0	126.5	125.1
East of England	28.8	34.5	38.3	45.3	38.8	83.5	100.0	111.2	131.3	112.5
London	28.5	27.6	36.7	40.2	36.8	103.1	100.0	133.0	145.6	133.1
South East	29.3	34.4	38.5	46.3	35.6	85.2	100.0	111.9	134.6	103.4
South West	25.0	32.8	38.5	35.4	37.3	76.2	100.0	117.2	107.8	113.6
Wales	26.4	32.6	39.0	41.0	35.8	81.1	100.0	119.9	125.9	109.9
Scotland	25.9	29.5	34.5	43.2	33.3	87.9	100.0	117.2	146.8	112.9
Northern Ireland	19.8	26.1	31.4	36.4	28.3	75.8	100.0	120.2	139.3	108.4
C. Technology										
High tech manufacturing		40.3	41.7	46.0	43.4		100.0	103.6	114.3	107.8
Low tech manufacturing		36.2	39.0	46.0	34.9		100.0	107.8	127.1	96.6
Other industries		29.2	36.2	41.2	35.7		100.0	123.9	140.9	122.2
D. Main sector										
Primary Sector		40.4	31.3	30.7	33.1		100.0	77.5	75.9	82.1
Engineering-based manufacturing		41.2	41.2	48.1	42.8		100.0	99.9	116.8	103.8
Other manufacturing		35.4	39.5	45.0	35.9		100.0	111.4	127.1	101.4
Construction		28.1	36.1	39.1	35.2		100.0	128.7	139.2	125.6
Retail & distribution		29.8	35.2	41.0	35.6		100.0	118.2	137.7	119.6
Knowledge intensive services		38.6	42.5	49.4	46.1		100.0	110.3	128.2	119.5
Other services		27.1	35.4	40.3	33.6		100.0	130.7	148.7	124.0

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 5: Percentage of firms undertaking in-house R&D

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	27.9	14.4	14.5	15.5	17.7	194.0	100.0	100.9	107.6	122.8
A. Sizeband										
Small (10-49)	26.5	13.2	13.2	14.1	16.1	201.0	100.0	100.3	106.9	122.0
S/M (50-99)		17.3	19.8	20.9	23.2	0.0	100.0	114.4	120.9	134.2
Medium (100-249)	34.9	22.1	20.8	22.5	26.5	157.7	100.0	93.9	101.7	119.5
Large (250+)	36.6	23.2	23.3	26.2	30.0	157.5	100.0	100.3	112.8	129.1
B. Region										
North East	26.6	14.8	14.9	18.6	13.7	180.0	100.0	101.0	125.9	92.5
North West	25.0	13.0	14.5	14.3	18.1	192.5	100.0	111.7	110.0	139.5
Yorkshire and The Humber	29.0	12.7	15.1	19.2	16.5	227.7	100.0	118.2	150.6	129.3
East Midlands	27.4	14.3	15.5	23.5	20.7	191.8	100.0	108.5	164.6	145.1
West Midlands	27.2	14.4	13.6	13.4	19.4	188.9	100.0	94.1	93.0	134.4
East of England	28.2	16.2	14.3	17.5	16.8	173.7	100.0	88.3	107.9	103.7
London	29.8	12.9	15.1	14.3	16.5	230.7	100.0	116.9	110.9	127.6
South East	30.8	17.5	15.6	15.1	20.8	175.8	100.0	88.8	86.3	118.8
South West	26.8	14.2	14.7	12.2	18.0	189.4	100.0	103.6	86.3	127.0
Wales	27.4	16.7	14.2	13.3	17.9	164.0	100.0	84.7	79.5	107.3
Scotland	26.7	13.4	12.5	14.0	13.8	199.7	100.0	93.2	104.5	103.4
Northern Ireland	23.4	11.3	11.4	11.5	14.7	207.7	100.0	100.8	101.7	130.3
C. Technology										
High tech manufacturing		33.8	35.8	35.8	43.8		100.0	105.9	105.9	129.3
Low tech manufacturing		24.1	20.4	24.4	26.6		100.0	84.8	101.1	110.3
Other industries		11.4	12.2	12.9	15.0		100.0	106.6	113.3	131.1
D. Main sector										
Primary Sector		19.4	19.4	19.0	14.0		100.0	99.7	97.6	72.2
Engineering-based manufacturing		40.0	42.6	44.3	52.8		100.0	106.6	110.7	132.1
Other manufacturing		22.8	20.7	23.5	26.7		100.0	90.9	102.9	117.2
Construction		7.4	7.6	8.6	12.9		100.0	101.8	116.2	173.5
Retail & distribution		11.0	10.3	12.0	14.0		100.0	94.2	109.7	127.9
Knowledge intensive services		28.1	28.7	32.6	37.6		100.0	102.0	115.8	133.8
Other services		22.8	20.7	10.0	10.8		100.0	90.9	44.0	47.3

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 6: Percentage of firms buying in external R&D services

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	9.2	5.2	3.5	3.9	5.8	177.3	100.0	66.7	74.7	111.4
A. Sizeband										
Small (10-49)	8.2	4.5	3.0	3.3	5.6	180.6	100.0	66.0	72.7	123.2
S/M (50-99)		6.3	4.7	5.5	5.9		100.0	74.7	85.9	92.8
Medium (100-249)	13.4	9.1	5.9	7.1	7.2		100.0	65.0	77.9	78.7
Large (250+)	17.0	11.5	8.0	9.9	8.3	147.8	100.0	69.4	85.7	72.3
B. Region										
North East	9.5	3.2	3.0	3.2	4.4	292.9	100.0	91.6	98.7	134.3
North West	9.6	5.8	3.2	2.5	6.8	165.0	100.0	54.9	42.9	117.3
Yorkshire and The Humber	8.8	3.4	3.6	3.8	5.1	256.9	100.0	104.5	110.0	149.3
East Midlands	8.1	5.5	3.3	3.3	6.7	147.6	100.0	60.1	60.1	122.3
West Midlands	10.0	4.7	4.0	2.3	6.2	211.0	100.0	85.0	47.6	130.8
East of England	8.5	5.3	3.6	3.7	4.7	159.2	100.0	66.5	69.1	87.5
London	9.5	5.1	3.7	3.9	5.4	187.5	100.0	73.8	76.8	105.7
South East	10.9	6.6	4.2	7.2	6.3	166.3	100.0	64.2	109.2	96.6
South West	7.8	5.2	3.7	4.1	7.4	149.9	100.0	70.6	78.2	142.3
Wales	7.8	5.8	3.1	3.0	5.6	135.0	100.0	53.7	51.9	97.1
Scotland	8.3	4.3	1.7	2.8	3.9	194.1	100.0	40.1	66.2	90.8
Northern Ireland	8.7	5.6	2.6	4.1	5.6	156.1	100.0	47.1	73.0	100.1
C. Technology										
High tech manufacturing		12.1	8.9	8.8	12.1		100.0	73.7	72.1	100.0
Low tech manufacturing		7.9	5.3	5.9	7.1		100.0	67.0	74.9	89.5
Other industries		4.2	2.8	3.3	5.2		100.0	66.4	77.3	123.5
D. Main sector										
Primary Sector		6.5	7.8	9.0	5.3		100.0	119.8	139.7	81.7
Engineering-based manufacturing		15.3	10.9	14.6	15.3		100.0	71.4	95.1	99.6
Other manufacturing		7.3	5.3	4.9	7.3		100.0	72.9	67.3	99.3
Construction		2.7	1.5	1.3	4.6		100.0	54.4	47.2	165.9
Retail & distribution		4.2	2.9	3.1	5.7		100.0	70.1	73.8	137.0
Knowledge intensive services		8.9	6.4	8.5	9.5		100.0	72.4	95.3	106.3
Other services		7.3	5.3	2.5	4.1		100.0	72.9	34.0	56.3

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 7: Percentage of firms investing in advanced machinery for innovation

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	12.7	8.3	8.6	10.2	12.5	153.3	100.0	103.8	122.8	151.4
A. Sizeband										
Small (10-49)	12.1	7.5	7.9	9.5	12.0	160.8	100.0	105.2	125.8	159.4
S/M (50-99)		10.5	11.1	13.8	14.1		100.0	106.2	131.8	134.6
Medium (100-249)	15.6	12.7	12.2	13.4	16.0		100.0	96.0	105.6	125.3
Large (250+)	17.9	13.7	13.5	14.1	17.3	130.5	100.0	98.5	102.5	126.0
B. Region										
North East	12.7	11.3	6.2	9.9	15.0	111.9	100.0	54.6	87.6	132.0
North West	12.6	7.9	9.0	10.5	13.1	159.0	100.0	113.5	133.0	165.7
Yorkshire and The Humber	16.7	8.7	9.8	11.2	13.9	192.4	100.0	112.8	128.9	159.9
East Midlands	10.4	11.6	11.3	11.6	14.6	89.5	100.0	97.6	100.0	125.9
West Midlands	15.4	10.4	10.5	12.5	12.8	148.5	100.0	101.3	120.3	123.5
East of England	14.3	9.3	9.3	9.7	13.8	154.1	100.0	100.6	104.6	149.1
London	5.7	4.4	6.2	6.8	7.6	129.9	100.0	141.5	155.0	173.5
South East	13.7	8.1	7.5	9.0	11.2	168.6	100.0	92.1	111.0	138.1
South West	13.2	7.5	8.0	10.9	16.2	175.7	100.0	106.9	145.1	214.9
Wales	14.9	9.4	12.1	12.2	15.9	158.0	100.0	128.3	129.8	169.0
Scotland	15.1	8.9	8.1	11.5	14.2	170.6	100.0	91.4	129.6	160.8
Northern Ireland	14.8	8.0	8.9	13.7	9.1	184.2	100.0	111.3	171.0	112.7
C. Technology										
High tech manufacturing		15.6	16.6	19.8	22.9		100.0	106.3	126.9	147.0
Low tech manufacturing		22.7	21.8	28.9	28.3		100.0	96.0	127.1	124.6
Other industries		5.5	6.2	7.1	9.9		100.0	112.0	128.9	179.6
D. Main sector										
Primary Sector		24.2	19.1	15.2	16.3		100.0	79.0	63.0	67.6
Engineering-based manufacturing		23.5	21.2	30.3	27.7		100.0	89.9	128.6	117.7
Other manufacturing		20.9	20.9	26.8	27.6		100.0	99.8	128.1	132.0
Construction		4.3	6.4	9.0	13.5		100.0	147.6	206.8	309.3
Retail & distribution		6.5	6.4	9.6	10.8		100.0	97.9	146.9	165.3
Knowledge intensive services		6.6	6.3	7.0	6.8		100.0	96.0	106.6	102.5
Other services		20.9	20.9	5.1	9.4		100.0	99.8	24.3	44.9

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 8: Percentage of firms investing in computer hardware for innovation

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	33.7	16.2	19.9	23.8	13.0	208.1	100.0	122.7	146.9	80.1
A. Sizeband										
Small (10-49)	33.6	15.7	19.4	23.5	12.5	213.6	100.0	123.5	149.4	79.5
S/M (50-99)		17.7	23.0	27.4	14.0		100.0	130.0	154.5	79.3
Medium (100-249)	34.5	18.8	21.3	22.1	16.2		100.0	113.1	117.2	86.2
Large (250+)	31.8	19.1	20.4	24.2	16.9	166.2	100.0	106.8	126.3	88.5
B. Region										
North East	32.5	17.1	19.4	24.8	13.9	189.8	100.0	113.3	144.6	81.0
North West	33.9	14.5	17.6	20.2	13.9	233.5	100.0	121.2	139.0	95.7
Yorkshire and The Humber	35.5	14.6	18.3	27.5	13.2	243.6	100.0	125.4	188.8	90.6
East Midlands	28.4	17.1	19.4	20.7	14.6	165.7	100.0	113.4	120.8	85.1
West Midlands	32.7	16.4	18.7	24.0	13.6	199.9	100.0	114.6	146.9	83.3
East of England	32.9	16.7	22.5	28.2	15.0	196.9	100.0	134.8	169.0	89.6
London	35.3	14.5	19.6	23.0	11.9	242.7	100.0	134.9	158.3	82.0
South East	37.0	19.6	22.6	25.2	11.5	188.9	100.0	115.2	128.6	59.0
South West	33.0	16.8	21.0	20.7	12.5	196.2	100.0	125.1	123.1	74.2
Wales	32.2	19.4	20.9	28.6	14.2	166.1	100.0	107.6	147.5	73.1
Scotland	31.5	14.5	17.3	23.6	12.0	217.4	100.0	119.2	163.0	82.6
Northern Ireland	33.3	12.6	19.7	18.8	11.0	263.8	100.0	155.9	149.1	87.3
C. Technology										
High tech manufacturing		23.2	23.7	27.1	19.5		100.0	102.3	117.0	84.2
Low tech manufacturing		19.1	21.4	23.2	13.6		100.0	111.9	121.4	71.2
Other industries		15.2	19.4	23.6	12.5		100.0	127.5	155.3	82.1
D. Main sector										
Primary Sector		19.7	11.6	10.9	8.2		100.0	58.9	55.2	41.4
Engineering-based manufacturing		27.2	26.1	31.7	18.5		100.0	96.1	116.9	68.1
Other manufacturing		17.8	21.0	22.5	14.3		100.0	118.3	126.6	80.3
Construction		12.0	17.7	20.8	12.2		100.0	147.4	172.5	101.2
Retail & distribution		17.1	20.5	25.7	13.7		100.0	120.2	150.2	80.1
Knowledge intensive services		21.9	24.0	29.7	17.3		100.0	109.5	135.1	79.0
Other services		17.8	21.0	22.1	11.1		100.0	118.3	124.2	62.2

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 9: Percentage of firms investing in computer software for innovation

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	37.1	19.3	23.3	26.4	18.8	192.3	100.0	120.5	136.9	97.3
A. Sizeband										
Small (10-49)	36.6	18.5	22.5	25.8	17.8	197.5	100.0	121.6	139.1	96.2
S/M (50-99)		21.7	26.7	30.2	21.8		100.0	123.4	139.3	100.3
Medium (100-249)	39.9	24.0	26.9	28.1	24.1		100.0	112.1	116.7	100.2
Large (250+)	37.7	23.8	26.3	30.3	27.2	158.2	100.0	110.2	127.2	114.0
B. Region										
North East	36.6	18.7	23.0	24.3	14.3	195.7	100.0	123.0	129.7	76.6
North West	35.0	16.6	21.2	24.9	19.4	211.1	100.0	127.6	150.4	116.9
Yorkshire and The Humber	37.6	18.4	22.8	35.1	18.3	204.0	100.0	123.8	190.2	99.2
East Midlands	33.3	18.9	22.9	26.2	19.6	175.8	100.0	121.1	138.1	103.4
West Midlands	36.9	19.6	22.7	25.9	18.5	188.4	100.0	115.7	132.2	94.3
East of England	37.1	21.2	24.6	27.3	21.5	175.0	100.0	116.0	128.8	101.3
London	36.7	17.0	22.8	22.9	18.4	215.8	100.0	134.3	134.6	108.2
South East	41.6	23.8	26.6	31.4	18.6	174.8	100.0	111.6	131.8	78.1
South West	37.7	21.6	23.5	20.5	20.0	174.3	100.0	108.7	94.9	92.5
Wales	37.8	20.2	24.1	28.1	18.4	186.8	100.0	119.1	139.0	90.9
Scotland	34.5	17.2	20.9	25.8	17.0	201.1	100.0	122.0	150.3	99.1
Northern Ireland	37.1	14.7	21.3	22.8	17.5	252.6	100.0	145.1	155.3	119.2
C. Technology										
High tech manufacturing		29.5	30.4	30.3	25.2		100.0	103.1	102.9	85.5
Low tech manufacturing		22.8	23.4	29.2	19.4		100.0	102.6	128.1	85.1
Other industries		18.0	22.7	25.8	18.3		100.0	126.4	143.5	101.8
D. Main sector										
Primary Sector		23.2	17.4	20.2	12.3		100.0	75.0	87.0	53.0
Engineering-based manufacturing		35.0	32.2	35.3	24.0		100.0	92.1	100.8	68.5
Other manufacturing		21.2	23.5	27.6	20.4		100.0	110.5	129.7	96.2
Construction		14.5	21.6	24.5	18.5		100.0	148.9	168.5	127.4
Retail & distribution		19.7	23.2	24.8	17.8		100.0	118.0	126.0	90.6
Knowledge intensive services		26.7	29.1	34.7	27.4		100.0	108.8	129.8	102.6
Other services		21.2	23.5	24.8	16.5		100.0	110.5	116.9	77.9

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 10: Percentage of firms investing in external knowledge for innovation

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	10.2	5.0	3.3	3.3	3.9	204.2	100.0	65.6	65.6	78.7
A. Sizeband										
Small (10-49)	9.7	4.7	3.0	3.0	3.7	206.0	100.0	64.6	64.5	78.7
S/M (50-99)		5.1	3.9	4.2	5.7		100.0	77.0	82.6	112.2
Medium (100-249)	12.5	7.0	4.5	4.3	3.7		100.0	65.1	61.7	53.8
Large (250+)	13.8	8.6	5.5	5.4	5.1	161.3	100.0	64.5	63.6	59.6
B. Region										
North East	9.7	3.3	2.8	2.8	4.0	290.4	100.0	82.9	82.4	120.8
North West	10.1	4.1	4.0	3.5	4.2	244.2	100.0	95.7	84.9	100.9
Yorkshire and The Humber	11.0	4.2	2.3	1.9	4.4	261.3	100.0	54.1	45.3	103.9
East Midlands	10.9	4.9	3.2	2.5	3.0	220.8	100.0	64.2	50.7	60.5
West Midlands	10.6	4.9	2.9	3.3	2.9	217.2	100.0	58.6	66.9	59.5
East of England	9.0	5.5	4.2	3.9	4.9	163.8	100.0	76.7	70.1	89.0
London	8.7	4.5	3.0	2.5	3.8	194.2	100.0	67.6	56.0	84.6
South East	11.9	6.1	4.2	3.7	4.9	194.1	100.0	67.8	60.2	79.1
South West	10.8	6.2	3.9	4.3	4.7	173.0	100.0	62.7	68.9	75.2
Wales	10.4	5.2	2.2	4.5	3.0	201.3	100.0	41.7	87.2	58.5
Scotland	9.0	5.6	1.8	3.5	2.7	159.5	100.0	31.5	62.8	47.2
Northern Ireland	9.0	2.9	3.3	3.6	2.6	309.3	100.0	111.7	125.1	89.8
C. Technology										
High tech manufacturing		9.0	6.1	5.9	6.5		100.0	67.5	65.4	72.2
Low tech manufacturing		6.3	3.9	4.2	4.4		100.0	61.6	66.0	69.5
Other industries		4.5	3.0	3.0	3.7		100.0	66.6	66.5	82.9
D. Main sector										
Primary Sector		6.6	6.4	4.0	4.9		100.0	97.0	60.4	74.8
Engineering-based manufacturing		9.5	6.9	9.0	7.9		100.0	72.9	95.3	83.5
Other manufacturing		6.2	4.0	3.8	4.5		100.0	63.9	61.5	72.7
Construction		3.9	1.5	1.2	3.7		100.0	37.0	31.2	95.1
Retail & distribution		4.0	3.4	4.7	4.0		100.0	86.1	118.0	100.8
Knowledge intensive services		8.6	5.5	4.9	5.5		100.0	64.7	57.0	64.7
Other services		6.2	4.0	2.0	3.1		100.0	63.9	31.5	49.6

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 11: Percentage of firms investing in training for innovation

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	23.1	12.1	13.9	14.4	17.2	191.1	100.0	115.4	119.5	142.7
A. Sizeband										
Small (10-49)	22.2	11.3	13.6	14.0	16.7	195.6	100.0	119.5	123.3	147.2
S/M (50-99)		13.6	15.2	16.4	20.1		100.0	112.1	121.0	147.7
Medium (100-249)	27.3	16.6	15.3	15.7	19.1		100.0	91.7	94.2	114.5
Large (250+)	29.6	18.6	18.1	19.1	20.7	158.7	100.0	97.1	102.5	111.2
B. Region										
North East	23.6	13.6	12.9	15.1	16.4	173.7	100.0	95.0	110.9	120.4
North West	23.3	11.7	14.5	11.2	14.5	199.9	100.0	124.7	96.2	124.4
Yorkshire and The Humber	21.1	10.5	14.0	10.8	16.1	201.9	100.0	133.6	102.9	154.4
East Midlands	18.9	12.5	12.6	22.6	20.8	151.4	100.0	101.2	181.4	166.2
West Midlands	24.0	13.2	15.2	15.3	19.4	181.9	100.0	115.4	116.1	146.8
East of England	23.2	14.1	12.6	13.8	19.7	165.0	100.0	89.9	98.2	140.4
London	24.0	10.4	14.4	13.4	16.3	230.9	100.0	138.8	129.1	156.5
South East	25.0	13.3	14.0	17.4	17.4	188.4	100.0	105.3	131.2	131.3
South West	21.1	11.9	14.3	14.2	17.6	177.3	100.0	120.3	118.9	147.9
Wales	26.3	12.9	16.3	17.5	17.6	204.0	100.0	126.4	135.5	136.7
Scotland	23.0	12.0	12.5	11.8	17.2	191.9	100.0	104.1	98.2	143.8
Northern Ireland	22.9	9.4	13.4	11.0	12.2	243.3	100.0	142.5	116.4	130.1
C. Technology										
High tech manufacturing		19.0	19.7	22.3	23.4		100.0	103.5	117.4	123.1
Low tech manufacturing		14.4	12.2	14.2	16.2		100.0	84.8	98.8	112.9
Other industries		11.2	13.8	13.9	17.0		100.0	122.9	124.3	151.7
D. Main sector										
Primary Sector		21.9	14.4	15.5	11.5		100.0	65.7	71.0	52.7
Engineering-based manufacturing		17.5	19.0	25.1	23.8		100.0	108.2	143.3	135.4
Other manufacturing		14.4	12.9	13.9	16.2		100.0	89.5	96.4	112.2
Construction		10.8	14.4	15.2	19.5		100.0	133.4	140.4	180.3
Retail & distribution		9.9	12.3	12.0	15.9		100.0	125.3	122.2	161.5
Knowledge intensive services		20.8	20.8	22.6	26.2		100.0	100.3	108.9	126.3
Other services		14.4	12.9	12.9	15.2		100.0	89.5	89.4	105.6

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 12: Percentage of firms investing in design for innovation

	Percentage of firms					2008-10=100				
	2006-08	2008-10	2010-12	2012-14	2014-16	2006-08	2008-10	2010-12	2012-14	2014-16
All	17.2	10.3	9.8	9.9	11.7	167.2	100.0	95.7	96.0	113.8
A. Sizeband										
Small (10-49)	16.0	9.5	9.2	8.9	11.1	168.2	100.0	96.3	94.0	116.8
S/M (50-99)		12.8	12.8	14.2	14.6		100.0	99.7	111.0	114.0
Medium (100-249)	22.8	14.8	12.7	14.3	14.3		100.0	85.9	96.3	96.6
Large (250+)	24.8	14.9	14.6	15.8	14.9	166.2	100.0	98.0	105.8	99.9
B. Region										
North East	14.3	9.4	10.4	10.6	8.9	151.4	100.0	110.4	112.2	94.2
North West	16.1	10.4	8.7	9.7	11.7	155.0	100.0	83.5	93.0	112.5
Yorkshire and The Humber	18.9	10.1	7.7	10.7	10.7	187.9	100.0	76.6	106.8	106.6
East Midlands	19.0	9.5	10.6	10.5	13.2	199.1	100.0	110.6	110.0	138.5
West Midlands	17.2	9.5	9.9	10.6	14.2	180.7	100.0	104.1	111.6	149.6
East of England	17.4	12.7	10.8	10.4	11.8	136.5	100.0	85.1	81.7	92.6
London	19.2	9.1	10.3	9.6	11.9	211.3	100.0	113.3	105.7	130.8
South East	19.1	12.4	11.3	10.4	12.9	154.2	100.0	90.9	83.7	104.5
South West	15.8	11.6	9.8	5.5	11.6	136.5	100.0	84.9	47.8	99.9
Wales	16.8	10.0	11.5	12.8	10.3	168.2	100.0	114.9	128.3	103.3
Scotland	12.8	7.7	8.0	10.9	10.3	166.0	100.0	103.6	141.3	133.2
Northern Ireland	12.2	7.7	7.8	7.7	5.6	158.0	100.0	101.0	99.4	72.6
C. Technology										
High tech manufacturing		27.4	24.3	25.4	24.5		100.0	88.7	92.8	89.4
Low tech manufacturing		17.0	15.0	17.2	14.4		100.0	88.2	101.3	84.9
Other industries		8.0	8.1	7.9	10.6		100.0	101.7	98.8	133.1
D. Main sector										
Primary Sector		6.7	7.0	8.5	5.6		100.0	104.3	126.5	83.7
Engineering-based manufacturing		34.0	29.7	34.4	30.7		100.0	87.3	101.3	90.2
Other manufacturing		16.2	15.0	16.3	14.6		100.0	92.7	100.4	89.9
Construction		5.5	5.2	6.7	10.7		100.0	94.8	120.5	193.9
Retail & distribution		8.3	7.9	8.8	12.8		100.0	95.5	106.0	154.1
Knowledge intensive services		17.3	17.1	19.9	16.9		100.0	98.9	114.7	97.4
Other services		16.2	15.0	5.0	8.1		100.0	92.7	30.8	50.0

Sources: Statistical Annexes for the UK Innovation Surveys, 2009, 2011, 2013, 2015 and 2017.

Table 13: Real total R&D spending by sector by business: 2007-18 (£m)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
TOTAL	19,043	18,732	18,100	18,383	19,694	19,249	20,195	21,378	22,294	23,397	24,118	25,048
Agriculture, hunting and forestry; Fishing		104		117	150	146	131	144	147	137	147	140
Extractive Industries	100	107	163	174	220	190	227	246	219	183	165	156
Food products and beverages; Tobacco products	398	359	338	351	413	402	474	461	450	504	447	418
Textiles, clothing and leather products	23	18	12	13	16	22	24	24	20	22	40	32
Pulp, paper and paper products; Printing; Wood and straw products	64	66	30	32	24	31	52	51	52	63	68	70
Refined petroleum products and coke oven products	333	111	111	84	81	84	119	202	189	149	133	139
Chemicals and chemical products	811	746	711	763	590	735	818	839	889	1,054	875	893
Pharmaceuticals	4,780	5,157	5,155	5,354	5,545	4,653	4,381	4,124	4,418	4,238	4,402	4,463
Rubber and plastic products	96	92	72	92	109	116	107	136	145	195	160	179
Other non-metallic mineral products	58	63	66	64	68	52	51	66	57	66	87	102
Casting of iron and steel		56	50	32	50	50	29	55	42	44	52	47
Non-ferrous metals		85		99	87	62	61	81	66	78	76	70
Fabricated metal products except machinery and equipment	111	86	108	107	134	116	123	118	130	115	209	209
Machinery and equipment	1,255	936	1,017	927	1,098	1,102	1,131	1,082	1,025	954	1,057	1,024
Computers and peripheral equipment	101	146	176	180	203	207	282	295	335	340	446	479
Electrical equipment	664	683	672	588	574	512	432	493	524	421	462	488
Consumer electronics and communication equipment	810	829	637	543	577	762	951	976	1,049	914	841	807
Precision instruments and optical products; photographic equipment	661	700	580	561	676	712	669	717	701	748	646	691
Motor vehicles and parts	1,133	1,369	1,211	1,417	1,721	1,949	2,279	2,614	2,978	3,566	3,669	3,755
Other transport equipment	34	36		53	56	53	69	83	99	97	107	111
Shipbuilding	165	186	202	212	255	253	253	284	318	321	350	361
Aerospace	2,515	2,052	1,708	1,646	1,623	1,671	1,778	1,782	1,802	1,973	1,527	1,709
Other manufactured goods	33	43	114	156	165	147	190	196	203	166	238	282
Electricity, gas and water supply; Waste management ⁶	43	47	87	82	77	130	152	180	208	166	180	156
Construction		25		16	35	71	99	162	165	222	326	351
Wholesale and retail trade	45	88	89	203	273	184	181	256	213	290	302	283
Transport and storage, incl. postal and courier activities	26	14	28	19	20		38	41	49	49	45	64
Telecommunications	1,865	1,663	1,550	1,293	1,170	967	911	1,027	853	826	769	947
Miscellaneous business activities; Technical testing and analysis	620	585	647	668	643	955	1,078	1,216	1,216	1,344	1,567	1,692
Computer programming and information service activities ⁷	1,820	1,735	1,614	1,748	2,084	2,285	2,145	2,385	2,506	1,852	1,955	1,946
Software development ⁷										1,068	1,411	1,518
Research and development services	190	455	591	708	884	533	837	874	1,084	1,089	1,174	1,271
Public administration	125	84	85	80	76		123	169	139	143	182	197

Source: UK Business Enterprise Research and Development 2018, ONS

Table 14: Real total business R&D spending by region: 2007-18 (£m, 2018 prices)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
United Kingdom	19,043	18,732	18,100	18,383	19,694	19,249	20,195	21,378	22,294	23,397	24,118	25,048
	0	0	0	0	0	0	0	0	0	0	0	0
North East	402	377	367	353	292	312	350	302	325	323	395	443
North West	2,455	2,523	2,244	2,376	2,505	1,969	1,991	2,047	2,243	2,475	2,224	2,031
Yorkshire and the Humber	530	513	529	559	621	663	716	749	815	799	955	921
East Midlands	1,290	1,156	1,156	1,303	1,293	1,347	1,454	1,576	1,621	1,737	1,550	1,769
West Midlands	1,209	1,050	987	1,015	1,446	1,614	1,827	2,058	2,290	2,430	2,516	2,744
East of England	4,849	4,954	4,442	4,406	4,107	3,987	4,488	4,380	4,455	4,682	4,766	5,141
London	1,296	1,314	1,057	1,005	1,262	1,736	1,400	1,844	1,992	2,436	2,844	2,906
South East	4,270	4,106	4,379	4,351	5,167	4,570	4,652	4,931	5,054	4,899	4,954	5,031
South West	1,493	1,593	1,572	1,666	1,534	1,511	1,573	1,670	1,565	1,571	1,692	1,752
Wales	374	288	283	268	284	296	398	413	390	456	429	430
Scotland	660	656	735	709	787	784	869	1,024	1,011	1,090	1,274	1,356
Northern Ireland	215	203	346	371	397	459	478	384	531	498	518	524
GDP deflator used to convert current prices to constant prices	82.321	84.421	85.813	87.283	88.615	90.440	92.185	93.472	94.277	96.510	98.139	100

Source: UK Business Enterprise Research and Development 2018, ONS

Table 15: Real total business R&D spending by industry: 2007-18 (2008=100)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
TOTAL	102	100	97	98	105	103	108	114	119	125	129	134
Agriculture, hunting and forestry; Fishing		100		112	144	140	126	139	141	131	141	134
Extractive Industries	93	100	153	163	206	178	213	231	205	172	155	146
Food products and beverages; Tobacco products	111	100	94	98	115	112	132	128	125	140	125	116
Textiles, clothing and leather products	130	100	66	71	89	124	134	132	113	122	224	180
Pulp, paper and paper products; Printing; Wood and straw products	97	100	46	48	36	47	78	77	78	95	103	106
Refined petroleum products and coke oven products	299	100	99	75	73	75	107	182	170	134	120	125
Chemicals and chemical products	109	100	95	102	79	99	110	112	119	141	117	120
Pharmaceuticals	93	100	100	104	108	90	85	80	86	82	85	87
Rubber and plastic products	104	100	78	99	118	126	116	147	157	211	173	194
Other non-metallic mineral products	93	100	106	102	108	83	81	106	91	106	138	162
Casting of iron and steel		100	90	58	89	89	53	98	76	78	93	84
Non-ferrous metals		100		116	102	73	71	95	77	91	90	82
Fabricated metal products except machinery and equipment	128	100	125	123	155	134	142	136	151	133	242	242
Machinery and equipment	134	100	109	99	117	118	121	116	109	102	113	109
Computers and peripheral equipment	69	100	121	123	139	142	194	203	230	233	306	329
Electrical equipment	97	100	98	86	84	75	63	72	77	62	68	71
Consumer electronics and communication equipment	98	100	77	65	70	92	115	118	127	110	101	97
Precision instruments and optical products; photographic equipment	94	100	83	80	97	102	96	102	100	107	92	99
Motor vehicles and parts	83	100	88	103	126	142	166	191	218	260	268	274
Other transport equipment	96	100	0	148	159	149	195	235	278	274	301	312
Shipbuilding	89	100	108	114	137	136	136	152	171	173	188	194
Aerospace	123	100	83	80	79	81	87	87	88	96	74	83
Other manufactured goods	77	100	268	365	386	345	445	459	475	389	559	661
Electricity, gas and water supply; Waste management ⁶	90	100	184	174	162	275	321	379	439	350	381	329
Construction		100		64	141	284	397	649	665	891	1,311	1,411
Wholesale and retail trade	51	100	101	231	312	209	207	292	243	331	344	323
Transport and storage, incl. postal and courier activities	179	100	197	137	143		267	286	343	343	315	450
Telecommunications	112	100	93	78	70	58	55	62	51	50	46	57
Miscellaneous business activities; Technical testing and analysis	106	100	111	114	110	163	184	208	208	230	268	289
Computer programming and information service activities ⁷	105	100	93	101	120	132	124	137	144	107	113	112
Software development ⁷												
Research and development services	42	100	130	156	194	117	184	192	238	239	258	279
Public administration	149	100	101	95	90		146	201	165	170	217	234

Source: UK Business Enterprise Research and Development 2018, ONS

Table 15: Real total business R&D spending by region: 2007-18 (2008=100)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
United Kingdom	102	100	97	98	105	103	108	114	119	125	129	134
North East	107	100	97	94	78	83	93	80	86	86	105	118
North West	97	100	89	94	99	78	79	81	89	98	88	80
Yorkshire and the Humber	103	100	103	109	121	129	140	146	159	156	186	180
East Midlands	112	100	100	113	112	116	126	136	140	150	134	153
West Midlands	115	100	94	97	138	154	174	196	218	232	240	261
East of England	98	100	90	89	83	80	91	88	90	95	96	104
London	99	100	80	76	96	132	107	140	152	185	216	221
South East	104	100	107	106	126	111	113	120	123	119	121	123
South West	94	100	99	105	96	95	99	105	98	99	106	110
Wales	130	100	98	93	99	103	138	143	136	158	149	149
Scotland	101	100	112	108	120	119	132	156	154	166	194	207
Northern Ireland	106	100	171	183	196	227	236	190	262	246	256	259

Source: UK Business Enterprise Research and Development 2018, ONS



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