



BRIEFING PAPER

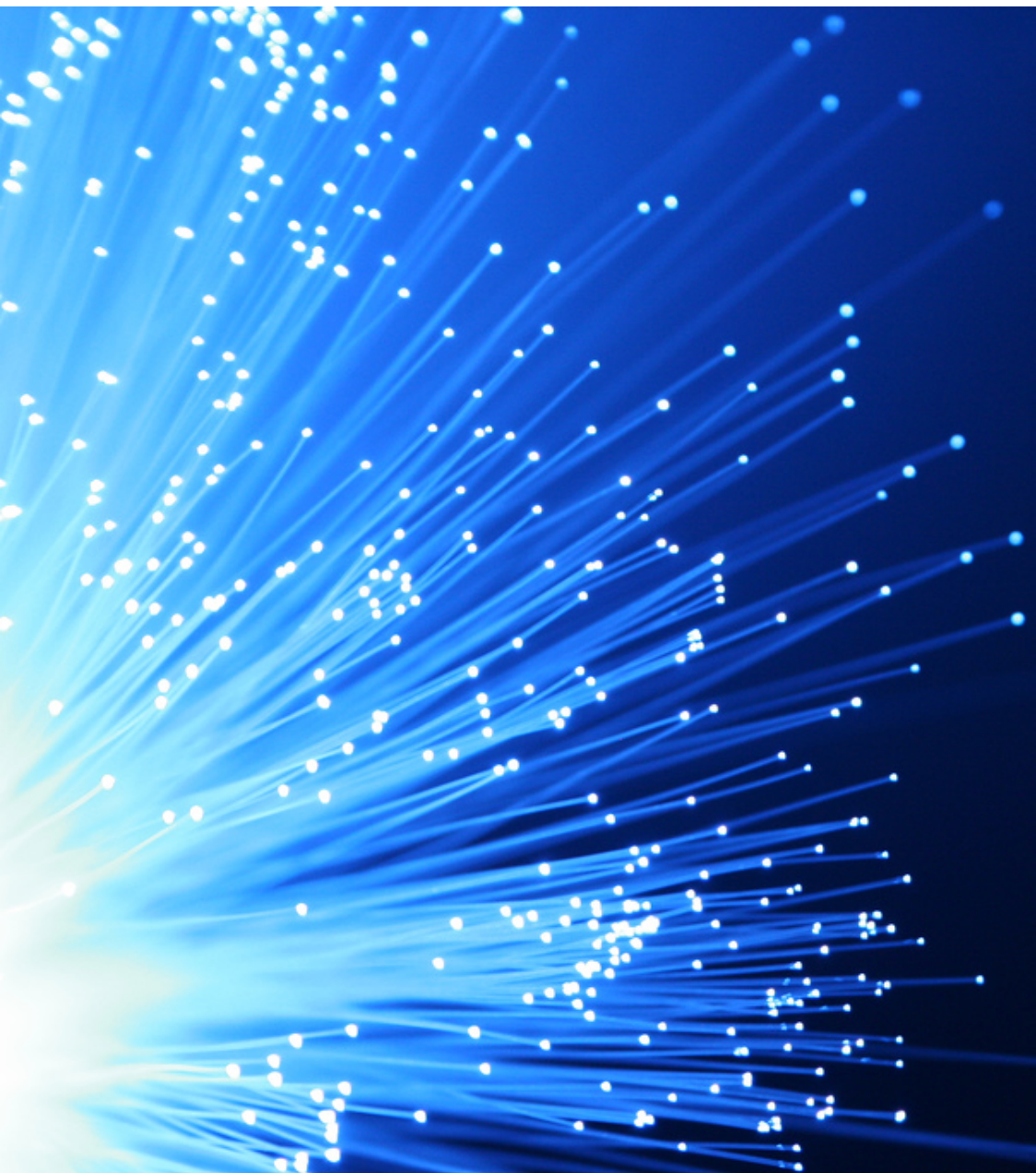
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Research & Development spending

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Summary

Research and development (R&D) is systematic work undertaken to increase the stock of knowledge.

Total R&D

In the UK in 2016, total expenditure on R&D was £33.1 billion, £505 per head, or the equivalent of 1.7% of GDP.

R&D investment has risen steadily over the past few decades, from £17.8 billion in 1981 to the current total of £33.1 billion (in 2016 prices). This is a real terms increase of 86%.

But as a proportion of GDP, R&D expenditure has fallen over this period (it was the equivalent of 2.0% of GDP in 1981).

The government have a target for R&D investment to reach 2.4% of GDP by 2027.

Sectors performing R&D

R&D performed by businesses accounted for 67% of all R&D expenditure in 2016 (£22.2 billion).

The higher education sector performed R&D worth £8.0 billion or 24% of the total.

The government sector (including the funding councils) performed £1.1 billion of R&D, 7% of the total.

R&D by region

R&D performed in the South East of England in 2016 totalled £6.7 billion, 20.1% of the total. R&D performed in the South East, the East of England and London accounted for 52.0% of all UK R&D.

Per head, R&D expenditure in the East of England is the highest: £924 per head. The figure for the whole UK is £505 per head. In Wales, per head R&D expenditure is £230.

R&D by sector

The pharmaceuticals sector performs by far the most on R&D of any industry in the UK: £4.3 billion in 2017, compared to £3.6 billion in the automotive sector which is the second highest total.

These two sectors also employ the most people in R&D related roles of any industries: 24,000 in the pharmaceuticals sector and 21,000 in the automotive sector. In the whole of the UK, 231,000 people are employed in R&D related roles.

International comparisons

The UK figure for R&D investment of 1.7% of GDP is below the OECD average of 2.3%.

R&D expenditure in Germany is the equivalent of 2.9% of GDP, in the US it is 2.7% and in France it is 2.2%.

1. Introduction

1.1 Defining Research & Development

Research and Development (R&D) spending is analysed according to the internationally agreed “Frascati method” for collecting and reporting on research and experimental development, named after the town in Italy where the original Organisation for Economic Cooperation and Development (OECD) guidelines were first proposed in 1963.¹

The Frascati Manual uses the following definition of R&D:²

...creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge.

For an activity to count as an R&D activity under the Frascati definition, it must be “novel, creative, uncertain [about what the final outcome will be], systematic and transferable/reproducible.”³

1.2 Key concepts in R&D spending

R&D is measured by the amount spent **performing** R&D by an organisation, or the **funding** provided to perform R&D. These are not always the same – for example, the higher education sector in the UK *performs* R&D worth around £8 billion, but the sector only provides direct *funding* for R&D worth £450 million.

These two ways of measuring R&D spending are different ways of analysing the same overall total for R&D, known as Gross Expenditure on R&D (GERD). GERD is the preferred way of measuring R&D spending in the UK, and for comparing R&D spending in different countries.

R&D is performed and funded by the following sectors: business, higher education, government (including the research councils in the UK) and private non-profit. Some funding for R&D in the UK also comes from overseas sources.

Box 1: Sources for statistics on R&D spending

The key source for information of GERD is **ONS**, [Gross domestic expenditure on R&D](#). This is published each year in March.

R&D performed by businesses is further analysed in **ONS**, [Business enterprise research and development](#) which is published in November each year.

The best source for international comparisons of R&D spending is **OECD**, [Main science and technology indicators](#).

¹ OECD, [Frascati Manual](#), 2015

² *Ibid*, p44

³ *Ibid*, p45

2. Total R&D funding

In the UK in 2016, total R&D (gross expenditure on research and development) was £33.1 billion, the equivalent of 1.7% of GDP. This was £505 per head.⁴

| Total R&D spending in the UK | | | | |
|------------------------------|------------------------|----------------------------|----------|------------|
| | £ billion (current) | £ billion (2016 prices) | % of GDP | £ per head |
| 2000 | 24.4 | 17.7 | 1.6% | 301 |
| 2001 | 25.2 | 18.5 | 1.6% | 314 |
| 2002 | 25.6 | 19.2 | 1.6% | 324 |
| 2003 | 25.6 | 19.7 | 1.6% | 331 |
| 2004 | 25.6 | 20.2 | 1.5% | 338 |
| 2005 | 27.2 | 22.1 | 1.6% | 366 |
| 2006 | 27.5 | 23.0 | 1.6% | 378 |
| 2007 | 28.8 | 24.7 | 1.6% | 403 |
| 2008 | 28.8 | 25.3 | 1.6% | 410 |
| 2009 | 28.7 | 25.6 | 1.7% | 412 |
| 2010 | 28.8 | 26.2 | 1.6% | 417 |
| 2011 | 29.8 | 27.5 | 1.7% | 434 |
| 2012 | 29.0 | 27.3 | 1.6% | 428 |
| 2013 | 30.3 | 29.0 | 1.6% | 453 |
| 2014 | 31.5 | 30.6 | 1.7% | 473 |
| 2015 | 32.5 | 31.8 | 1.7% | 488 |
| 2016 | 33.1 | 33.1 | 1.7% | 505 |

Source: ONS, GERD statistics, 2018; Series GLBA, GLBD, GLBD

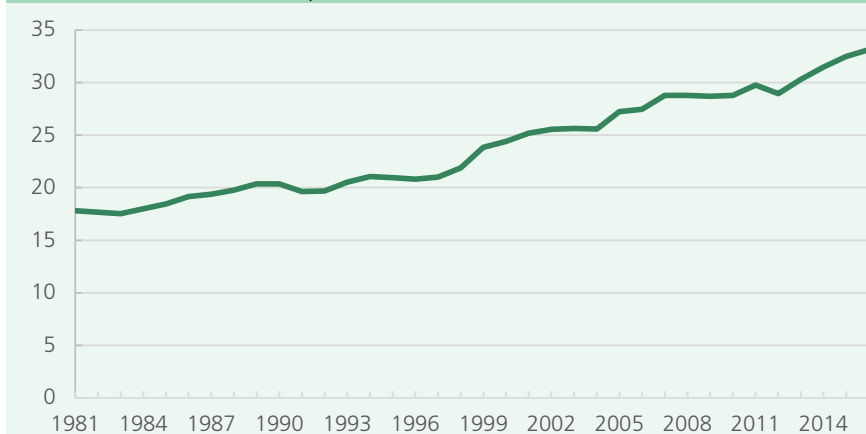
Gross expenditure on research and development

Per head data uses ONS population estimates and current price data

R&D investment in the UK has risen steadily over the past thirty years, from £17.8 billion in 1981 to the current total of £33.1 billion (in 2016 prices). This is a real terms increase of 86% over the period.

Gross expenditure on research and development, 1981 to 2016

UK, £ billion, 2016 constant prices

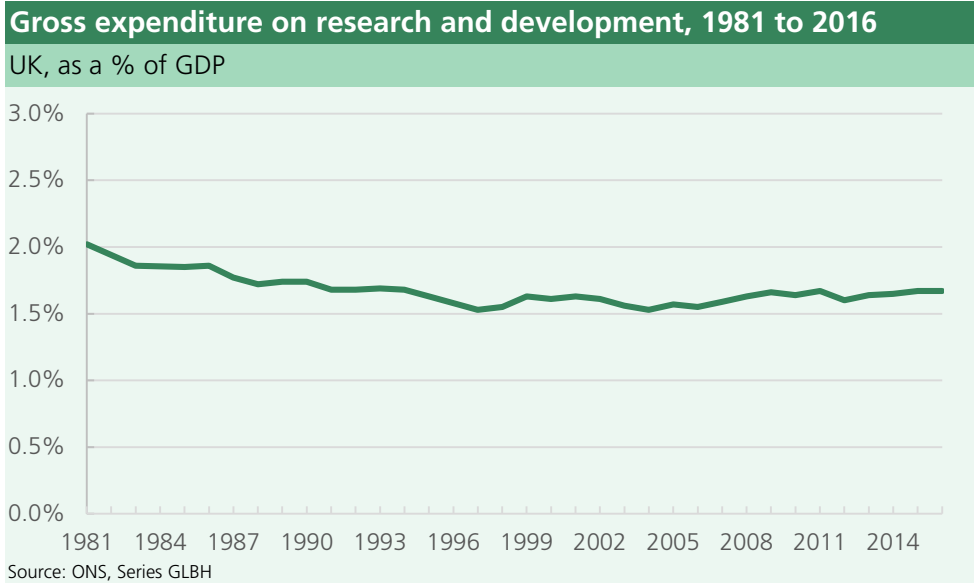


Source: ONS, Series GLBD

⁴ Unless otherwise stated, the data in this briefing paper is from ONS, [Gross expenditure on Research and Development](#), 2018

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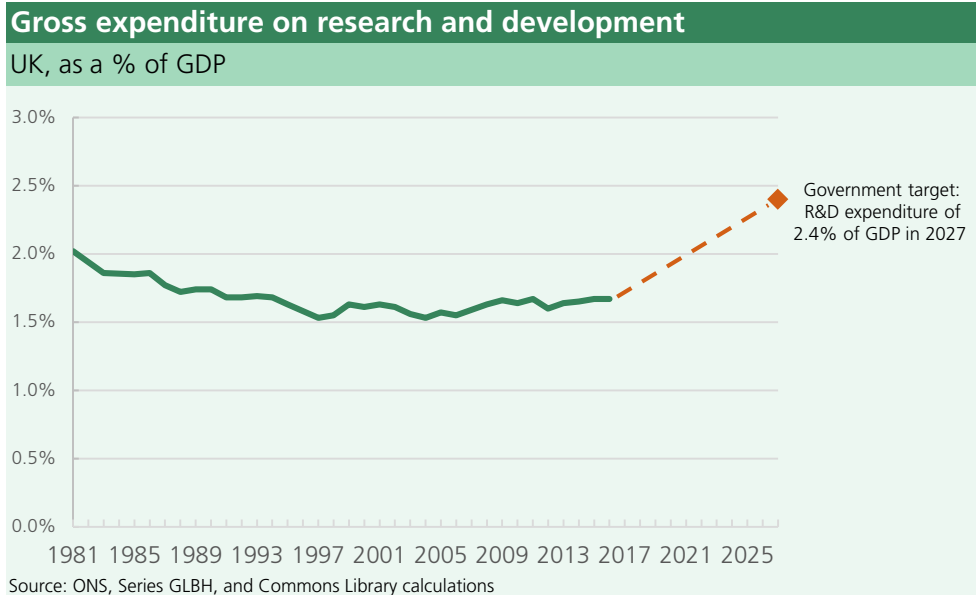
However, over the same period, R&D expenditure has fallen as a proportion of GDP. R&D expenditure was the equivalent of 2.0% of GDP in 1981, compared to the 2016 figure of 1.7% of GDP.



Box 2: Government target for R&D expenditure to be 2.4% of GDP by 2027

In its [Industrial Strategy](#) (published in November 2017), the government set a target to "...raise total R&D investment to 2.4% of GDP by 2027" (page 11).

In 2016, R&D expenditure was the equivalent of 1.7% of GDP.



Increasing expenditure on R&D to the equivalent of 2.4% of GDP would lead to a record level of R&D investment in the UK. At 2.4% of GDP, R&D expenditure in the UK would be above the current OECD average.

3. R&D performance and funding

The following table breaks down R&D funding/performing expenditure data for 2016. It shows not only the totals for the funding and performing sectors, but also the amount of that total performed or funded by the other sectors.

For example, £1.7 billion of government funded R&D was performed by the business sector. £1.2 billion of private non-profit funded R&D was performed by the higher education sector.

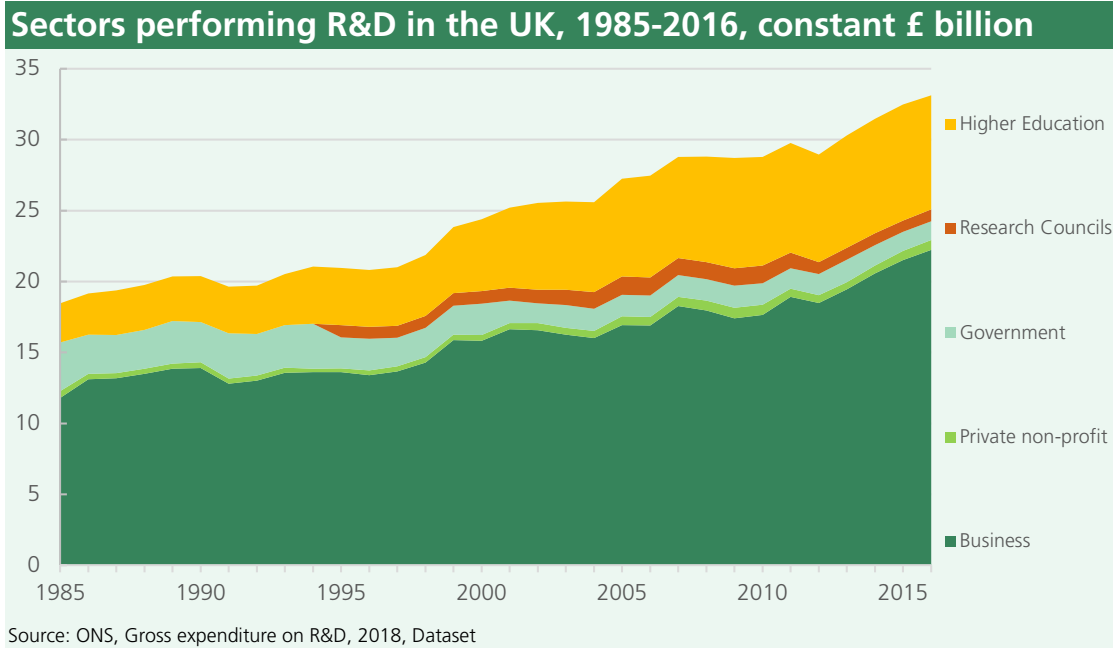
| Total expenditure on R&D, by performing and funding sectors | | | | | | | |
|---|----------------------------------|-------------------|------------------|---------------------|--------------------|---------------|----------|
| <i>£ million, 2016, UK</i> | | | | | | | |
| | <i>Sector performing R&D</i> | | | | | Total | Overseas |
| | Government | Research Councils | Higher Education | Business Enterprise | Private Non-Profit | | |
| <i>Sector funding R&D</i> | | | | | | | |
| Government | 1,136 | 137 | 483 | 1,730 | 98 | 3,584 | 542 |
| Research Councils | 47 | 554 | 2,107 | 5 | 197 | 2,909 | 292 |
| HE Funding Councils | - | - | 2,207 | - | - | 2,207 | - |
| Higher Education | 2 | 17 | 299 | - | 131 | 449 | - |
| Business Enterprise | 15 | 25 | 350 | 16,742 | 18 | 17,151 | 6,658 |
| Private Non-Profit | 13 | 42 | 1,242 | 188 | 170 | 1,655 | - |
| Overseas | 122 | 60 | 1,346 | 3,560 | 85 | 5,174 | - |
| Total | 1,335 | 837 | 8,035 | 22,224 | 699 | 33,130 | - |
| of which: | | | | | | | |
| Civil | 1,178 | 837 | 7,994 | 20,658 | 688 | 31,354 | - |
| Defence | 156 | - | 42 | 1,567 | 11 | 1,776 | - |

Source: ONS, Gross expenditure on R&D, 2018, Data table 1

3.1 Sectors performing R&D

The biggest R&D performing sector in 2016 was the business sector which performed R&D worth £22.2 billion, 67% of all total R&D. The higher education sector performed R&D worth £8.0 billion, 24% of the total.

The government sector, including the research councils, performed £1.1 billion of R&D, 7% of the total. The following chart illustrates the amount of R&D expenditure performed by different sectors.



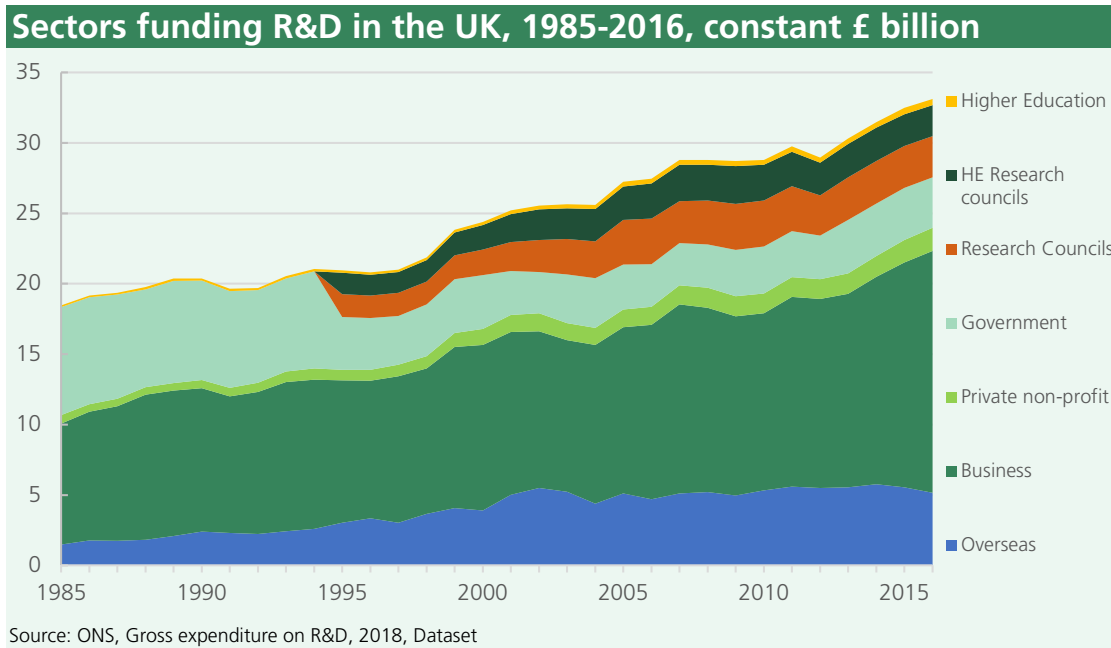
The proportion of R&D performed by each sector has remained largely the same over this whole period.

In 1981, R&D performed by the business sector was worth £17.8 billion (in 2016 prices), 63% of the total. Government performed 21% of the total in 1981.

3.2 Sectors funding R&D

The business sector is also the largest sector funding R&D: £17.2 billion, 52% of the total.

The government (including the research councils, which were only created in the mid-1990s, a change clearly visible in the chart), funded £8.7 billion R&D, 26% of the total.



The proportion of R&D funded by government has fallen from 49% in 1981 to the 2016 figure of 26% (including the research councils).

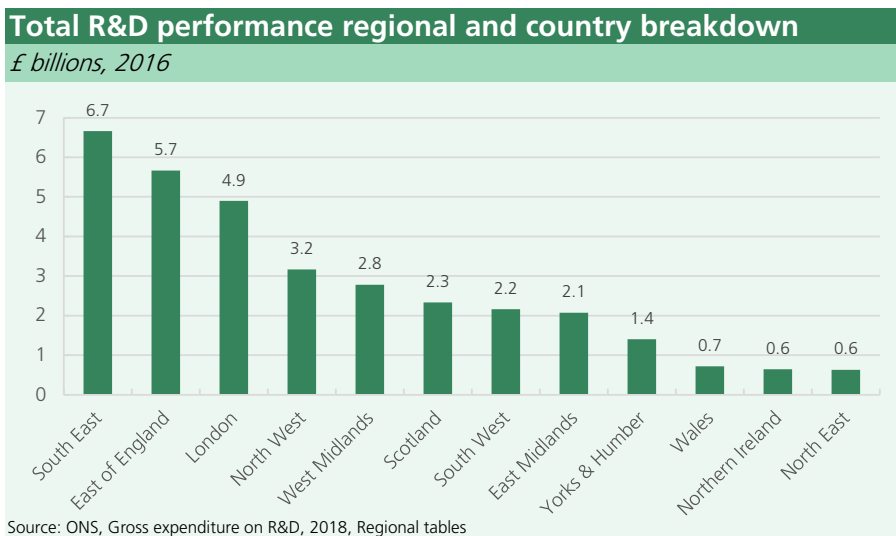
The proportion of R&D funded by business has increased from 41% in 1981 to the 2016 total of 52%.

4. R&D by region

Total R&D expenditure is available broken down by the region or country of the UK in which it is performed.

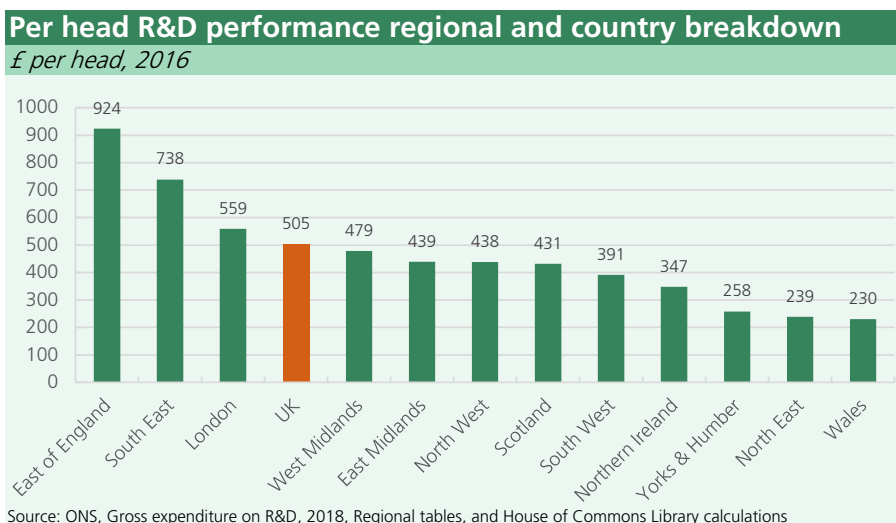
In 2016, R&D expenditure performed in the South East totalled £6.7 billion, 20.1% of the total. R&D investment performed in the South East, the East of England and London was worth £17.2 billion, 52.0% of the UK total.

The North East and Northern Ireland saw only £0.6 billion worth of R&D investment each.



Per head R&D expenditure was £505 in the UK as a whole in 2016. In the East of England it was substantially higher – £924 per head.

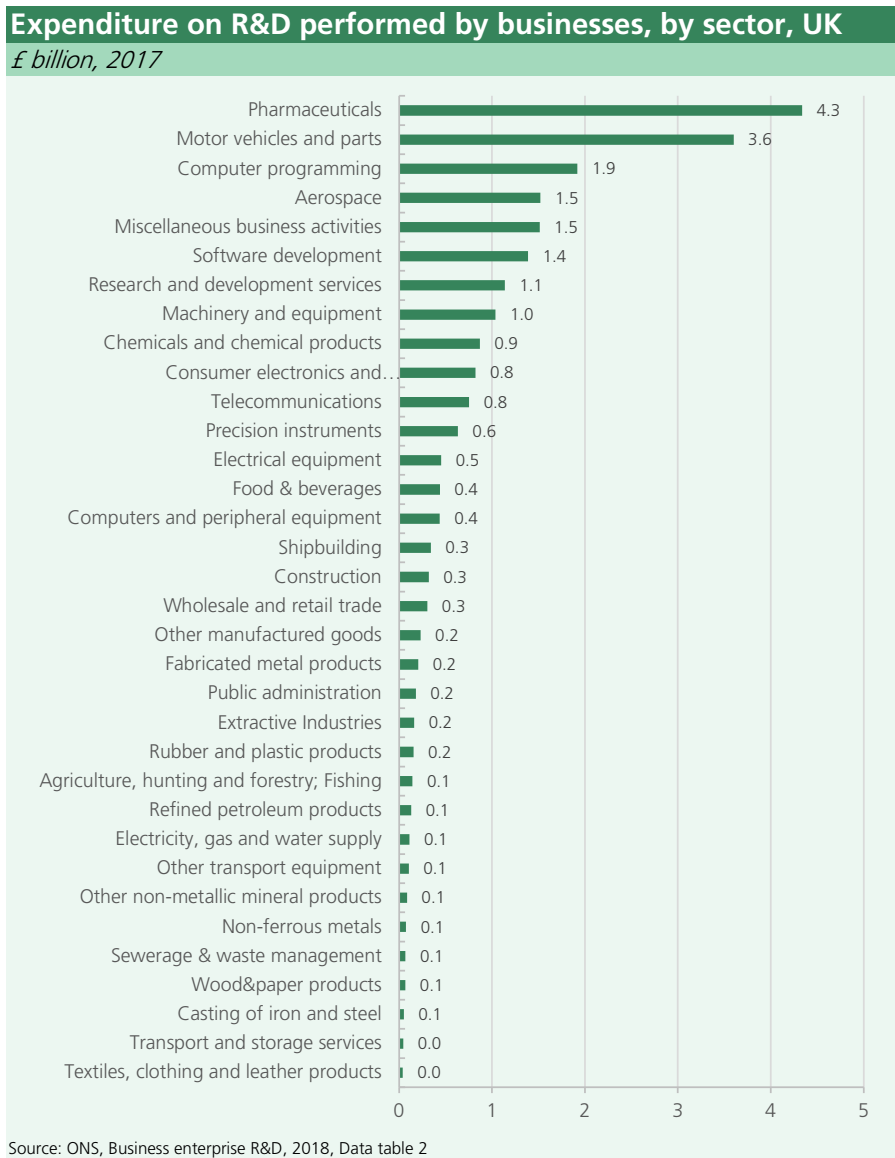
At the other end of the scale, Yorkshire and Humberside, the North East and Wales had R&D investment per head of between £260 and £230.



5. R&D by sector

Expenditure on R&D performed by businesses is available broken down by sector.⁵

In 2017, the pharmaceutical industry performed the most R&D – worth £4.3 billion. The automotive manufacturing industry had the second highest R&D investment: £3.6 billion.



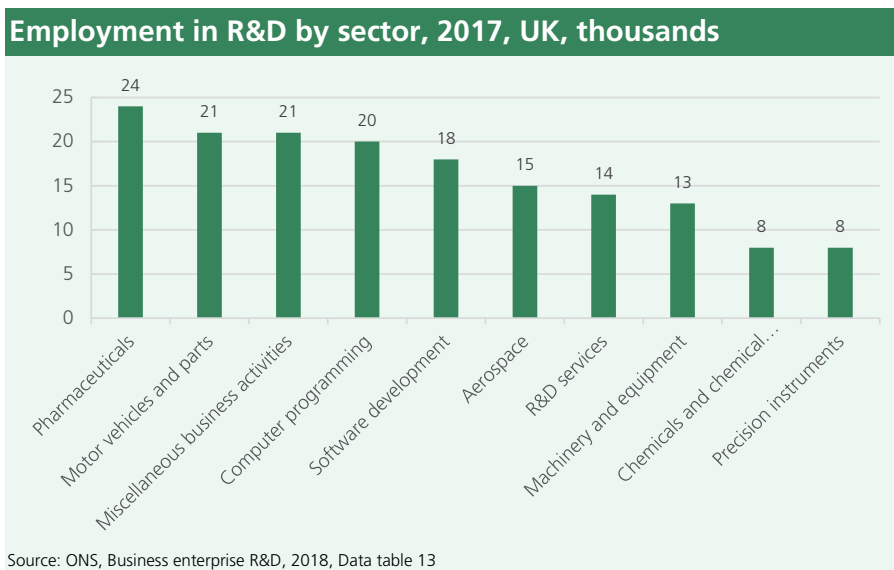
⁵ ONS, [Business enterprise R&D](#), 2018

6. Employment in R&D

In 2017, there were 231,000 people working in R&D related roles in the UK. Most of these people (49%) work as researchers. Technicians made up 29% of all R&D employment.⁶

The following chart shows the number of R&D roles in the ten largest R&D employing sectors.

The pharmaceuticals sector employs the most people in R&D related roles: 24,000. The automotive manufacturing sector employs the next highest number: 21,000.



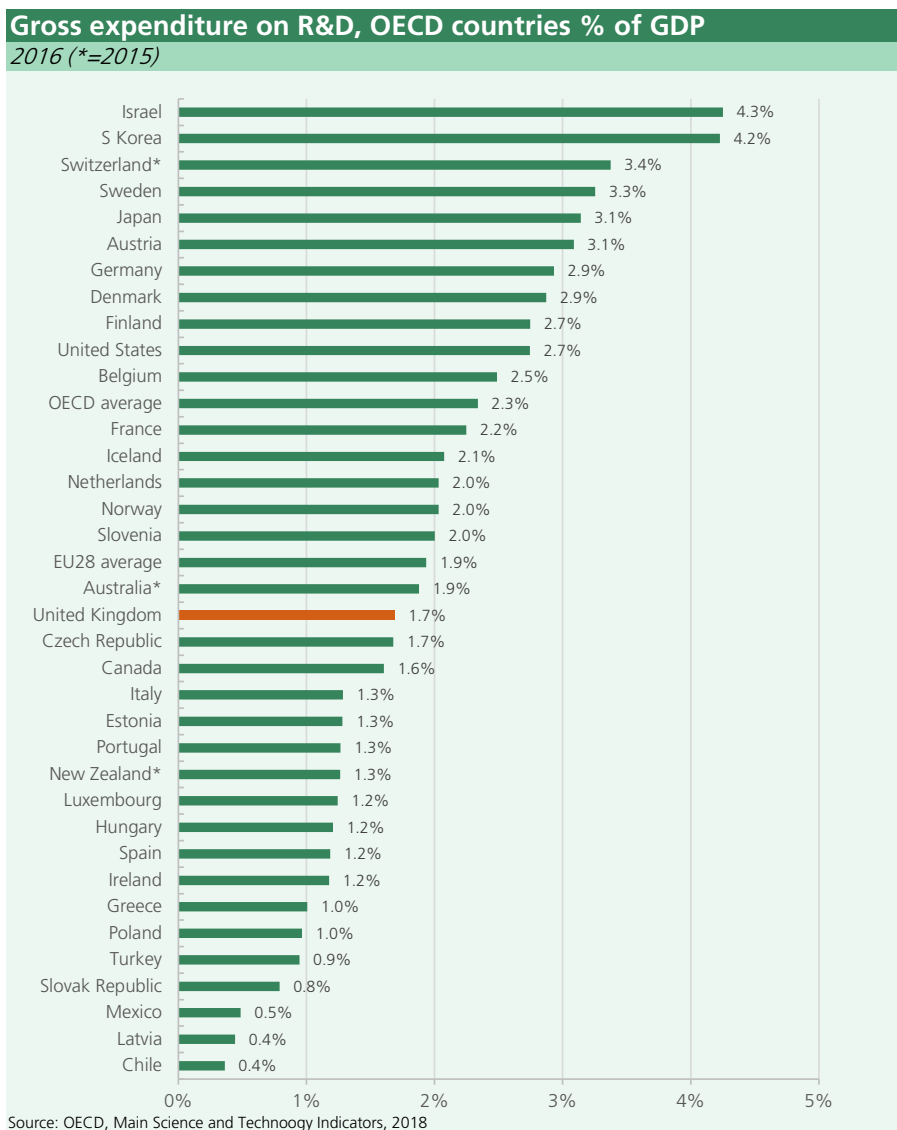
⁶ ONS, [Business enterprise R&D](#), 2018

7. R&D: international comparisons

The following chart shows total R&D investment as a proportion of GDP in each of the Organisation for Economic Co-operation and Development (OECD) member countries, the EU28 average and the OECD average.⁷

UK R&D investment equivalent to 1.7% of GDP is below the EU28 average of 1.9%, and below the OECD average of 2.3%.

UK has a lower level of R&D investment than competitor countries such as the France (with R&D investment equivalent to 2.2% of GDP), the US (2.7%) and Germany (2.9%).



⁷ OECD, [Main science and technology indicators](#), 2018

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