

## What is the best way to achieve the Government's target of spending 2.4% of GDP on R&D by 2027?

Date and Location: 17th October, 2018 at The Royal Society

Chair: The Earl of Selborne GBE FRS  
Chair, The Foundation for Science and Technology

Speakers: Dr Patrick Vallance FRS FMedSci FRCP  
Chief Scientific Adviser to HM Government, Government Office for Science  
Chi Onwurah MP  
Labour Shadow Minister for the Industrial Strategy, Science and Innovation  
and MP for Newcastle Central  
Christopher Haley  
Head of New Technology and Startup Research, Nesta

Panellists: Dr David Halpern  
Chief Executive, The Behavioural Insights Team  
Rebecca Endean OBE  
Strategy Director, UKRI

Sponsors: Association for Innovation, Research and Technology Organisations (AIRTO),  
the Building Research Establishment (BRE Group), GO-Science, the  
Knowledge Transfer Network, the UK Innovation and Science Seed Fund and  
the Royal Society of Chemistry

Audio Files: [www.foundation.org.uk](http://www.foundation.org.uk)

Hash tag: #fstr&d

DR PATRICK VALLANCE noted that there was little data to enable determination of what was the right amount of GDP to spend on R&D. The average spend in OECD countries was 2.4-2.5%, and the UK was 1.7% in 2016. With that expenditure, UK research featured in 16% of the world's most highly cited articles, and the UK was fifth in the Global Innovation Index in 2017 (having been second in 2014 and 2015). The UK's performance on ratio of innovation inputs to outputs was 20th, so our record on turning research into economic benefit was not so good. 50% of the UK's current research expenditure was carried out by business, a figure that was relatively low compared with other countries. Looking at the performance of other countries, ten had increased the proportion of GDP spent on R&D by 0.7 percentage points, and the bulk

of that increase had come from business. The main factors that encouraged companies to locate investment in R&D in a particular country were: access to specialised talent; a vibrant small business base; the regulatory environment; certain tax incentives; and procurement practices. A relatively high proportion of R&D business spend in the UK was by foreign owned companies. It was questionable how well the statistics captured R&D in the service sector. In conclusion, 2.4% was a reasonable target; to achieve it, it would be essential to increase business funding; for this, the right levers needed to be in place; and the crucial factor was the ability to attract and retain top talent.

CHI ONWURAH MP said a crucial question was why research was not being funded

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sufficiently by business. The banking sector had largely retreated from funding the real economy. As the financial services sector had grown in the UK, it had coincided with a decline in the proportion of business R&D spend. Short term thinking was a key factor in this. Labour Party policy was to turn the tide of financialisation, and create an Innovation Nation. It was proposed to create a National Investment Bank, with a regional network. The target was to increase the proportion of R&D spend to 3% by 2030. £1.3 billion of public investment would be available in the first two years. The aim, through the public investment, was to increase the overall proportion to 2% of GDP. Other levers were being developed, eg. to reduce carbon emissions from energy generation by 60% by 2030; greater collaboration in the health sector (eg. creating a medical research hub); action in the transport sector; tax options (including the retention of R&D tax credits); access to skills; ensuring that Industrial Strategy focused on place; and setting up more sector councils.

CHRISTOPHER HALEY repeated the point that a particular focus had to be on how to increase business spend on R&D. Innovative firms grew twice as fast as others both in terms of employment and sales. The UK ranked above most EU countries in terms of broader innovation activities. Looking at the reason for the relatively low level of business investment in R&D, the short term nature of equity markets was a key factor. Institutional investors had largely been replaced by overseas investors, and this fragmentation of shareholders had reduced the quality of interaction with companies. Another key factor was the relatively short term nature of remuneration incentives, which could run counter to long term investment. An analysis of the FTSE 350 showed that the top 50 firms accounted for half the business R&D investment, and, among the more active ones, higher levels of R&D correlated with higher profits. But only a small minority used any R&D metric in the remuneration incentive scheme; and there was little focus on science and technology by Boards. Another key element was the need for two-way movement of staff between academia and business.

The panel members added the following comments in response to what the speakers had said:

DAVID HALPERN said there was a respectable evidence base for R&D tax credits, and work was under way to see how they could be shaped in a way that

would encourage research. More forward guidance from HMRC would be useful, and ways should be examined of encouraging firms to invest the money returned in R&D. More R&D could be done in the area of public services, eg. innovation around education, and health. In Canada for example all Departments were expected to spend a proportion of their budget on R&D. Thirdly, the context for R&D could be improved, eg. through innovation by consumers and purchasers, and greater encouragement of entrepreneurs. About 6% of the population were serial adaptors/inventors, and the question was how we could tap that reservoir.

REBECCA ENDEAN said that the current system did not capture all the spend on R&D. International comparisons showed the need to combine business investment with public policy actions. In addition to areas that other speakers had identified, the right infrastructure or capturing and processing data was an area to develop. A target had been set for the proportion of GDP spent on R&D in the 2004 science strategy but the target had not been achieved.

In the ensuing debate, the following points were made:

- Were there the right incentive structures in Government to invest in R&D? More thought should be given to R&D in the context of Departmental objectives.
- Public sector research establishments and Research Councils attracted business investment. There was a case for more public laboratories, and more could be done to promote research and innovation in areas such as housing and transport.
- The UK record in scaling up start-ups was not good. What more could be done to incentivise “patient capital”? There were an increasing number of examples of corporates experimenting with start-ups, and it would be good to see how this could be further encouraged. When information was provided on areas where markets and products were effective, it encouraged greater take-up and growth.
- What was the optimal balance between blue skies research and development? The UK balance favoured research rather than development. Interestingly, China had initially focused more on the latter, but had begun to invest substantially in pure research in universities.
- How could procurement be used in a way to incentivise R&D? This was an area that required a lot more thought. The current arrangements had

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a strong bias in favour of minimising risk, and yet innovation inherently involved risk. The budget for the Small Business Research Initiative (SBRI) had not been spent. Perhaps more should be put outside Government to encourage risk taking and to see what works.

- Was the use of citations an appropriate measure, since it focused on research? It was hard to think of a better measure; the number of patents was not a good one. The requirement for an impact statement in the Research Excellence Framework (REF) had made a positive contribution to thinking about the connection between research, innovation and end-users.
- Company Chief Technology Officers should be brought into the debate more. The public offer should be better signposted and more comprehensive, to encourage businesses to invest more. The original idea of the Catapult Centres had been to share the cost of late stage development, but, arguably, they had not been sufficiently funded to operate as effectively as they might.
- More thought needed to be given to funding start-ups over a longer period: patient capital, use of more innovative funding methods (eg crowd funding), earning from overseas examples of strong innovative systems (eg Boston).
- The subject of this debate was not new; it had been discussed many times over the last 20 years, so what was going to be done differently this time? More should be done on access to funding, eg getting more people in the City who understood these issues; changing some of the rules around how investment funds operate to encourage more risk spending; training company builders; providing

tax credits for taking risks. Home markets, eg energy, housing, transport, should be used to drive investment in innovation. Innovation standards (eg zero carbon homes) could be developed to drive demand. Company reporting requirements should promote the long term market. And access to talent was the crucial factor.

- There was good evidence that the right regulatory environment incentivised business, though care should be taken to avoid international regulatory divergence. Regulation in emerging sectors, where no harmonisation existed at present, could play a key role. More intelligent procurement could do so too.
- Approaching the next Spending Round, it would be important to work together, though the analytical case for investment in R&D was solid.
- Diversity should be improved; we were not using all the potential skills at our disposal. The short-termism of employment contracts for early post-doctoral careers should be addressed, and there should be more transparency and accountability in reporting by university departments.
- Post Brexit, it was important to realise that we would lose international collaboration at our peril.

In the concluding remarks by the panellists, the following points were made. We should focus on processes that would change attitudes. Cultural change was necessary. The country had got better at teaching entrepreneurship, but more should be done in schools. To achieve the target, we needed 60% more researchers – and to retain them. Long term planning was crucial.

Sir Brian Bender KCB

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## MEASURING R&D SPENDING - NOTE FROM THE OFFICE OF NATIONAL STATISTICS

The Office for National Statistics (ONS) collects data on R&D expenditure by businesses and government in the UK<sup>1</sup>. We follow international guidance on how to define R&D, which is set down in the Frascati Manual<sup>2</sup> published by the OECD. The key definition is:

*“Research and experimental development (R&D) comprises creative and systematic work undertaken in order to increase the stock of knowledge... and to devise new applications of available knowledge.”*

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1 - [www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure](http://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure)

2 - [www.oecd.org/sti/inno/frascati-manual.htm](http://www.oecd.org/sti/inno/frascati-manual.htm)

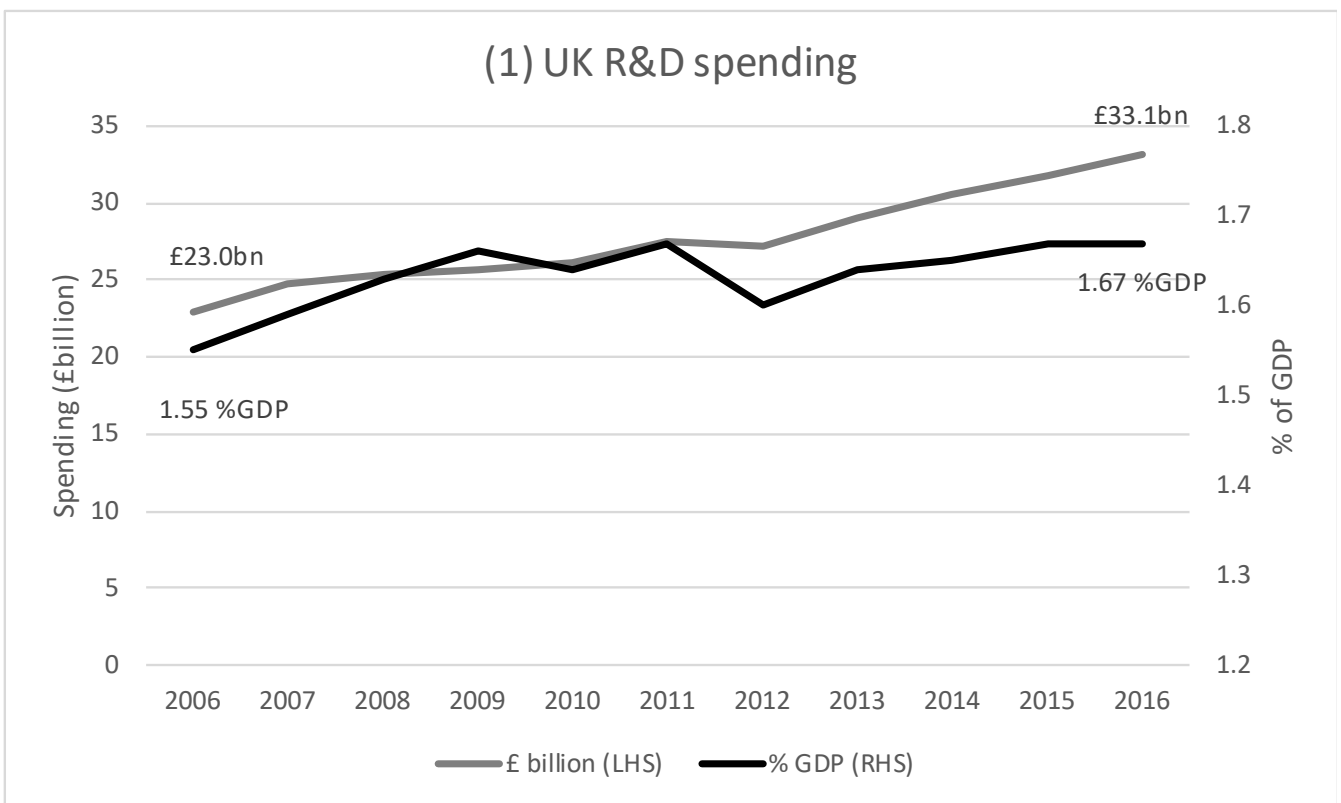
To qualify as R&D under the Frascati manual definition, research must meet five criteria. It must be:

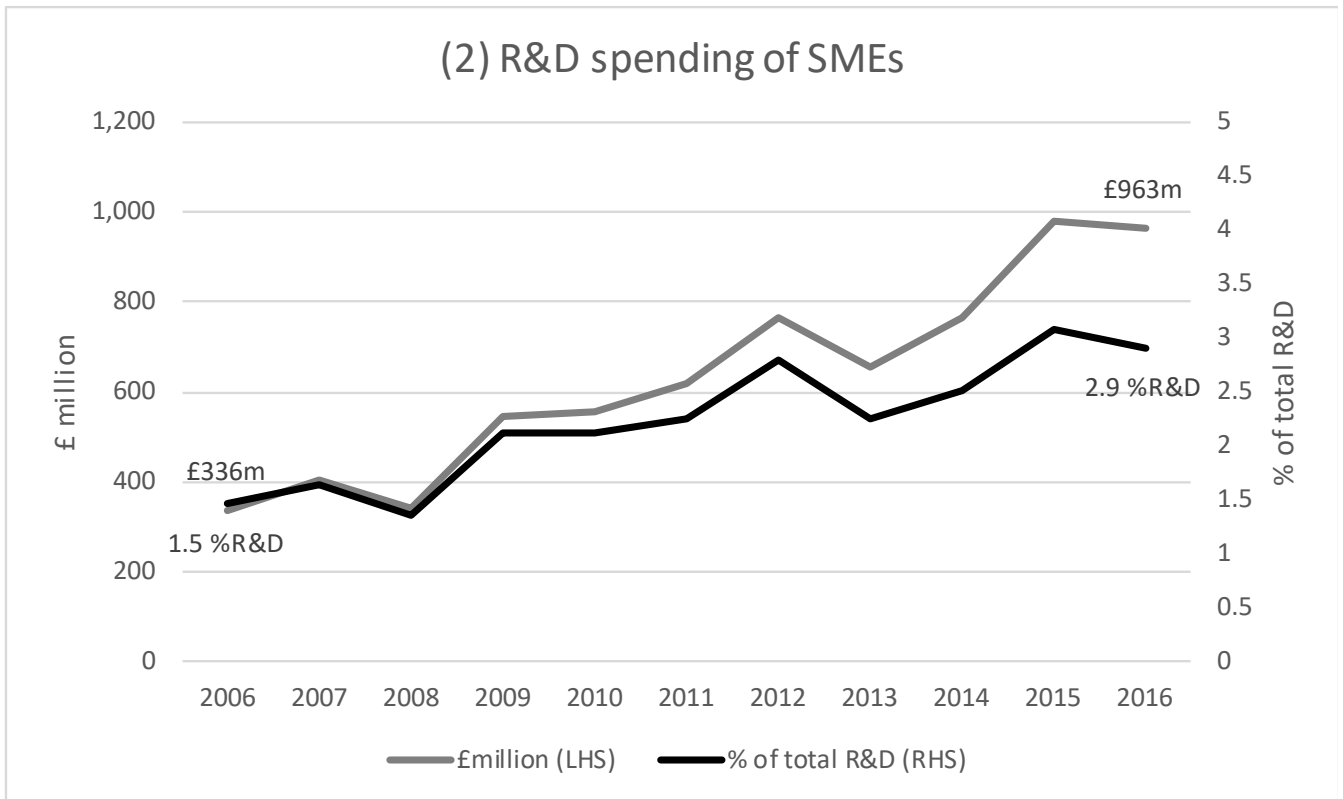
1. Novel;
2. Creative;
3. Uncertain;
4. Systematic;
5. Transferable and/or reproducible.

We measure the number of firms undertaking R&D and the amount spent on R&D activities. We do not collect other metrics such as patents. It is worth noting that R&D expenditure counts as business investment, so it is also an integral part of our measure of investment in the economy.

The R&D statistics produced by the ONS are collected through two main methods:

- For government, data on R&D spending is collected directly from departments;
- For businesses, we run an annual survey, comprising around 5,400 businesses. From this we can make an estimate of overall spending on R&D performed by UK businesses, and the characteristics of businesses undertaking those activities. We regularly review the method for sampling firms to ensure we are capturing R&D intensive firms and sectors;





We also collect data for the higher education sector from administrative sources, and the private non-profit sector from a small survey undertaken every two years. The four sectors together form the GERD measure of total spending on R&D performed in the UK (Gross domestic Expenditure on Research and Development). The charts below show (1) total R&D spending in the UK in cash terms and as a share of GDP and (2) the contribution of SMEs to R&D spending<sup>3</sup>:

- total R&D spending has risen from £23.0 billion in 2006 or 1.55 per cent of GDP in 2006 to £33.1 billion of 1.67 per cent of GDP in 2016; and
- SMEs have seen a steep rise in spending, from £336 million in 2006 to £963 million in 2016. As a share of overall R&D spending, SMEs have almost doubled their contribution from 1.5 per cent of all R&D spending to 2.9 per cent. Nonetheless, this remains a modest percentage of all R&D spending.

Out of the approximately 32,000 businesses making up the total value of business R&D performance in 2016, 30,000 had fewer than 250 employees and of those 18,500 were SMEs.

R&D is only one element of intellectual property. For example, investment in design of products does not necessarily qualify as R&D, but is nonetheless part of a wider measurement of intellectual property or wider measures of ‘intangible assets’.

Office for National Statistics | November 2018

<sup>3</sup> Based on data published in November 2017 available here:

<https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/businessenterpriseanddevelopment/2016>

Useful URLs: are on the next page.

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The Prime Minister's speech on science and modern Industrial Strategy delivered in May 2018.  
[www.gov.uk/government/speeches/pm-speech-on-science-and-modern-industrial-strategy-21may-2018](http://www.gov.uk/government/speeches/pm-speech-on-science-and-modern-industrial-strategy-21may-2018)

Data on R&D spend by government, businesses and others is available on the ONS website at:  
[www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure](http://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure)

**UK Research and Innovation (UKRI):**

[www.ukri.org](http://www.ukri.org)

Arts and Humanities Research Council, UKRI  
[www.ahrc.ukri.org](http://www.ahrc.ukri.org)

Biotechnology and Biological Sciences Research Council, UKRI  
[www.bbsrc.ukri.org](http://www.bbsrc.ukri.org)

Economic and Social Research Council, UKRI  
[www.esrc.ukri.org](http://www.esrc.ukri.org)

Engineering and Physical Sciences Research Council, UKRI  
[www.epsrc.ukri.org](http://www.epsrc.ukri.org)

Innovate UK, UKRI  
[www.gov.uk/government/organisations/innovate-uk](http://www.gov.uk/government/organisations/innovate-uk)

Medical Research Council, UKRI  
[www.mrc.ukri.org](http://www.mrc.ukri.org)

Natural Environment Research Council, UKRI  
[www.nerc.ukri.org](http://www.nerc.ukri.org)

Research England, UKRI  
[www.re.ukri.org](http://www.re.ukri.org)

Science and Technology Facilities Council, UKRI  
[www.stfc.ukri.org](http://www.stfc.ukri.org)

**Companies, Research Organisations and Academies:**

Association of Innovation, Research and Technology Organisations (AIRTO)  
[www.airto.co.uk](http://www.airto.co.uk)

AstraZeneca  
[www.astrazeneca.co.uk](http://www.astrazeneca.co.uk)

BAE Systems  
[www.baesystems.com/en/home](http://www.baesystems.com/en/home)

Behavioural Insights - Dr David Halpern  
[www.behaviouralinsights.co.uk/people/dr-david-halpern](http://www.behaviouralinsights.co.uk/people/dr-david-halpern)

Benevolent AI  
[www.benevolent.ai](http://www.benevolent.ai)

BP  
[www.bp.com](http://www.bp.com)

British Academy  
[www.britac.ac.uk](http://www.britac.ac.uk)

BRE Group  
[www.bregroup.com](http://www.bregroup.com)

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Catapult Programme  
[www.catapult.org.uk](http://www.catapult.org.uk)

Department for Business, Energy and Industrial Strategy  
[www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy](http://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy)

European Research - Horizon 2020  
[www.ec.europa.eu/programmes/horizon2020/en](http://www.ec.europa.eu/programmes/horizon2020/en)

Global Innovation Index  
[www.wipo.int/edocs/pubdocs/en/wipo\\_pub\\_gii\\_2017.pdf](http://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2017.pdf)

Government Office for Science  
[www.gov.uk/government/organisations/government-office-for-science](http://www.gov.uk/government/organisations/government-office-for-science)

GSK  
[www.gsk.com](http://www.gsk.com)

Home Office  
[www.gov.uk/government/organisations/home-office](http://www.gov.uk/government/organisations/home-office)

Knowledge Transfer Network  
[www.ktn-uk.co.uk](http://www.ktn-uk.co.uk)

Learned Society of Wales  
[www.learnedsociety.wales](http://www.learnedsociety.wales)

Lloyd's of London  
[www.lloyds.com](http://www.lloyds.com)

Lloyd's Register Foundation  
[www.lrfoundation.org.uk](http://www.lrfoundation.org.uk)

London Chamber of Commerce  
[www.londonchamber.co.uk](http://www.londonchamber.co.uk)

London Stock Exchange Group  
[www.lseg.com](http://www.lseg.com)

National Physical Laboratory (NPL)  
[www.npl.co.uk](http://www.npl.co.uk)

Nesta  
[www.nesta.org.uk](http://www.nesta.org.uk)

Office for National Statistics  
[www.ons.gov.uk](http://www.ons.gov.uk)

Pfizer  
[www.pfizer.com](http://www.pfizer.com)

Rolls-Royce  
[www.rolls-royce.com](http://www.rolls-royce.com)

The Royal Society of Chemistry  
[www.rsc.org](http://www.rsc.org)

Shell  
[www.shell.co.uk](http://www.shell.co.uk)

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Royal Academy of Engineering  
[www.raeng.org.uk](http://www.raeng.org.uk)

The Royal Society  
[www.royalsociety.org](http://www.royalsociety.org)

The Royal Society of Edinburgh  
[www.rse.org.uk](http://www.rse.org.uk)  
Russell Group  
[www.russellgroup.ac.uk](http://www.russellgroup.ac.uk)

The Alan Turing Institute  
[www.turing.ac.uk](http://www.turing.ac.uk)

UK Innovation & Science Seed Fund  
[www.ukinnovationscienceseedfund.co.uk](http://www.ukinnovationscienceseedfund.co.uk)

UK Statistics Authority  
[www.statisticsauthority.gov.uk](http://www.statisticsauthority.gov.uk)

University Alliance  
[www.unialliance.ac.uk](http://www.unialliance.ac.uk)

Wellcome Trust  
[www.wellcome.ac.uk](http://www.wellcome.ac.uk)

Willis Towers Watson  
[www.willistowerswatson.com/en](http://www.willistowerswatson.com/en)

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[www.cam.ac.uk](http://www.cam.ac.uk)

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[www.ed.ac.uk](http://www.ed.ac.uk)

University of Glasgow  
[www.gla.ac.uk](http://www.gla.ac.uk)

Imperial College London  
[www.imperial.ac.uk](http://www.imperial.ac.uk)

University of Oxford  
[www.ox.ac.uk](http://www.ox.ac.uk)

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