

Speech: UKRI Research and Innovation Infrastructure Roadmap Launch

Thank you to the Royal Society for hosting us today. Speaking as a new science minister, there is nothing that reminds you of Britain's awe-inspiring history of scientific excellence like a visit to the Royal Society.

The photos of generations of distinguished fellows evoke the UK's great tradition of research. The current fellowship is a list of global stars in discipline after discipline – a reminder that British science has a remarkable present as well as a great past. The sheaf of stats that you receive as a new minister bears this out – and I have rapidly learnt about exotic data like Field-Weighted Citation Indices – the moral of which is that when it comes to science, Britain continues to punch above its weight.

I've also learnt that our research strengths go beyond the scientific remit of the Royal Society to fields of arts, humanities and social sciences. If the watchword of principle of 21st Century innovation is STEAM – Science, Technology, Engineering, Arts and Maths – then the British research base is well positioned for success. After ten days in the job, it's hard to think that if you are going to be a science and research minister anywhere, Britain is the place.

But I'm also well aware that when it comes to research and innovation, the UK faces its fair share of challenges.

Already I have heard some clear messages from you and your scientific colleagues about areas that need more work.

- Importance of achieving a good result for science from Brexit, both in terms of European research funding and in terms of the welcome the UK offers to the world's best minds.
- Despite concerted efforts over a decade to improve business-university links, business R&D remains disappointingly low by international standards. (Some say we lack the critical mass of institutions that sit between business and research that are more common in countries like Germany or Korea.)
- A strong suspicion that we are not making the most of the country's potential when it comes to research talent. Whilst the total number of women professors are growing, HESA stats shows that in one third of universities the proportion of women professors has declined in the last five years. There are more black cleaners and porters than lecturers and professors.

And of course, at a global scale there are a different set of challenges, ones crying out for solutions grounded in technology, science and research: from climate change to how to deploy automation and AI to antimicrobial resistance.

To shape the future, we need a plan

I am of the view that if you want to shape the future, you need to do more than worry. You need to act, and for that you need a plan.

Part of having a plan involves having goals. This is why in the government's Industrial Strategy has set out a number of grand challenges: areas of societal, global importance where we believe technology and innovation can help us solve some of the most pressing problems facing the world.

It is also why we have set out a commitment to encourage investment in R&D. In other fields, the government has set clear targets as a sign of our aspiration. We show our commitment to our country's security by spending the NATO target 2% of GDP on defence. We show our commitment to our international obligations by spending the UN aid target of 0.7% of GDP. And now, in the Industrial Strategy White Paper, we are signaling our commitment to the future of our country and the world through our goal to increase UK R&D spending to 2.4%. This is an ambitious target: an increase of two-thirds. We have begun this process with the biggest increase in public R&D funding for 40 year, ensuring that public spending on R&D will rise in every year of this parliament to around £12.5 billion in in 2021/22.

As part of this investment in R&D, I'm pleased to announce – in addition to the launch of the Infrastructure Roadmap – the allocation of £70m through the 'Accelerating innovative healthcare and medicines' challenge of the Industrial Strategy Challenge Fund. This investment from government and industry will speed up patient access to new medicines and improve treatments for our ageing society. It will also support new virtual reality projects to help patient recovery. This will see three new Advanced Therapies Treatment Centers opened across the UK in Birmingham, Newcastle and Manchester.

We will be announcing further details of the second wave of challenges within the Industrial Strategy Challenge Fund shortly. This new funding will support challenges to allow us to:

- Prosper from the energy revolution
- Transform construction and food production
- Use data improve early diagnosis of disease
- Develop the technologies and services to support a society that ages healthy

- Use technology to create the audiences of the future for our creative industries
- Pioneer technologies in Next generation services and quantum technologies

And we will continue this new approach to mission-driven innovation by launching an expression of interest for Wave 3 of the ISCF.

Openness the world

To tackle these challenges effectively, we will need to work together with the best and brightest from around the world. Science and innovation are global enterprises. Bill Joy, the founder of Sun Microsystems, famously said “no matter who you are, the smartest people mostly work for someone else”; this is true for companies, but it is also true for countries. British science is at its best when we collaborate deeply with other countries, and welcome researchers to the UK.

To this end, we are working to deepen our research and innovation ties to other countries – such as the historic agreements we have recently signed with the US and China.

It also means securing the best possible relationship with the EU after Brexit. I am deeply conscious of the importance of Horizon 2020 and future framework programmes to research in the UK and the huge benefits we have reaped from participation in programmes like the ERC. We are working hard to secure a good research and innovation agreement with the EU after Brexit, and I can confirm that I have already had cordial discussions with Commissioner Carlos Moedas, and will be sitting down with him and other EU science ministers in Bulgaria next week, as my first foreign trip in the job.

UKRI and its strategic role

Having goals is a necessary part of having a plan, but not a sufficient one. You also need to capacity to carry out the plan, and to work out how you are doing. This is where UK Research & Innovation comes into the picture.

The establishment of UKRI was, from the point of view of science and research, the central part of the reforms set out in the Higher Education and Research Act. (At this point, I must acknowledge my great debt to my predecessor in this role Jo Johnson, for stewarding this major reform through Parliament, and to discussing it with so many of you here.)

UKRI matters because it can fund research and innovation in a mindful, considered and strategic way. Because it brings together the seven Research Councils, it will be better able to bridge the gap between the sciences, social science, and arts & humanities. Because it connects Innovate UK together with the Research Councils, it will improve the links between research and innovation. The first two waves of the Industrial Strategy

Challenge Fund, which is financing R&D in fields with important business applications, suggest that these links are already bearing fruit.

And by linking Research England to the research councils, it will enable us to carefully consider and better align our funding for specific research projects with the quality related research funding stream. Research England's work with the other UK funding bodies and the Office for Students will help UKRI in its consideration of the sustainability of the research base, a joined up skills and talent pipeline and an approach to innovation which captures the strengths of each of the devolved nations.

Just as important will be UKRI's ability to make strategic funding choices. Sir John Kingman (who I was delighted to see appointed as substantive UKRI chair last week) argued that UKRI should aspire to provide a "strategic brain" for research funding, looking right across the UK landscape. This strategic brain would complement the existing processes of the research councils and Innovate UK, and would help ensure that funding opportunities were not overlooked because they fall afoul of disciplinary boundaries, and that important emerging areas are prioritized.

The infrastructure roadmap – an example of what UKRI can do

A good example of the kind of prioritization that UKRI makes possible is the Infrastructure Roadmap that we are here to initiate today, an initiative where the UK will want and need to play on a global scale. As you know far better than I do, good science and effective innovation depend not just on brainpower and funding but on the right infrastructure.

Some of this is big, imposing physical kit: from linear accelerators and data centers to research stations, Met Office super-computers and, of course, Boaty McBoatface. Some of it is rather more intangible: such as carefully-collected longitudinal data sets or institutions like the Catapult centers, which are as much about networks and know-how as they are about physical buildings.

The roadmap will survey the state of the UK's research and innovation infrastructure, and use this mapping to inform the prioritisation of future investments.

This matters. If we let our infrastructure decay, research and innovation suffer. In his superb book, "England and the Aeroplane", historian of science David Edgerton describes how a lack of appropriate wind tunnels and testbed was one of the factors that caused Britain's aerospace industry, which was at the cutting edge of technology at the end of WW2, to fall behind that of the US. But if we can invest strategically in new infrastructure, we can open up new vistas for research, especially as digital technologies are changing the way research works in discipline after discipline. An example of this is the Structural Genomics Consortium, based at the University of Oxford, is a great example of how open science has been used to spur on innovation in drug discovery. Currently funded by 13 public and private organisations, the

consortium takes an open and innovative approach to intellectual property, which allows the industrial partners to collaborate and maximise the impact of the research

I hope that the Infrastructure Roadmap will be a sign of things to come from UKRI. There is huge potential for UKRI to build on the promising work that has been done by the Research Councils, Innovate UK and HEFCE in recent years to improve how we use data to understand the research base, to investigate promising areas, and to record the impact both of research itself and of the ways we fund research. There is also a great opportunity for UKRI to improve how we communicate research and its benefits to the general public, who after all pay for what we do and have a right to know about it – especially if we want to win popular support for greater public funding of research.

This work will be led by Professor Mark Thomson, the new Executive Chair of the Science and Technology Facilities Council. I am delighted to announce Professor Thomson's appointment today; he will be a great asset to STFC, reinforcing the UK's reputation as being world-beating in this exciting and ever-evolving area of science.

Mark will take over from STFC Chief Executive Brian Bowsher at the beginning of April when UKRI comes into being. I'm sure we would all like to take the opportunity to thank Brian for his sterling work at the helm of STFC over the last year and congratulate him for his OBE in the New Year Honours.

Sir Mark and I will be speaking more about the future of UKRI in the weeks and months leading up to its formal launch on 1 April. I am hopeful that it will live up to its promise of being the most exciting research funder in the world.

Encouraging optimism, and the limits of planning

Having spoken about the importance of having a plan, I'd like to conclude with a few words of humility. One thing I know is that plans that are too rigid generally don't survive contact with reality.

The best plans are dynamic, not dictatorial, and allow room for chance and for change. The same is true when it comes to the government's vision for research and innovation.

To encourage innovation, it is not enough to increase investment and to set challenges. We also need to provide the freedom that innovators and optimists need to thrive. In the world of business, this means creating the conditions for new entrants to and competing with old established firms. It means improving access to finance for the best new businesses to scale up.

It means making sure that our regulators and the rules they make are tech-savvy, and responsive to new ways of doing things. We should draw on examples like the Human Fertilisation and Embryology Authority, where informed, proportionate regulation, devised with public consent, created the conditions where research and investment could flourish, safe from both over-zealous legislators and public backlash.

And it also means ensuring there is space for serendipity in research. As the sociologist Robert Merton pointed out over sixty years ago, major breakthroughs arise unexpectedly or obliquely. No doubt many of you will recognize this from your own research. Shatterproof glass, penicillin, cancer chemotherapy, and vulcanized rubber are just a few examples of how the most important discoveries are sometimes the most unexpected. Alongside challenge-led funding pots like the Industrial Strategy Challenge Fund, we believe it is essential to continue to fund curiosity-driven research generously. And we will continue to support a diverse funding system, which values the role of the UK's impressive research charities, and recognizes the importance of QR funding in allowing institutions to invest in their own ideas and capabilities.

Providing freedom and encouragement for innovators and independent thinkers is essential for the future of research and for the future of the country.

Conclusion

Let me conclude by congratulating UKRI beginning their infrastructure roadmap.

Rising to Global expectations – It will be welcomed in much, if not all, of the UK's S&R community; but there are global expectations, and we are being watched carefully to see how this great new organisation works – just what will be different for those wanting to work with UK researchers and innovators that will ensure the UK is hugely attractive to others?

As we celebrate rising R&D spend from HMG, how will UKRI balance the need to clear accountability (which suggests plenty of process and rules) with creating the space I have just referred to for creativity and invention?

Launching in April 2018, UKRI will be critical – ensuring the UK maintains its world leading position in research and innovation. It will catalyse a more strategic, agile and interdisciplinary approach to addressing global challenges and play a key role in helping the UK strengthen its competitiveness as part of the new Industrial Strategy.

If you want to shape the future, it helps to have a plan. UKRI and its infrastructure roadmap is part of that plan.