

6 August 2020

How can we best increase knowledge and understanding through research, including by achieving bigger breakthroughs?

Increasing the public research budget to £22bn by 2024/25, a hugely welcome commitment, provides the UK Government, UKRI and others with the opportunity to be more creative in how they support research and innovation. Far from the turn of the 2010s, where a ring-fenced budget left the Government with little room to manoeuvre, the UK can afford to be bold while addressing some issues around public research investment.

However, the Covid-19 pandemic has put serious pressure on the ability of the sector to continue to fund and facilitate research. This not only brings unprecedented questions to the way in which research-intensive organisations need to be supported in the short and medium term, but also poses questions about how the UK public sector can most effectively and sustainably invest in research to create the best outcomes for the citizens of this country.

Balance of R&D investment

For many years the UK has had a relatively stable system of funding and evaluation for R&D. However, significant increases in funding are likely to change both the balance between and the effectiveness of the different funding streams. The past balance between different funding streams or types doesn't necessarily set out a blue print for what future balance should be. Rather, a clear vision of the purpose of increasing the R&D intensity of the UK is necessary to make decisions on the desirable balance of spending and interventions.

Similarly, evaluating the effectiveness of research and innovation spending requires a clear view of the purpose and outcomes against which success will be measured and it isn't yet clear what these are. That said, there are some principles and patterns of investment on which the UK's strength in research and innovation is built, and there are lessons to learn from the experience of those in different parts of the research and innovation landscape on what they need to thrive in the UK.

It is important that weight is given to two factors when considering the balance of funding. The first is the dual support system. Over time, Quality-related (QR) funding has reduced as a proportion of higher education institutions income from a third in 2006/7 to a quarter in 2016/17. This has resulted in a change to the types of research funded and the relative level of strategic flexibility HEIs have in making research funding allocation decisions. At a time when the Government is investing heavily in the R&D, support must be provided for the research that drives discovery, through QR, to maintain the balanced funding principle.

The second factor is diversity of funding streams. Diversity brings resilience and spurs innovation. The UK currently has strength in breadth, which is widely regarded as an asset. It must continue to foster a breadth and diversity of funders, investment instruments, settings for research & innovation, disciplinary strengths and people. This will give the UK the potential to lead the world in new research areas, work across boundaries and create new markets.

Increasing opportunities for research and innovation

As with QR funding for universities, funding opportunities that allow greater flexibility can allow organisations to move with greater agility to address challenges and opportunities. We were pleased to see the Government commit to increase the level of tax credits for R&D and also look to expand

the types of activity that are eligible for tax relief. Our community of members have told us that tax credits are of vital importance for their R&D activities¹ and the receipts of the tax relief allow for flexibility within innovative businesses.

We are pleased to see that the roadmap outlines some ideas of new ways to fund research, such as investigator-led or teams-based funding. Alongside ‘moonshots’ and the creation of an ARPA-style funding agency, the UK has the opportunity to diversify the types of research and innovation it supports. The Conservative manifesto states that the agency would fund “high-risk, high-payoff research”².

There is an important distinction to be made between funding ‘riskier’ research and funding bold and adventurous research while minimizing unnecessary risk such as misuse of funding³. An effective audit mechanism will be required to show to HM Treasury, and the public, that funds are being used well. The successes of the US DARPA owes partly to the longevity of funding and support. It is incredibly important that for any new ‘moonshot’ programmes or investments in a new research agency are not a flash in the pan. This means that these funding mechanisms will need to be robustly designed in partnership between Government and the research sector.

How can we maximise the economic, environmental and societal impact of research through effective application of new knowledge?

Scaling up businesses

The UK has been successful in creating spin-outs from universities based on the outcomes of research. However, it has had limited success in scaling up these businesses into large, research intensive companies. The Government should continue to take forward the recommendations of the Patient Capital Review⁴, commissioned by the Treasury, to unlock investment from pension funds. Access to this investment would help businesses in the scale-up phase and could mean that innovative UK start-ups are not lost to overseas take-overs or relocations.

The Government should consider offering non-commercial loans to scaling businesses looking to purchase a building or secure a lease, secured against fixtures and fittings. This would support scaling of small businesses in the UK. The Government could also create a competitive process to provide matched funding for new buildings that provide flexible laboratory workspace for starting and scaling companies. This must be around existing research strength and with support for bids from local or regional government to ensure wider infrastructure supports the investment.

Regulation

Embracing innovation in new areas of regulation will be essential to secure first mover advantage in new and emerging sectors and technologies. If UK regulation is not able to keep pace, or provide the opportunity for companies to develop, test and roll out innovation in the UK environment, there is a risk that these activities and subsequent market advantage, jobs and benefit will be located elsewhere. The Government should embed the innovation principle alongside the precautionary principle in their approach to regulation to support innovation and sustainability. This means

¹ <https://www.sciencecampaign.org.uk/news-media/case-comment/case-member-hm-treasury-roundtable-r-d-investment.html>

² [Conservative Party Manifesto](#), 2019

³ House of Lords Select Committee on Science and Technology: [Corrected oral evidence: Life Sciences and the Industrial Strategy, Q67](#); Tuesday 31 October 2017

⁴ <https://www.gov.uk/government/publications/patient-capital-review>

assessing the impact of policy and regulatory decisions on research and innovation. This will require proactive adoption, coordination, communication and training in departments.

How can we encourage innovation and ensure it is used to greatest effect, not just in our cutting-edge industries, but right across the economy and throughout our public services?

Procurement

Procurement accounts for a third of public expenditure at £284bn a year⁵. It is a significant lever government holds at national and local levels to contribute to increased research intensity and greater innovation. It brings benefits to public service delivery, public budgets and the private sector innovation environment. In the Barber review, 'Delivering better outcomes for citizens: practical steps for unlocking public value' Sir Michael Barber said that "increasing productivity also requires disruptive innovation: radically new ways of doing things that deliver much better outcomes for reduced costs."⁶

Currently Innovate UK supports government departments on procurement for innovation. This function is crucial but is not central to Innovate UK's role. To build on and expand Innovate UK's role the Cabinet Office should take on the role of harnessing government procurement to support innovation for the benefit of UK economy, public service delivery and long-term cost effectiveness. This would include taking on the role of running and supporting other departments in the SBRI process as well as working with CSAs and Heads of Profession to train and equip relevant teams in departments on procurement that supports innovation.

Accessing Innovation Support

Action is needed to make it easier for businesses to find and apply for relevant innovation support and funding. CaSE members, including small fast-growing companies⁷, large prime companies⁸ and other investors or funders of innovation have said that there is a lot of good innovation support, infrastructure and incentives in the UK, but that these are not effectively showcased or communicated, either domestically or internationally. There are a plethora of government websites and portals for different types of support, which means the whole is less than the sum of its parts⁹.

The Government should create a digital 'shop window' that showcases in one place the many different incentives, funding, and initiatives for UK research and innovation support, alongside a clear narrative of the UK offer. This one link could be easily shared to ensure so, for example, all business incubators have the link, that universities include it on their business facing sites, and that it is included on all relevant government webpages and communications. It would be a crucial first step towards the ideal of a 'one stop shop' 'no wrong door' offer for entrepreneurs and businesses looking to start or grow R&D activity in the UK.

R&D across Government

⁵ Government Procurement: the scale and nature of contracting in the UK, Institute for Government, 2018

⁶ Delivering better outcomes for citizens: practical steps for unlocking public value, Michael Barber for HMT, 2017

⁷ CaSE roundtable with BEIS: R&D investment, Aug 2018

⁸ CaSE member & HM Treasury roundtable: R&D investment, May 2018

⁹ What Government support is available for research and innovation? CaSE website, Sept 2018

Departmental R&D budgets are responsible for up to 30% of public expenditure on R&D¹⁰ thus clearly have a crucial role in delivering the Government target to increase the UK's research intensity. There is great potential for R&D investment to directly benefit the delivery of public services by government, supporting more effective and efficient policymaking, and in assessing policy outcomes against objectives.

Departmental R&D budgets can be used to mitigate risk and use resources more efficiently, for example by identifying policy interventions that reduce the severity of road traffic incidents in cities or help prevent and respond to adverse weather conditions and disease outbreaks.

There is an important role for departmental Chief Scientists in decision making about their departments R&D budget and while good progress has been made on publication of Areas of Research Interest for each department more can be done to make the most of these across all departments. We strongly support the aim within the roadmap to continue to implement the recommendations of the Science Capability Review.

How can we attract, retain and develop talented and diverse people to R&D roles? How can we make R&D for everyone?

The roadmap identifies some of the issues regarding research careers in the UK. We are pleased to see that the Government has committed to developing an R&D People and Culture strategy and will watch the development of the Office for Talent closely. It is important that there is cross-Government buy-in for these efforts. Effectively championing careers in research and innovation with young people will require leadership from DfE. The Office for Talent will need to gain prominence across departments and retain significant influence with the Home Office to successfully impact immigration policy.

Careers in research

Diversity in the workplace has been shown to enhance productivity¹¹ and this is no different for the research sector. Diversity brings fresh perspectives, new ideas and collaborative opportunities that enhance research and innovation. The UK's endeavours to increase research intensity will require a significant increase in the workforce, which should be able to provide opportunities for all. Problems posed by new immigration policy, which we will outline below, means it is likely the UK will have to rely more heavily on a domestically-trained workforce.

In the short-term, this means increasing retention of individuals currently working in research and innovation sectors. Job flexibility is a particular barrier to retention of women in STEM. Amongst academic staff, the gender gap between part-time working is larger in STEM (32% of women and 19% of men) than non-STEM subjects (48% of women and 38% of men)¹². Financial barriers, particularly the cost of childcare, are also cited as most important in preventing return to the scientific workforce (52% of respondents)¹³.

In the long-term, more needs to be done to highlight the breadth of careers available to people within research and innovation. This begins with increasing the importance of careers advice to

¹⁰ <http://www.sciencecampaign.org.uk/resource/casesubmissionbalanceandeffectivenessofr-d-s-tcommitteeinquirysept18.html>

¹¹ McKinsey – Diversity Matters, 2015

¹² CaSE analysis of Equality Challenge Unit statistical report, 2011 and 2017

¹³ Prospect - Survey findings: Women in STEM - are you in or out?, 2015

young people in schools and colleges. Diversity and inclusion should be embedded throughout a joined-up national careers strategy and do more to encourage flexible working practices and career pathways.

Under-representation in STEM is perpetuated by a lack of knowledge of career pathways. 41% of school children with a parent working in STEM felt encouraged to study STEM subjects, compared to 26% of those whose parents worked in a non-STEM related field, whilst half of GCSE students think the only way to attain a STEM job is through a university degree¹⁴. Only 0.5% of schools achieve all 8 Gatsby Good Careers Guidance benchmarks for all pupils, with provision of careers education 1.3x higher for boys vs girls and 1.5x higher for students with high vs low 'cultural capital'¹⁵.

Immigration policy

There have been many welcome changes to immigration policy in recent years to expand the opportunities for non-EEA nationals to come to the UK. The roadmap confirms the commitment to extend post-study work visas for PhD students and the reintroduction of two year post-study work visas for international students. This means the UK can offer a far more globally competitive route to full time employment. The introduction of the Global Talent Visa is also a positive step by the Government.

However, as a result of the end of free movement for EEA citizens, the UK must do more to consider its offer to a globally mobile workforce. No comprehensive analysis has been carried out to assess the affects that removing freedom of movement will have on the research and innovation labour market, thus has not been factored in to designing a new immigration system. The UK will now find itself competing against other European countries for talented individuals on an uneven playing field.

Amongst other world-leading scientific nations, the cost of moving to the UK as an individual is by far the highest. These costs increase further if an individual would like to bring family members with them. Costs to individuals and employers in the UK are on average, 540% higher than other leading scientific nations¹⁶. When considering a family of five, total costs would reach £21,299 to obtain a five year visa. By comparison, the same criteria would cost £1,204 to enter Germany, £1,668 to enter Canada and £5,767 to enter the United States¹⁷. It is also worth noting that these costs will increase to £26,924 by October 2020 in the UK due to increases to the Immigration Health Surcharge.

Working in the UK's research and innovation sector is clearly an attractive proposition for individuals from across the globe. The UK must, however, do more to understand how such costs will change the patterns of inward mobility to support the research and innovation sector. This will particularly be the case for EEA citizens who can relocate without the need or cost of obtaining a visa across the rest of the continent. Businesses, universities and others are not likely to cover visa costs beyond their own legal responsibilities and even less likely for those earlier in their careers. Without consideration of these issues, the UK could find it incredibly difficult to attract the number of individuals required to grow and enhance research and innovation.

How should we ensure that R&D plays its fullest role in levelling up all over the UK?

¹⁴ Adecco Group – The Gender Agenda: STEMming the Gap, 2015

¹⁵ [ASPIRES 2 Project Spotlight: Year 11 Students' Views of Careers Education and Work Experience](#), 2016

¹⁶ <https://royalsociety.org/-/media/policy/Publications/2019/international-visa-systems-explainer-july-2019.pdf>

¹⁷ Fragomen analysis of visa costs, 2020.

The following recommendations are taken from the CaSE report “The Power of Place”. In the report, we set out how to maximise the local economic impacts of R&D investment across the nations and regions of the UK. The report is based on views gathered from CaSE members and stakeholders through an extensive consultation exercise across the UK, conducted over the last 18 months.

Building on excellence and developing a brand

Investment should be focussed on R&D excellence that already exists – even if it is small and nascent. Investment is likely to give a greater return when it builds on existing excellence and it is difficult to re-create the conditions that give rise to excellence just by spending money – it is a process that has often happened organically over many years.

Improve the branding of a place to highlight its strengths. Places should clarify their distinctive strengths and sectors in order to present a pitch for national and overseas investment. This should be coupled with greater local and national championing to attract UK and global investment.

Local and regional branding should, where possible, be mapped on to areas where there is already a sense of local or regional identity and the appropriate local bodies exist in order to take advantage of that brand and any investment that comes with it.

The importance of local leadership

There needs to be greater involvement of leaders from local authorities, combined authorities and LEAs in regional R&D conversations. Those examples we have found where regions have been successful have often been driven by strong leadership by a small number of committed individuals. However, this works both ways and it is incumbent on leaders in the research community, both in businesses and universities to build a strong narrative to show local civic leaders what R&D can do for the local growth agenda.

Combined authorities and other local leaders should assess what levers they currently have to design and implement tailored regional interventions and should consider making the case to Government for more levers if needed.

Central and local government should work together to improve national coordination between local and national R&D priorities. This will help maintain the breadth of the UK research base by ensuring that regions do not all focus on the same areas or disciplines.

Improving infrastructure and housing will help equip places for increased research intensity. Making places more attractive to live will also help to retain skilled people. It is important that decisions made about regional R&D are linked up with other regional development decisions across local and national Government. UKRI has a role to play in encouraging all parts of Government to think about these issues holistically.

Supporting small business

There needs to be greater support from local and national government to enable SMEs to form collaborations with universities and others and secure R&D investment. This support could come from local or national government and universities.

EU structural funds currently support a large number of SME collaborations and help build research capacity across the country. Careful consideration needs to be given to how domestic schemes such as the Shared Prosperity Fund replace this support.

How should we strengthen our research infrastructure and institutions in support of our vision?

Mitigating Covid impact

The UK science base is a rich ecosystem of research and innovation by organisations across the private, public and third sectors. These include multinational R&D-led corporates, scale-ups and start-ups, early-stage investors, science parks, research institutes, learned societies, universities, further education colleges, publishers, research charities, trade unions and public science centres. Partnerships between these organisations have flourished in recent years, particularly in pursuit of the economic and societal impact of research.

However, these connections are fragile. Current financial pressures as a result of the Covid pandemic mean that partners from public, private and third sectors will experience ‘pain and recovery’ at different times, making it even more difficult to participate in collaborations. Some of the UK’s strategic R&D assets take this multi-partner form and could be subject to such fragility. While the support package announced for research was welcome, the Government should continue to consider the health of the whole research base in the implementation of any policies resulting from the roadmap.

Importance of universities

Universities play an important role in the UK’s research ecosystem and will be vital to achieving increased research intensity. They have a central role in bringing together industry and others to create local partnerships that drive cutting-edge research in world class facilities. The UK has just 4% of the world’s researchers but they generate 15% of the most highly-cited papers, used most frequently by other researchers¹⁸.

Due to the ongoing pandemic, one issue that has come under renewed focus is the ‘research deficit’ across UK universities. This is the shortfall in funding for research, where the university has to find additional funding from across the institution to make research projects viable. UKRI commit to providing 80% of the Full Economic Cost (FEC) of their research grants¹⁹, but in 2017/18 this figure averaged 72%²⁰ for English and Northern Irish universities. This means universities are required to work increasingly hard to find funding to make these research projects economically. This deficit in English HEIs has grown from £1.8bn in 2010/11 to £3.7bn in 2017/18²¹.

Universities will often partner with other research organisations, whether that be private enterprise or research charities to find this additional funding. The current economic environment, however, has seen research charities face incredibly significant drops in revenue and undertake aggressive scaling-down of research activities²². Research is often cross-subsidised by student fees, particularly international students, a situation that has also been highlighted as unsustainable during the current crisis.

While the increased envelope for publicly-funded research will allow UKRI to run more programmes and fund more research, paying these grants at the current proportion of FEC will only serve to increase the research deficit. All UKRI-research should not necessarily be funded at 100% FEC, but this deficit must be taken seriously. The Government should consider increasing the amount of un-

¹⁸ <https://www.elsevier.com/connect/report-compares-uks-research-performance-with-key-nations>

¹⁹ <https://www.ukri.org/files/legacy/documents/fecfaq-pdf/>

²⁰ https://www.ucl.ac.uk/research/sites/research/files/supporting_uk_research_nov_2019.pdf

²¹ Ibid

²² <https://www.amrc.org.uk/covid-19-the-risk-to-amrc-charities>

hypothecated Quality-Related funding to provide universities with larger settlements to enable institutions to meet matched funding requirements.

Finding a solution to addressing the research deficit in universities is key to the long-term sustainability of research funding in the UK. The implementation of any of the recommendations of the review into post-18 education (the Augar Review) recommendations related to the funding of teaching in universities may also have an impact on research, which the Government should assess and be aware of. Cross-subsidy of research from teaching budgets is common²³, and shortfalls in funds for teaching provision would very likely affect the amount of money available for research.

How should we most effectively and safely collaborate with partners and networks around the globe?

It is welcome that the roadmap restates the Governments desire to associate to Horizon Europe. The EU and UK have been discussing UK participation in union programmes, including Horizon Europe, as part of the negotiations on a future EU-UK relationship. It is encouraging that both sides have committed to the principle of UK participation in their mandates, recognising that collaboration between the UK and the EU strengthens our ability to tackle shared challenges, such as cancer and climate change.

It is vital that this commitment now translates quickly into an agreement on the terms of participation. Horizon Europe association should be a core part of the future relationship between the EU and the UK for research, underpinning valuable scientific partnerships that have been built up over many years. Horizon Europe presents a key opportunity for EU and UK research communities, and agreement on association can be reached through strategic, sensible and pragmatic compromise. With enough will on both sides it should be possible to reach an agreement in the time available. CaSE, along with over 100 other UK and Europeans organisations and individuals, has signed a statement from the Wellcome Trust setting out how a compromise in the negotiations could be reached²⁴.

There are also other funds that should be reviewed for effectiveness that build international collaborations. UKRI's Fund for International Collaboration is still relatively small and should be assessed for the potential for expansion. The research funded by the UK's Overseas Development Assistance fund, through programmes such as Newton, should also be reviewed given the UK's new position outside the EU.

How can we harness excitement about this vision, listen to a wider range of voices to ensure R&D is delivering for society, and inspire a whole new generation of scientists, researchers, technicians, engineers, and innovators?

CaSE and the Wellcome Trust are working together to look at how best to make the case to for sustained R&D investment over the next decade. As a first step we commissioned policy specialists [Public First](#) to assist us. We published a report on advocacy models for the sector in July 2020²⁵.

²³ <https://www.hepi.ac.uk/wp-content/uploads/2017/11/HEPI-How-much-is-too-much-Report-100-FINAL.pdf>

²⁴ <https://www.sciencecampaign.org.uk/news-media/case-comment/securing-research-in-the-eu-uk-future-relationship.html>

²⁵ <https://www.sciencecampaign.org.uk/our-work/campaigns/the-r-d-decade-making-our-case-/case-wellcome-report-advocating-for-r-d-investment.html>

The Public First work included reviewing the existing literature on [what makes a successful campaign](#), [profiling other campaigns](#), identifying [key tools for campaigning](#), and [exploring the public's attitudes](#) to different types of advocacy. While public support for research is quite high, it is also quite shallow. It was clear that more needs to be done to explain how both the outcomes of research and the process of doing research have tangible impacts on people's lives. Public support and knowledge is highest for medical research – where there is already a greater understanding of how it can have an impact on people's lives, for example through new treatments for cancer.

About CaSE

The Campaign for Science and Engineering (CaSE) is the UK's leading independent advocate for science and engineering. Our mission is to ensure that the UK has the skills, funding and policies to enable science and engineering thrive. We represent over 115 scientific organisations including businesses, universities, professional bodies, and research charities as well as individual scientists and engineers. Collectively our members employ over 336,000 people in the UK, and our industry and charity members invest over £32bn a year globally in R&D. We are funded entirely by our members and receive no funding from government.