
Summary

- The science budget ring-fence has provided stability and confidence to the sector, and leveraged significant private funding. Although the UK continues to outperform international competitors a continued real-term decline in investment risks long-term damage.
- Departmental R&D spending has seen a downward trend over several decades, placing additional pressure on the science budget and reducing capacity for evidence-based policy, efficiency gains and an innovation culture within front-line departments.
- The Government should consider the risks of underinvestment in the sector, and strive to capitalise on the opportunities presented by the UK's world-leading and highly efficient research sector which is capable of delivering further economic, health, social and cultural benefits. For example investment in a wide range of disciplines including the medical sciences, social sciences, and bioengineering must be made if our health and welfare system is to be effective and affordable in the face of future challenges.
- The Government should set out a sustainable trajectory that aligns the UK with investment levels seen in key competitor countries, a goal which would require an approximate doubling of public expenditure to around 1% of GDP.
- If coupled with wider policy priorities which foster a positive research environment and safeguard the skills pipeline, these additional resources would support the research community's contribution to closing the UK's productivity gap.
- Government should recognise the role of public funding within the broad and balanced ecosystem, and support policies which help leverage further industry and charity investment.
- Available resources should be maximised through increased coordination and collaboration between funders and regional clusters. The medical research community has worked synergistically to identify and exploit opportunities for greater efficiency, supported by the convening activities of bodies such as the Office for Strategic Coordination and Health Research (OSCHR) and ourselves.

Introduction

The Academy of Medical Sciences promotes advances in medical science, and campaigns to ensure that these are translated into healthcare benefits for society. Our elected Fellowship includes the UK's foremost experts drawn from a broad and diverse range of research areas.

We welcome the opportunity to provide evidence to HM Treasury's 2015 Spending Review. Our submission highlights the value of the UK research base, and its role in driving innovation, growth and productivity across the wider economy. In financially constrained times, it is vital that the

Government supports and grows the sector, and works to ensure the UK is the best place to do research and innovation.

Our submission builds on our joint Academies statement, *Building a Stronger Future*, and has been informed on the expertise of our Fellows, from across the disciplines and sectors we represent.¹ It sets out three key areas which the Government should consider when deciding the future of the UK's research community. We would be pleased to provide further evidence if required.

1. Long-term investment

The Government is uniquely placed as a research funder to identify and implement a long-term vision for investment, providing the confidence and stability which leverages private and charitable spend. The UK currently lags behind international competitors on investment levels, and we risk losing our world-leading reputation unless the sector is placed on a sustainable path for growth.

The ring-fence

By protecting the ring fence around the science budget and maintaining it in cash terms in recent years, the Government has provided stability and reassurance to the sector. This commitment by the Government was, and remains, vital to inducing confidence among private and charitable investors. It created appreciable rewards even in the short-term, with an estimated £1.2bn of additional private investment leveraged by the protected science budget, which would have been lost if it had been cut in line with other departments in 2010.² As a further example, we have recently been allocated funding from the Science Budget for our activities that support evidence-based policy making, and have used this as a base to leverage a further 72% of additional funding from sources other than the Department for Business, Innovation and Skills.

However, the funding within this ring-fence has still seen a 6% real-terms decline since 2010/11. Whilst the community has actively pursued efficiency gains to maintain excellence, the capacity for further savings is rapidly diminishing and the sector risks breaching the lower limits of sustainability. Now, more than ever, the Government must provide stability and long-term vision, to attract globally-mobile private investors, retain talent, and engage the public who support research through their donations.

Departmental research budgets

Pressure on the science budget has also increased due to the downward trend of departmental research spending over the course of several decades.³ This erodes the capacity to generate tailored evidence for policy making, and fails to capitalise on the research potential of front-line experience within departments.

This trend represents false economy and undermines the Government's desire to embed a culture of innovation across public services. The burden is shifting onto the science budget, which is increasingly compensating for, rather than complementing, departmental spend. To safeguard long-term economic security, departments must be encouraged to see the value in research investment, and these budgets offered protection alongside the science budget. The potential of departmental spending is well demonstrated by the establishment of the National Institute for Health Research (NIHR) within the Department of Health. Its research funding evaluates the effectiveness and impact of new and existing healthcare treatments, finds new ways of preventing,

¹ Building a Stronger Future, joint National Academies statement, February 2015

² Economic Insight, What is the relationship between public and private investment in R&D? 2015

³ Building a Stronger Future, joint National Academies statement, February 2015

identifying and treating ill health, and makes this evidence widely available to ensure that decisions about health and social care are being informed by the best possible evidence. Valuing and protecting this departmental research spending within Whitehall is essential to embedding an innovation culture across all Departments.

Risks of cuts

As set out in our joint Academies statement, *Building a Stronger Future*, UK investment in research already lags significantly behind our global competitors.² This trajectory is set to worsen as many emerging players make research a national priority.

The consequences of funding cuts should be carefully considered. Short-term funding restrictions can lead to promising research areas and expertise being lost from the UK research base, even if funding is later reinstated. Sustained underinvestment can generate long-term problems, which may result in the UK becoming less attractive to global investors and talented individuals (see Box 1). If allowed to dissipate, the strong reputation of UK research may not be recoverable.

The recent Research Excellence Framework 2014 exercise demonstrated the breadth of impact stemming from UK research, and the Government should recognise that in a highly competitive and mobile world we will rapidly fall behind if we fail to invest and allow our strengths to erode.

Box 1 - 1980's research funding cuts

Cuts introduced in the early 1980's saw double-digit budget reductions for universities and funding councils, resulting in cancelled programme grants and the loss of thousands of science positions from 1980-1982.⁴

This period saw a decline in the UK's share of recent global research citations, falling from 10.9% in 1976 to 8.9% in 1982, against a background of rising shares for key competitors.⁵

This decline in international standing fed into concerns around researcher migration. A 1987 report from the Royal Society noted that although net researcher migration was low, there were concerning trends which indicated a disproportionate loss of world-class, senior scientists, particularly in emerging research areas.⁶

The data suggested that key individuals were being lost from the UK research base, increasingly on a permanent basis, driven by improved career opportunities and superior facilities abroad. These individuals were vital to anchoring entire research communities in the UK, and the report's authors worried their loss would have a 'debilitating effect' on UK research.

Opportunities

By setting a clear vision for the community, coupled with appropriate resource, the Government has an opportunity to lead by example and demonstrate a commitment to research as a source of growth and increased productivity.

It has been demonstrated that by leading from the front, public funding creates a 'crowding in' effect – driving up commitments from industry and charities. Recent BIS analysis suggests that

⁴ Universities Statistical Records, staff data 1972-1993

⁵ National Performance in Basic Research, Nature, 1986

⁶ The migration of Scientists To and From the UK, Royal Society, 1987

each £1 of public funding leverages an increase in private funding of £1.13-1.60, with 'medicine, dentistry and health' and 'engineering and technology' delivering the highest leveraging ratios.⁷

A world-class research base also supports the UK's success in attracting high levels of funding from overseas, including a disproportionate amount of EU research funding which is awarded on the basis of excellence. The Government should recognise that excellence nurtured through public funding is central to this UK success across international funding platforms, and to attracting direct foreign investment into UK research assets (see Box 2).

Box 2 – GE Healthcare

The diagnostics and life sciences firm Amersham Ltd developed from a publicly-funded national laboratory, which was privatised in 1982. After General Electric's (GE) purchase of Amersham Ltd in 2004, a decision was taken to relocate the GE Healthcare subsidiary to the UK.

This move marked the first ever GE subsidiary headquartered outside the US, demonstrating the value of a strong science base in not only attracting foreign investment in existing assets, but also the deployment of greater long-term investment centred in the UK.

The Government should embrace its role in driving an 'entrepreneurial State', in which public investment can help de-risk novel and promising research areas in order to pave the way for private investment. The evidence supporting this model has been widely addressed by Professor Mariana Mazzucato at the University of Sussex, who highlights the role of publicly-funded research in developing the fundamental technologies behind the iPhone.⁸ Her research details the public funds behind many of the technologies within the iPhone, including internet connectivity, GPS and touch-screen displays.

Alongside direct funding, the Government must also seek to create a research environment in which innovation can flourish. The impact of leveraging can be maximised through increased support for SME-University collaboration, ensuring the UK's industrial landscape has a broad base to the pyramid. We welcome the Dowling Review consideration of this area, and are confident that the adoption of its recommendations will greatly improve the quality and number of collaborations between academia and industry.

Actions in this area would help secure the future of 'big pharma' in the UK, the loss of which would significantly impact the UK's absorptive capacity and ability to forge intellectual collaborations between sectors. Academics should be supported by public funders to take on high-risk/high-return projects which can further support collaborative working with industry to deliver innovation.

A trajectory for growth

The Government should recognise that research represents a first-rate investment opportunity, and one which aligns with its stated goal to transition the UK towards a knowledge economy producing high-skilled and high-value jobs. The UK has a significant comparative advantage in research, particularly in key fields such as medical research, and this advantage should be recognised and protected as a national asset.

The UK continues to outperform international competitors, but we have highlighted the risk of continued flat cash settlements, including the reduction in the UK's ability to leverage additional

⁷ What is the relationship between public and private investment in R&D, April 2015, BIS

⁸ The Entrepreneurial State, Professor Mariana Mazzucato, 2015

sources of funding. An informed and long-term commitment should be made to reverse recent funding restrictions and raise research spending to a level closer to that of competitor nations.

This goal would place the UK on a trajectory to roughly double current public spending, to approximately 1% of GDP. The machinery required to efficiently and rapidly deliver this additional commitment is already in place in the form of the Research Councils and other research funding bodies. Making research a national priority and committing the necessary resources would be highly productive and represents one of the most cost-effective ways to boost growth.

Striking the balance

Any changes to funding should be developed in discussion with the sector and wider stakeholders including the public, to ensure that risks and opportunities are appropriately managed. The effects of any change should be monitored and this data used to shape the process, to ensure that funds are sustainably disbursed. This avoids the situation faced by the US National Institute of Health, which received a windfall from economic stimulus spending in 2008 but was forced to make a damaging retreat from commitments after funding wasn't maintained in subsequent settlements.⁹

Capital spending must also be coupled with appropriate resource allocation. The Government has set out an inflation-linked capital budget of £1.1bn per year, running through to 2021.¹⁰ Whilst this protects capital spending from short-term cuts, both existing and planned capital investments must be coupled with long-term resource commitments to ensure full benefit can be derived from them.

The UK must also consider the broader investment landscape, to ensure that infrastructure keeps pace with developing centres of excellence across the UK, and that restrictions are not placed on the pipeline of talent being produced in the UK or attracted to our research base from abroad. At a time when many competitor nations, especially emerging powers, are investing heavily in STEM graduates it is vital that the UK nurtures its pool of talent to support the growth of the future knowledge economy.

2. Growing productivity

The Government recently set out plans to tackle the UK's productivity gap in 'Fixing the Foundations: Creating a more prosperous nation'. This productivity plan highlighted the central role of research in tackling this challenge, an approach which is backed by evidence - 51% of productivity growth from 2000–2008 was due to innovation, and firms which consistently invest in R&D are 13% more productive than those which do not.^{11,12}

Evaluating impact

The research base is a key national asset for closing the productivity gap – its world-class performance generates high-value jobs, innovative solutions and export earnings for the nation, a level of impact reflected in the recent Research Excellence Framework assessment.

The community has already made significant efficiency savings, and is committed to evaluating the economic impact of health research.¹³ A series of reports commissioned within the sector have

⁹ <http://www.nature.com/news/the-nih-faces-up-to-hard-times-1.11458>

¹⁰ March Budget, HM Treasury, 2015

¹¹ Our plan for growth: science and innovation (evidence paper), HM Treasury and BIS, 2014

¹² Innovation and the UK knowledge economy, Cable, V, 2014

¹³ Universities: efficiency and value for money, UUK, 2013

demonstrated that each £1 invested in research into cancer, cardiovascular disease and mental health returns respectively 10p, 9p and 7p each year in perpetuity.¹⁴ A fourth study, focussing on musculoskeletal research, is due to report in 2016.

These figures are then further boosted by a wider 'spillover' return generated within the broader economy, with imminent analysis expected to show this at least doubles the direct return figures. Such significant rates of return demonstrate the high efficiency within the sector, further reinforcing it as a primary avenue to introducing greater productivity to the wider economy.

Haldane

It is vital that investment in research be directed appropriately to address societal challenges, including productivity. We recognise the value of the Haldane principle, and the importance of Research Council independence from government, with an investment agenda set by scientists.¹⁵ Whilst strategic vision from Government is both warranted and useful, this should develop from ongoing discussion with the sector and wider stakeholders including the public, and provide long-term and flexible goals within which the Research Councils can deliver.

Greater investment does not necessarily lead to greater productivity, as seen in the UK during the 1960's. The investment strategy during the post-war period has been described as the 'misallocation model', with world-leading levels of research funding being misallocated towards prestige projects.¹⁶ The lack of agility within this model meant that this commitment of resource did not create the economic growth or productivity boost expected, reinforcing the need to insulate direct allocation from short-term political pressures.

In contrast, the current Research Council mechanism offers an existing, proven and independent framework for the distribution of funding based on excellence. Our submission to the 2015 Nurse Review discussed agility across the Councils, and the necessity of accommodating external priorities when tackling current and future societal challenges. If empowered by a broad and long-term vision from government, this current framework has the power to deliver health and wealth impact from further investment.

Skills and mobility

The policy environment must support a stable skills pipeline to ensure that the UK's workforce retains its capacity for innovation. Mobility across sectors and disciplines must be maintained to ensure that skills generated within the research base are able to circulate both within and outside the sector to deploy talented individuals across areas of need.

The productivity plan notes that just 13% of UK growth in recent decades came from knowledge created in the UK, reinforcing the need for continued receptivity to new ideas. The rapid recognition and adoption of new innovation requires a strong UK research base with dynamic global connections, a level of connectivity fostered by collaboration and international career pathways.¹⁷ The UK must therefore avoid barriers (real or perceived) that may isolate it from the international talent pool.

¹⁴ Medical Research: What's it worth?, 2014

¹⁵ 2013 Triennial Review submission, Academy of Medical Sciences

¹⁶ The White Heat Revisited: The British Government and Technology in the 1960's, David Edgerton, Twentieth Century British History, Vol. 7, No. 1, 1996, pp. 53-82

¹⁷ International Comparative Performance of the UK research base, Elsevier, 2013

Regional excellence

The Science Minister recently spoke about mapping regional strengths to support recognition and funding.¹⁸ Our joint FORUM report due in September will explore how geographical clusters can drive medical innovation (see Box 3), and the Government may wish to consider the UK's potential as a 'macro-cluster' in which regional expertise can cooperate closely throughout the country.

Box 3 – AstraZeneca

AstraZeneca has chosen to relocate its global headquarters to the Cambridge Biomedical Research Campus, to be alongside significant public assets such as the new MRC Laboratory of Molecular Biology, Cambridge University Hospital, and world-leading research teams within the University's School of Clinical Medicine.

The features which make this site an attractive biosciences cluster are likely to provide a template for fostering similar regional centres of excellence elsewhere.

Innovative public services

NHS England needs to make £22bn of efficiency savings in the next four years and a recent King's Fund report noted that innovation has historically been a major contributor to such savings.¹⁹ The knowledge generated by medical research directly contributes by reducing the burden of disease through prevention and treatment.

The operation of NIHR within the Department of Health is a major step towards placing research at the heart of delivering affordable, cutting-edge and effective universal healthcare for the UK. Achieving this harnesses the UK's universal healthcare system as a unique, national asset for supporting research – the outputs of which will be able to rapidly feed back into delivering improved care.

Alongside this, UK expertise is deployed against international health challenges – improving global health and mitigating external risks to the NHS from increasing international mobility. Research focussed on the development of treatments for low-resource settings are increasingly relevant in high-resource settings, as healthcare systems across the world struggle to maintain standards in the face of growing societal challenges from ageing and disease.

3. A broad and connected ecosystem

The Government should recognise the value of diversity within the research ecosystem, providing a network of funding sources and expertise which can support the entire discovery pipeline. Aside from funding, there are several ways in which the Government can help shape the research environment to best support this community.

Maintaining balance

The UK research base is a uniquely diverse ecosystem of public, industry and charitable funders. To function optimally, the commitments of the different players must remain balanced so that they can work together synergistically to tackle research priorities (see Box 4).

¹⁸ One Nation Science, Jo Johnson MP, 2015 <https://www.gov.uk/government/speeches/one-nation-science>

¹⁹ Better Value in the NHS, King's Fund, 2015.

Box 4 – Stevenage Bioscience Catalyst

The Stevenage Bioscience Catalyst opened in 2012, adjacent to the GSK R&D site, to provide start-ups and SMEs with access to the expertise, networks and facilities associated with multi-national pharmaceutical companies.

It was founded by a consortium of partners from across the medical research community including GSK, Innovate UK, the Wellcome Trust and Department for Business, Innovation and Skills. The site is developing rapidly, with a second building to open shortly hosting MRC Technology's drug discovery activities.

The Government's productivity plan discussed the drag on productivity created by impaired resource allocation, and we would support exploration of how constrained public funding weighs on the ecosystem of funders. Failure of public sources to effectively balance industry and charity investment risks reducing the impact of all three contributors, and the value generated by mechanisms such as the Charity Research Support Fund should be revisited.

Working together, this ecosystem provide a diversity of funding streams to the research base which supports agility and balances strategic versus opportunistic funding decisions. It also creates a broader base of support for the skills pipeline, demonstrated by GlaxoSmithKline being the largest private sector supporter of PhD students in the UK.²⁰ It should be recognised that medical advances are best achieved and implemented as part of a broader community of research excellence – for example, sociological research can be critical to delivering impact, and sectors should be joined-up at all levels.

Coordination

In a time of constrained resource and increasingly interdisciplinary challenges, coordination and collaboration are central to maximising the output of the research base. It is vital that public funders are able to work in synergy, and we submitted a response to the Nurse Review, which is examining Research Council strategic coordination, noting the importance of agility.²¹

Ongoing work is needed to ensure that the research base is aligned with future challenges, and our projects such as *Health of the Public in 2040* directly address this issue.²² We continue to engage with Government and Whitehall on topical issues, and we believe that the ability of the national Academies to channel the expertise of their Fellowship is of great value to the UK.

Greater collaboration will require coordination if duplication is to be avoided. We have frequently highlighted the distinct, but synergistic, roles of the Medical Research Council and the National Institute of Health Research. Operating within different departments, these two separate funders provide breadth of support to the entire pipeline of medical discovery and are efficiently coordinated by the Office for Strategic Coordination of Health Research (see Box 5).

²⁰ GlaxoSmithKline submission to the HMT Spend Review consultation, 2015

²¹ <http://www.acmedsci.ac.uk/policy/policy-projects/review-of-the-research-councils-by-sir-paul-nurse/>

²² <http://www.acmedsci.ac.uk/policy/policy-projects/health-of-the-public-in-2040/>

Box 5 – Office for Strategic Coordination of Health Research

In the 2006 Cooksey report, it was recommended that an Office for Strategic Coordination of Health Research (OSCHR) be established.²³ Its objective was to coordinate the funding of health research between NIHR and the Medical Research Council (MRC).

Subsequently established in 2007, OSCHR reports jointly to the Secretaries of State for Health and Business and has a board composed of representatives from academia, government, MRC, NIHR, HEFCE, medical research charities and industry.

The office has been extremely successful in coordinating funding across the two research bodies – one channelling departmental spend, and the other operating within the science budget. OSCHR's work has allowed each funder to utilise its distinct advantages as a separate entity, but also work in a highly complementary way to support the whole pipeline of research.

Since being founded, OSCHR has supported the development of projects which have improved NHS electronic data capabilities for research, created a research programme for public health, and enhanced translational science.

We would encourage Government to consider the value of extending the OSCHR model to other budgets in order to drive efficiencies and capture departmental expertise. A wider coordination of spending could build on existing links such as between RCUK and the Defence Science and Technology Laboratory, or between the Department for Defence and NIHR.^{24,25}

Summary

We regard this as a critical time for research and innovation within the UK. Challenges facing our society will increasingly demand a strong and inter-connected research base, and short-term cuts now are likely to induce long-term costs later.

The UK has a world class research base that punches well above its weight. Government must ensure that it capitalises on this opportunity to invest for the future of the nation, and be the Government that backs rhetoric with resource.

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²³ A review of UK health research funding, Cooksey and HMT, 2006

²⁴ <http://www.rcuk.ac.uk/media/news/130204/>

²⁵ <http://www.srmrc.nihr.ac.uk/>