Written evidence submitted by Scienceogram UK

Summary

- The 2010 and 2013 Spending Reviews have had significant financial and policy repercussions for UK research and development, including a real-terms cut in funding for R&D across government.
- The National Audit Office's recent memorandum on science and technology R&D funding provides a valuable official collation of data.
- However, the memorandum lacks the kind of context that could elucidate the topic and involve a wider constituency of public and policymakers in the debate over science funding.
- We recommend that assessments of R&D funding should take place within the context of the social and economic problems that science is trying to solve.
- The government therefore needs to collect improved data on R&D funding broken down by socioeconomic objective.
- These should be collated alongside corresponding, commensurate data on the scale of the economic and social challenges, as well as projections of the costs of achieving socioeconomic and scientific goals through R&D.
- The government should make these data publicly available, and integrate them into R&D funding targets.

Introduction

1 This evidence is submitted on behalf of Scienceogram UK, an organisation aiming to raise awareness of the amount that the UK government spends on scientific research, and highlight the disparity between this and the size of the problems that science is trying to solve.

2 One technique employed is to divide up spending on science and technology into pounds per person per year—and this simple methodology yields some surprising results. For example, cancer kills around 30% of people, and yet we spend just £4.30 per person per year on public-funded cancer research. Furthermore, cancer is by far the best-funded medical condition—stroke is responsible for 10% of deaths, and yet just 28p per person per year is spent on research. More information is available on the Scienceogram website.[1] (An edited extract on health research spending is available in the Appendix.)

3 We are strong proponents of open data. Most of the data used on scienceogram.org has been obtained from publicly available sources, with supplementary data obtained from government sources. All of our results, together with calculations, are available online.[2]

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[1] scienceogram.org
[2] Scienceogram UK, Data. scienceogram.org/in-depth/data/

4 Scientific research and innovation are vital to the UK economy, our health and our lifestyles. We believe that putting science and technology funding into context, through the use of per capita figures and other such techniques, would be useful when making science funding policy decisions, and additionally makes an extremely important but potentially arcane topic more accessible. We would like to see wider participation in the debate surrounding science funding both within politics and the public, and hope that the insights we have gained in developing the Scienceogram can be of use to the Committee in commissioning reports or inquiries to that end.

5 We have divided our submission into three sections:

- Comments on the National Audit Office report, 'Research and Development funding for science and technology in the UK'
- Comments on the 2010 and 2013 Spending Reviews
- Suggestions for future reports or inquiries into UK science funding

Comments on the National Audit Office report, 'Research and Development funding for science and technology in the UK'

6 The NAO's recent report[3] draws together a range of pre-existing data on public and private inputs to UK R&D, and provides a useful official compilation of this information. However, we would argue that the kinds of data presented—past inputs and international comparisons—are not the most useful context in which to consider R&D spending.

7 For instance, whilst the data presented do make it clear that the UK could invest more when compared to many other economically successful countries, international comparisons are an unsophisticated tool for determining what a country should spend on science. Desired and expected outputs—rather than others' inputs—should inform levels of spending.

8 Additionally, the NAO report does not fully reflect recent changes in UK science funding. This is understandable, given that the SET Statistics[4] and OECD data[5] from which it is drawn are necessarily post-hoc audits of spending across a large number of institutions. For example, the SET Statistics are, at the time of writing, only available until financial year 2010–11; this limits analysis of recent budget decisions. It would be helpful for policymakers, journalists and citizens to have access to an official source of more up-to-date figures, even if they are provisional, or based on budgets rather than expenditure.

9 More fundamentally, the NAO report in its present form seems unlikely to engage a broad constituency of policymakers and the public. We believe that improved data collection and more accessible presentation could raise the profile of research in politics and allow a wider debate about R&D funding and policy.

[3] NAO memorandum: Research and Development funding for science and technology, July 2013. www.nao.org.uk/report/nao-memorandum-research-and-development-in-the/

[4] Science, engineering and technology (SET) statistics 2012, September 2012. www.gov.uk/government/publications/science-engineering-and-technology-set-statistics-2012

[5] OECD Main Science and Technology Indicators. stats.oecd.org/Index.aspx?DataSetCode=MSTI_PUB

10 We have a number of specific recommendations which could be suitable for a follow-up report or committee inquiry, presented in the third section of this submission, starting at paragraph 20.

The 2010 and 2013 Spending Reviews

11 It is very likely that the net effect of the 2010 and 2013 Spending Review decisions constitutes a substantial real-terms cut in science funding over the term of this parliament.

12 As mentioned above, the most recent SET Statistics are those from FY2010–11, meaning that only one year of public R&D funding numbers is available since CSR2010. According to these numbers, total public spending on science fell from £10.7bn in 2009–10 to £10.0bn in 2010–11; a 7% cut, and the largest real-terms drop in per capita research spending since the SET data began in 1986.[6]

13 It is difficult to ascertain what exactly has happened to public funding of R&D since then, but there are strong indications that the trajectory is downwards. The two major sources of R&D funding within government are the Department for Business, Innovation and Skills (BIS), which disburses resource and capital funding directly to universities and research councils, and individual departments' R&D budgets.

14 We are currently in correspondence with BIS and, though we have yet to complete our analysis, we understand from the figures provided that the annual budget from 2011–15 has been cut in real terms compared to the 2010–11 baseline.[7]

15 Figures obtained by the Campaign for Science and Engineering (CaSE) suggest that other departments have been reducing the proportion of research within their budgets, which are themselves being cut.[8]

16 A recent report by grassroots campaigning organisation Science is Vital[9] attempted to gauge the impacts of these cuts on the ground. An online survey of nearly 900 working and former scientists found that 85% were worried about funding, and 68% were concerned about their employment (a figure which rises to 90% if you exclude principal investigators, many of whom have permanent positions). Over half of respondents reported reduced success in grant applications since 2010.

17 There are also broader policy implications from the way spending has been allocated. Over a third of capital spending on science between 2010 and 2015 was announced in a number of windfalls by the Chancellor. Disbursing funding through these unpredictable 'fiscal events' leads to uncertainty about science spending in the long term, making planning difficult at all levels, from individual research scientists considering their own careers to multinational companies considering investments in the UK.

18 Further, the windfalls have largely been earmarked for a range of specified projects, from green computing to graphene. Where to direct research money has typically been the

[6] Scienceogram UK, Data. scienceogram.org/in-depth/data/
[7] Ongoing correspondence with BIS, August 2013.
[8] Campaign for Science and Engineering: Government R&D hit by disproportionate cuts, October 2012. sciencecampaign.org.uk/?p=11131
[9] Science is Vital: Legacy of the 2010 Science Budget Cash Freeze, June 2013. scienceisvital.org.uk/2013/06/17/legacy-of-the-2010-science-budget-cash-freeze-final-report/

domain of practising scientists via peer-review panels; instead, these decisions about the allocation of science funding were made at high levels within government. Strategic direction of funding by central government is not in itself a bad thing; however, this change has seemingly occurred without the opportunity for consultation or debate.

19 In summary, the 2010 and 2013 Spending Reviews have had significant financial and policy repercussions for science.

Suggestions for future reports or inquiries

20 Science and technology have widespread impacts on everyday life, and their funding should be an issue with broader political recognition among both policymakers and the public. Comprehensive and comprehensible statistics are vital to inform future science funding decisions, and to facilitate wider engagement with this important issue.

21 We suggest that further collation of data is needed for meaningful and accessible analysis of R&D spending, extending the NAO report to include a more detailed breakdown of funding and additional context so that this disaggregated data can be understood. This would require:

- collating spending data categorised by socioeconomic goals;
- collecting data relating to the scale of the goals themselves;
- estimating likely required research investment to make progress on these goals; and
- making these statistics accessible to a broad range of policymakers and the wider public.

Research spending data by socioeconomic goal

22 Currently available science and technology spending data are usually divided up either according to internal governmental budgetary divisions (for example by research council or department), or by traditional subject area (such as physics, chemistry, biology, engineering, maths, social science, etc). Whilst these do have some policy relevance, they are not as important as the ultimate aims of research activities, and do not allow spending to be put into context. (For example, there is no obvious imperative for a certain specific level of investment in the Biotechnology and Biological Sciences Research Council [BBSRC], or the subject of physics, considered in the abstract.)

23 We recommend collecting data on R&D spending in cross-departmental, interdisciplinary thematic areas based on socioeconomic goals. These goals could include health, energy, food, and so on. Such categorisation is arguably the best lens through which to view science and technology funding from both a public interest and a policy perspective. Further granularity within these socioeconomic goals (e.g. specific diseases within the health research portfolio) would be very useful for more detailed comparisons.

24 It is, of course, important not to neglect research which does not have an immediate and predictable application. Public-funded ‘basic’ or ‘blue-skies’ research has resulted in many extremely significant discoveries, from lasers to the internet, whose full importance would have been impossible for contemporary technologists to have understood. Therefore,

focusing on research with a defined socioeconomic impact at the expense of more general investigation could be deleterious for scientific progress. It would nonetheless be valuable to collect these data on basic research funding alongside more applied science.

25 The SET Statistics do make some attempt to divide spending into themes, but there are large uncertainties resulting from the underlying methodology. Indeed, according to BIS, 'these calculations are not very meaningful'[10] because the survey asks respondents to report how much of their expenditure 'relates' to specified categories, without requiring a thorough or consistent audit of spending. Additionally, 'general advancement of knowledge' accounts for nearly half of spending, but is not broken down further.

26 Some further information on the component of general advancement of knowledge funded by universities is available through, for example, the Higher Education Funding Council for England (HEFCE) breakdown of mainstream quality-related funding.[11] This is categorised by academic subjects (known as 'units of assessment'). However, research into a particular subject could touch on one or many socioeconomic objectives, and further uncertainty is introduced because these block grants need not be spent on the area for which they are allocated.[12]

27 Similar ambiguity exists in departmental R&D spending data due to the diversity of funding sources. For example, medical research is funded through research councils such as BBSRC and MRC via BIS; the Department of Health; and money allocated to universities via the Higher Education Funding Councils. Aggregating these figures is not, as far as we know, currently possible.

28 We believe creating a single authoritative source of well-curated data broken down by socioeconomic goal would be a worthwhile priority for the Committee.

Gathering context-setting data

The socio-economic scale of science funding

29 The context most relevant to science funding is the scale of these socioeconomic goals. We therefore recommend that the Committee collect data to quantify the magnitude of these challenges.

30 The best way to set this context will vary by category of research, and there may be multiple perspectives from which to view each one. For example, in the case of health, the Scienceogram compares spending on disease research to the fraction of deaths caused by those diseases, as well as their total economic cost (as mentioned in the Introduction—additional detail is available in the Appendix).

31 For energy research, the simplest comparison is purely economic. The Department for Energy and Climate Change (DECC) reports that we spend around £2200 per capita on energy.[13] Energy prices are also increasing rapidly: the UK per capita spend on energy

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[10] BIS Ministerial Correspondence Unit, April 2013. Correspondence reference 333251.
[11] HEFCE, Quality-related funding data 2013–14, March 2013. www.hefce.ac.uk/data/year/2013/quality-relatedfundingdata2013-14/
[12] Correspondence with HEFCE Analytical Services Group, April 2013.
[13] DECC, Digest of UK Energy Statistics, DUKES 1.1.6, July 2013. www.gov.uk/government/statistical-data-sets/dukes-2012-annual-tables

increased by 60% in real terms between 2001 and 2011. The combined spend by UK research councils and the EU on energy research amounts to just over £5 per person per year—less than 0.25% of the current total.[14]

32 There are many different ways to make these comparisons; for example, energy research should also be considered in the context of the effects that energy generation has on the climate. The choice of comparators inevitably has a subjective and political component, and judicious use of multiple comparisons allows conclusions to be robust and politically neutral.

33 We recommend that the Committee consider appropriate comparators to a variety of categories of science spending and collate those figures alongside a thematic summary of science spending.

Estimating the cost of scientific objectives

34 Another perspective which can be used to put science funding into context is the historical and projected costs of achieving specific scientific goals. There is a widespread misconception that research objectives, such as medical treatments or new energy technologies, can be considered to be a certain number of years away. However, it is common for resource constraints to be a bottleneck in science (for example, experiments could often be run in parallel if sufficient resources were available); it is therefore more instructive to imagine that scientific goals are a certain number of person-hours, or an investment, away from fruition.

35 For example, a 2002 German government analysis estimated that developing nuclear fusion to the point of viable electricity generation would cost between €60 and €80 billion.[15] Whilst such estimates are inherently uncertain, this figure is comparable to the cost of large public infrastructure projects, but with transformative implications for global energy production.

36 The resources and skills upon which the Select Committee can draw could allow similar estimates on a variety of socioeconomic and scientific goals from across UK R&D to be developed in consultation with experts.

Conclusion

37 Official data on research funding grouped by socioeconomic objective should be collected. Assessment of R&D funding should then take place within a context set by the scale of socioeconomic and scientific challenges being addressed. This framework would allow policymakers and the public to partake in more informed debate and decisions around public funding of research. The government should make these statistics publicly available, and integrate them into R&D funding targets.

Authors and declarations of interest

38 Dr Andrew Steele is a bioinformatician at Kings College London. His work is funded by the ERC, and he has previously received grants from EPSRC and STFC. He is a member of the Science is Vital executive committee.

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[14] Scienceogram UK, Data. scienceogram.org/in-depth/data/
[15] Thermonuclear fusion: TAB report no. 075, 2002. www.tab-beim-bundestag.de/en/publications/reports/ab075.html

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Appendix: ‘Health research’ from Scienceogram UK

39 Cancer kills nearly a third of us, and yet public spending on cancer research is less than £5 per person per year. And it’s arguably the best-funded medical condition—looking at other big killers paints a stark picture of the state of UK medical research funding.

40 Heart disease is responsible for around 15% of deaths, and yet we spend just £1.30 per person per year researching it. Stroke is the third most deadly individual condition, responsible for 10% of deaths; stroke research receives just 28 pence per person per year. So, astonishingly, these three conditions are responsible for over half of the deaths in the UK, and yet we invest less than £6 per person per year to try to understand their causes and find new treatments.

41 Looking at mortality statistics starts to give a sense of scale to measure up health research spending, but what doesn’t kill you can nonetheless have a huge effect on your quality of life. It would be a mistake to concentrate our research solely on the most fatal conditions. For example, dementia has a massive effect on quality of life, but the condition itself is rarely fatal. It affects one in six people over 80; we spend about 60p per person per year researching it.

42 The suffering caused by illness should be reason enough to invest more seriously in looking for treatments. However, diseases also come with a significant economic cost. Firstly, there’s the substantial direct cost, in terms of health and social care for sufferers. Secondly, there are large indirect costs, such as friends and family members taking time off work to care for loved ones. The total economic impact of the four diseases mentioned is over £800 per UK citizen per year. This makes the combined £6.50 we each spend researching all four of these conditions look rather paltry.

Adapted from scienceogram.org/in-depth/health