Introduction

University Alliance brings together universities with government, business and charities to create innovative solutions to social and economic challenges and promote the value of higher education in the UK. We are pleased to contribute to this House of Commons Science and Technology Select Committee review of the Science Budget at this critical time for investment decisions.

1 - The extent to which the current ring-fence arrangements, and the separate arrangements for determining 'resource' and 'capital' allocations, have produced coherent UK science and research investment

1. We welcomed the last Government's commitment to invest, in real terms, more than £5.5bn in science and research capital over the next five years. However, the UK's investment in R&D and innovation remains well below average amongst competitor nations, and significantly lower than OECD and EU averages. We must prioritise investment in our research and innovation infrastructure – both capital and resource – if we are to maintain the UK's status as a leading science and research nation with all the benefits this brings.
2. Over the past 5 years we have also welcomed additional funding from government for research capital but note that this has only partially offset the large decline (45%) in the research capital budget following the 2010 Comprehensive Spending Review (CSR).
3. We are also concerned that capital investments will not be fully maximised if the resource (including human) is not there to support it. Nor can the capital strategy maximise the UK's research resource if it is planned in isolation from it. We urge the Government to produce a complementary research resource investment strategy to accompany – even direct – the capital strategy.
4. In terms of guiding principles for capital funding decisions, a balanced approach is critical – enabling investment in large scale projects whilst protecting our ability to support growth in cutting-edge areas of research that might not easily be predicted. This should mirror the dual funding system (a mix of block-grant funding and project-based funding) for research, which includes the flexibility for universities to invest strategically in new areas. Open innovation needs open competition so all funding should be allocated according to the principle of funding excellence wherever it is found.

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5. The funding system – for both capital and resource - should also promote and reward collaboration. National centres, for example Catapult Centres, should be accessible to the best researchers across the ecosystem. More widely, asset sharing should lead to efficiency savings and University Alliance is undertaking and supporting efforts at the national level to improve the sharing of resources amongst universities and the wider research eco-system.

6. Before making decisions about research investment, the government should also commission a thorough analysis of the current system to identify gaps and areas of fragmentation in the UK's science capability. The Science and Innovation audits announced in the Summer Budget 2015 must include the full range of activities within a complex science and innovation ecosystem.[1] University Alliance would be happy to help convene discussions about priority areas.

2 – The extent to which science and research expenditure in Government departments (outside the Science Budget) complements or competes with the Science Budget

7. Science and research expenditure across other departments is complementary to the Science Budget. Universities currently receive a significant amount of research grants and contracts from Government departments outside of BIS and the Science Budget. These departments often fund projects which have substantial impact on the research ecosystem and greatly compliment other spending from other departments within the Science Budget.

8. Due to the flexibility afforded these departments they are able to fund specific projects and activity which would not be funded from BIS or from research councils. One example of this is the Advanced Wellbeing Research Centre in Sheffield which is being built through a Department of Health grant. The centre is set to become the most advanced R&D centre for physical activity in the world, and will work in collaboration with the private sector to achieve this.[2]

[1] HM Treasury, Summer Budget 2015.
[2] http://www.shu.ac.uk/mediacentre/sheffield-hallam-awrc-announces-%C2%A315m-toshiba-deal

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3 – The need for and rationale for any adjustment to the trajectory of future Government expenditure on science and research, and what would be gained from an increase (or lost from a reduction) compared with current expenditure levels

9. The UK science base punches above its weight in terms of efficiency and productivity, and is a major source of economic, social and cultural value for the UK generating substantial returns to public investment–estimated to range between 20% and 50% but often much higher.[3] However, it is also well known that UK investment in science is low by OECD and EU averages, at the same time as new and emerging economies are investing heavily in science and research.[4] The case for investment in research has been well made by many organisations. We have therefore not set it out again at length here but support the points that the Campaign for Science and Engineering make in their publication "Why Champion Science and Engineering"[5] and that Tera Allas makes in her 2014 report "Insights from international benchmarking of the UK science and innovation system".

10. In particular, we note that government investment in science and engineering creates a virtuous cycle, leveraging investment from industry, raising productivity and creating high-value jobs. It is a highly effective way to invest public money to drive economic growth - for every £1 spent by the government on research & development, private sector R&D output rises by 20p per year in perpetuity.[6]

11. The quality of Alliance research is drawing business investment regionally and internationally. One example is the engineering multinational BorgWarner who have developed a new partnership to improve turbo-charged engine technologies with the University of Huddersfield. The university has invested more than £3.5 million in facilities and in developing research expertise, and has attracted £5 million inward investment from BorgWarner. The partnership has established bespoke turbocharger research and test facilities, co-developed a

[3] T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014*.
[4] Rt. Hon Liam Byrne MP (June 2014). *Agenda 2030: One Nation. Labour's Plan for Science* (Green Paper); T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014*.
[5] CaSE (May 2015) http://sciencecampaign.org.uk/Whychampionscienceandengineering.pdf
[6] J. Haskel, A. Hughes and E. Bascavusoglu-Moreau (2014). *The Economic Significance of the UK Science Base*. CaSE.

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Masters' course for training the next generation of turbocharger engineers and has created and safeguarded jobs at the BorgWarner Bradford site.

4 – Whether the current distributions of the budget between particular types of expenditure and between different organisations is appropriate for future requirements, and achieves an appropriate balance between pure and applied research

12. The autonomy of institutions has been shown to have a direct correlation to the quality of a research system. The UK is recognised as being distinct in both its level of autonomy and its quality.[7] Autonomy allows Alliance Universities to manage their strategic advantage within various markets, operate flexibly in response to drivers and opportunities, be responsive to both threats and opportunities and to focus resource on their strengths within an increasingly dynamic higher education environment.

13. Maintaining excellence in a broad range of subject areas and research activities will future-proof the UK research and innovation ecosystem in a rapidly changing world. As Government acknowledges, predicting future market changes is an inexact science and we need to make sure we are allowing growth sectors to thrive – this is why the dual funding system for research, which includes the flexibility for universities to invest in new areas, remains critical.

14. It is therefore essential that universities have predictable and targeted sources of funding to support them to develop their research capacity and specialisms, and to support the exchange of this knowledge with wider society. The dual support of research and funding excellence through open competition has driven up the quality of UK research. There has been a notable increase in the UK's share of world citations since the introduction of the first Research Assessment Exercise (RAE) in 1986.[8]

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[7] Laura de Dominicis, Susana Elena Pérez and Ana Fernández-zubieta (2011) *European University Funding and Financial Autonomy. A Study on the Degree of Diversification of University Budget and the Share of Competitive Funding*; Philippe Aghion and others (2008), "Higher Aspirations: An Agenda for Reforming European Universities," *Bruegel Blueprint Series*, V.

[8] J. Adams and D. Smith (2006). Evaluation of the British Research Assessment Exercise. In: L. Bakker, J. Boston, L. Campbell and R. Smyth (eds.) *Evaluation of the Performance- Based Research Fund*, pp. 109-17; Wellington: Institute of Policy Studies, Victoria, cited in Libby Aston and Liz Shutt (2009), *Concentration and Diversity: Understanding the Relationship between Excellence, Concentration and Critical Mass in UK Research.*

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15. We therefore recommend that UK should continue its policy of selectively distributing research funding, based on quality, in order to continue to further drive the quality and impact of UK research and secure the future health of the UK research base. In other words, research excellence should be funded wherever it exists. In a difficult fiscal environment it is essential that these existing principles are maintained because they have "enabled the Government and funding bodies to maximise the return from the limited public funds available for … research".[9]

16. QR funding is the most efficient way to support the continued production of excellent and innovative research across the UK. The REF provides granular information about research excellence and supports strategic investments in areas of strength and growth. This flexible strategic investment is critical to the dynamism and responsiveness of UK research, allowing universities to develop areas of expertise including in new and high-risk areas, across the spectrum of research activities.[10] We therefore argue that the government should consider increasing the proportion of research funding that flows through QR.

17. The evidence for funding excellence wherever it exists is well established and this principle is an important pillar of the UK's dual funding system for research. However, there are examples of public funding streams where these principles are not being followed, particularly around doctoral training - with implications for the future workforce and skills base. Research Council policy to fund 'fewer, larger, longer awards' in response to efficiency pressures has meant that some important funding streams supporting postgraduates and knowledge exchange activities are no longer open to all HE Research Institutions.

18. Although Research Councils use a variety of different mechanisms and allocation methods to fund postgraduate study, the majority of funding for PhDs is channelled into block grant awards (for example, DTPs, CDTs and CASE awards). The introduction of block grants and Doctoral Training Centres, coupled with the removal of PhD researchers as a viable cost in other research grants, has closed off Research Council funding for postgraduate researchers (PGRs) for many university departments where excellent research is undertaken. This is despite a House of Lords' Science and Technology Committee report into higher

[9] www.rae.ac.uk/Pubs/2004/01/rae0401.doc
[10] PACEC and Centre for Business Research at the University of Cambridge (2014), *A Review of QR Funding in English HEIs: Process and Impact. Report to the Higher Education Funding Council for England (HEFCE).*

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education in STEM subjects, published in 2012, which noted the importance of maintaining a diverse complement of training mechanisms, recommending that a variety of PhD delivery models be utilised, to ensure that the UK's current breadth of expertise in science and technology is maintained.[11]

19. Another example of uncompetitive funding is Impact Acceleration Accounts (IAAs), which some Research Councils have allocated based on the size of Research Organisations' recent research funding history. Calculating eligibility by previous funding allocation within a Research Council context is misleading, as it does not reflect excellence in a diversity of research activities - an open competition for IAAs would recognise excellence throughout the system in realising impact in research.

5 – What level of Government expenditure on science and research is needed; to significantly drive the overall level of such expenditure in the economy, through synergies between government and private sector investment (including overseas investment); and to optimally balance its benefits against the opportunity cost of government expenditure foregone on other public services.

20. To achieve economic prosperity by means of the knowledge economy, innovation activities need sufficient and sustained funding. Government funding for university-business collaboration leverages other funds and generates profit - there is strong evidence that increasing public investment also crowds in private investment in R&D (where the UK is weak).[12] By failing to invest sufficiently, we are not maximizing the leverage of private investment.

21. The UK has a well-performing university-business interface. That said, business spend on innovation, particularly among SMEs, is low. We will only make the most of university research and teaching if we also support knowledge exchange into SMEs. As Dowling recommends, the government should make a long-term commitment to maintaining a form of flexible public funding for knowledge exchange.[13] We argue that the Higher Education Innovation Funding (HEIF) should remain flexible and stay within HEFCE's national portfolio

[11] http://www.publications.parliament.uk/pa/ld201213/ldselect/ldsctech/37/37.pdf
[12] J. Haskel, A. Hughes and E. Bascavusoglu-Moreau (2014). *The Economic Significance of the UK Science Base*. CaSE.
[13] Dame Ann Dowling (2015) *The Dowling Review of Business-University Research Collaborations*

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22. HEIF is a success story. It returns over £6 for every £1 invested[14] and has achieved its original remit to build knowledge exchange capacity in universities. It is now a good time to think about refocusing this funding stream. We think that a new fund should focus on two areas: improving the innovative skills of each generation of students and academics; and supporting proof-of-concept testing. It should still be allocated to universities, because they have the knowledge, scale and connections to provide the best support to these activities.

23. SMEs are constrained by limited resource and time and are often unable to capitalise on the knowledge and research that is available to them. Absorptive capacity and lack of leadership and management skills act as barriers to innovation in SMEs. Responsive university interventions which provide businesses with easy and open access to expertise – such as Sheffield Hallam University's Fix It Fridays, the GAIN network run by Plymouth University and Coventry University's KEEN network, all one-stop shops for helping local SMEs solve problems in the Yorkshire region, the South West and the West Midlands respectively. Knowledge exchange funding, as outlined above, is critical to delivering returns on investment in science.

6 – Whether the Government's expenditures on aspects of science and research are consistent with other government policies, including the Industrial Strategies and the Eight Great Technologies and fiscal incentive policies for research investment

24. Improving productivity continues to be of critical importance to the UK, and UK science has a central role in delivering the advancements and innovations that will support growth. National science projects should be prioritised if they are enhancing the UK's existing strengths, and if they are building capability to exploit large international markets. Long-term transparent priorities (such as outlined in the Science Strategy) allow greater complementarity of the research system to these aims.

25. However, funding should also continue to support niche and experimental research at institutional level – in accordance with the Haldane Principle. A flexible research system will be able to respond to opportunities that could not have been predicted but which are important for future growth and prosperity.

[14] Tomas Coates Ulrichsen, *Knowledge Exchange Performance and the Impact of HEIF in the English Higher Education Sector*, Report for HEFCE (April 2014)

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26. Large scale projects in the national interest should aim to address fundamental weaknesses in the UK's research and innovation ecosystem. A recent benchmarking study found that the UK's capacity to commercialise research is currently lagging behind international competitors.[15] We should prioritise expanding our existing research strengths, especially in near-to-market research, and build the UK's capacity to exploit large international markets. Priorities which map on to a defined and long-term strategy (i.e. Industrial Strategy and Great Technologies) help the research base to align their own resources to national aims.

27. To drive quality, all national, large scale capital resources must remain accessible to the most excellent researchers and innovators within the UK, which will involve a commitment to outreach and autonomy. Furthermore, investments in national capital projects should be balanced with greater funding streams through the funding and research councils, with a more integrated approach to how those resources are shared and made accessible as part of a truly international infrastructure.

28. Multi-disciplinary and multi-partner approaches are key to problem-solving and innovation and there is real opportunity for innovation through the constructive tension on the boundaries of disciplines and refreshing research collaborations. National funds for joined-up big research, around key challenges such as ageing, obesity and environmental sustainability. would focus research efforts. These could be in the form of a No. 10 'Big Challenge' or RCUK cross-Council fund and bids should – as with other large challenge-based schemes, such as Horizon 2020 – require collaborative and multidisciplinary bids.

7 – The extent to which any increase or reduction in Government expenditure on science and research will have an impact on the UK's relative position among competitor states

29. Many international comparators show the UK is successful at innovation. It tends to perform particularly well on business-university collaboration indicators. For other parts of the innovation system, however, the UK performs less well comparatively. The European Commission's Innovation Union Scoreboard measures whole system performance in innovation, and defines the UK is defined as an 'innovation follower' – ranking seventh out of all member states and lying outside of the top group of 'innovation leaders' (Sweden, Denmark, Finland and

[15] T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014.*

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Germany). Over time, innovation performance among Member States is converging, and the UK must make efforts to maintain and improve its innovation performance. The Innovation Union Scoreboard shows that the UK is performing relatively well (and is improving) in innovation, with strong Human Resources and Linkages and Entrepreneurship. But there are declines according to indicators measuring Finance and Support (-5.8%) including a particularly significant decline in Venture Capital Investments (-10%).[16]

30. Any reduction in science and research spending is likely to put the UKs position as a leader in the world-wide research and innovation ecosystem in jeopardy. If the UK wishes to continue to compete and remain at the forefront further investment into the science budget is required.

[16] European Commission (2015), Innovation Union Scoreboard 2015

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