

BioIndustry Association response to the Science and Technology Committee's inquiry on a new UK research funding agency

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Introduction

1. The BioIndustry Association (BIA) is the trade association for innovative life sciences in the UK. Our goal is to secure the UK's position as a global hub and as the best location for innovative research and commercialisation, enabling our world-leading research base to deliver healthcare solutions that can truly make a difference to people's lives.
2. Our members include:
 - Start-ups, biotechnology and innovative life science companies
 - Pharmaceutical and technological companies
 - Universities, research centres, tech transfer offices, incubators and accelerators
 - A wide range of life science service providers: investors, lawyers, IP consultants, and communications agencies
3. The BIA's members are at the forefront of innovative scientific developments targeting areas of unmet medical need. This innovation leads to better outcomes for patients, to the development of the knowledge-based economy and to economic growth. Many of our members are small, pre-revenue companies operating at the translation interface between academia and commercialisation.
4. The BIA welcomes the Committee's inquiry on the Government's intention to create a new UK research funding agency, broadly modelled on the US' Defense Advanced Research Projects Agency (DARPA).

The role of UK ARPA

5. The role of UK ARPA must be unique. It must not be "just another funder". The key aspect that sets US DARPA apart from other R&D funders is its vision, which is driven by extraordinary ambition. While US DARPA projects often have a very specific problem that is quite practical (e.g. prepare for the next pandemic by learning to quickly develop and deliver a vaccine), the agency's unique remit means that it seeks a solution that goes way beyond the minimum required to resolve the need (e.g. develop 100,000 doses of any vaccine made from DNA within 24 hours in a container in the desert). The scope of this ambition pushes academics and companies alike to find ways to meet the target. These ambitious targets are not developed by DARPA overnight; rather, they are designed with a great deal of thought, so that even projects that fall short of their target are capable of delivering transformative change. For a UK ARPA to truly differentiate itself from existing R&D funders in the UK, it must embrace an equally extraordinary ambition and vision.
6. Flowing from this, for a UK ARPA to succeed, it should:
 - Clearly identify, articulate, design and address challenges that are under-served by existing public funders, industry, and investors
 - Fund research from any discipline in a technology-agnostic way at any stage of the innovation pipeline

- Actively manage the overall R&D process throughout its projects whilst providing flexibility and freedom to the individual researcher groups and companies which it funds
 - Work with end-users (customers), industry and downstream investors to ensure the solutions its projects are developing are implemented in practice
 - Operate with a high degree of autonomy from central government and have long-term horizons
7. The March 2020 Budget stated that the Government would “invest at least £800 million” in a “blue skies” funding agency, which would fund “high risk, high reward science”. However, the US DARPA has not been successful by funding blue skies research. Rather, its success can largely be attributed to addressing the ‘valley of death’¹ – the gap between early stage research and late stage commercial development in which high-risk research projects struggle to secure either government funding or private investment. It is important to note that the US DARPA is not bridging the ‘valley of death’ by only providing funding to these high-risk projects; the agency also has an important role in guiding projects through the R&D process to ensure the new technologies ultimately reach the market and are applied in practice.
 8. Most R&D funding programmes in the UK – whether academic or business focused – are competition-focused, with established processes and bureaucracies around them. Established scientific and commercial concepts have established funding routes which are working reasonably well. To make a difference in the UK’s science and innovation landscape, a UK ARPA should take a difference approach compared to existing funders by instead funding novel and high-risk ideas. As noted in ‘Visions of ARPA’, published by the Policy Exchange, “if more than half of ARPA’s projects succeed fully it will be being too cautious”. However, while UK APRA’s extraordinary ambition may mean that its projects fail more often compared to other R&D funding agencies, this does not mean that UK ARPA should overlook failure.
 9. Technical failure in reaching milestones that were set in the proposal stage should be accommodated and supported with agile re-planning, contingency funding and flexible consortiums. However, if a project is failing to make innovative leaps in the right direction at the right speed, it must be judged a failure as quickly as possible and dropped. This will allow a UK ARPA to spend more money in the right places. Every 12 months, US DARPA tests the progress of its projects to see how far they get towards the overall objective. If the project fails in a way that is deemed fundamental to the objective, the project is swiftly discontinued. US DARPA project managers are held to equally high standards and if the projects they are managing are not progressing towards the objective, they are dismissed. A UK ARPA must develop a similar attitude to failure, which is a radically different approach to funding compared to what the UKRI and government are currently taking and are used to.
 10. A good example which the Government and UK ARPA should learn from is the COVID-19 research and manufacturing efforts funded and supported by the Government’s newly formed Vaccine Taskforce. The Taskforce was formed in mid-April to “drive forward, expedite and co-ordinate efforts to research and then produce a coronavirus vaccine”.² Due to the high-risk nature of biomedical research, funding

¹ William B. Bonvillian (2020), ‘A Summary of the Darpa Model’: <https://policyexchange.org.uk/wp-content/uploads/Visions-of-Arpa.pdf>

² <https://www.gov.uk/government/news/government-launches-vaccine-taskforce-to-combat-coronavirus>

decisions have been made for projects in which a successful outcome is not guaranteed.³ To mitigate the risks, the Vaccine Taskforce is funding multiple potential solutions (e.g. by funding vaccines candidates from the University of Oxford and Imperial College London).

11. As many commentators have observed, a key to the US DARPA's success is the established "customer" as the end of the R&D process, the US Department of Defense, which requires a solution to a specific problem. For the UK Government's Vaccine Taskforce, the customer is the DHSC and Public Health England, again with a specific problem to be solved. While not all UK ARPA projects may have that established customer at the end of the R&D process, the problem which each project is trying to solve must be clearly defined. ARPA project managers will then be able to fund R&D activities within academic teams, companies or other groups to address that challenge, drawing on the breadth of expertise within the UK science and industry base. As the solution to the problem emerges, it is vital that UK ARPA's project managers provide a guiding hand throughout the R&D process and work to engage the Government, companies and/or investors which can either act as the final customer, or bring the project to market. A UK ARPA cannot fulfil these critical roles by focusing on blue skies research alone. However, within each individual group, flexibility and freedom will be essential for the innovation process.
12. The US DARPA is a small organisation within the large US innovation system and has a proportionally small budget. However, the proposed annual budget of £200m for UK ARPA is a small amount and not sufficient for the agency to fund a novel idea from discovery all the way through to market. Bringing a product to market is expensive and requires considerable private investment, especially in life sciences. This is another reason why it is vital that UK ARPA project managers work with the private sector and investors to secure additional investment and/or industry partnerships as the R&D projects progress. A framework for if, how and when the R&D is handed over fully to the private sector for final commercialisation will be crucial and should be thought about carefully during the setup of UK ARPA. It is essential that the way UK ARPA funds R&D makes the commercialisation of the products as easy as possible. In addition, a small UK ARPA budget will necessarily affect its vision, ambitions, and impact. It is therefore important that the Government is mindful of this and does not expect results that are on par with US DARPA's achievements or spread the budget too thinly by attempting to address as many challenges as its US counterpart.
13. The success of a UK ARPA should be measured over a long timeline that stretches 10+ years. As such, the Government should not expect the agency to contribute to its (pre-pandemic) ambition of raising R&D to 2.4% of GDP by 2027. The bureaucratic oversight by government must also be minimal to ensure the agency can develop an extraordinary ambition and fund the high-risk R&D projects necessary to deliver on its core function and promise. The Government should be cognisant of the UK's heritage, expertise and capabilities within existing institutions and ensure ARPA, in whatever shape it takes, complements these, integrates seamlessly and avoids past mistakes in the Government's management of innovation policy. A recent article⁴ by Ian Campbell, the existing Interim Executive Chair of Innovate UK, and David Bott, a former director of the Technology Strategy Board (as Innovate UK was previously named), explores this and should be considered by the committee.

³ For example, the Government is funding the vaccine candidate being developed by the University of Oxford and biotech SME Vaccitech. The vaccine is still in development, so funding is provided at-risk to accelerate timelines. For more info, see e.g. <http://www.ox.ac.uk/news/2020-05-18-funding-and-manufacturing-boost-uk-vaccine-programme>

⁴ <https://www.telegraph.co.uk/technology/2020/07/20/british-darpa-cant-solve-uks-innovation-woes/>

UK ARPA and the wider UK R&D funding landscape for life sciences

14. UK ARPA has the potential to make a significant contribution to the existing UK R&D funding landscape. This section briefly outlines the existing routes and challenges for the funding of innovation within the life sciences sector. As a fundamental element in UK ARPA's success will be its ability to draw on existing UK capabilities and cutting-edge science, it is important that the Government and UKRI work to address these challenges. Moreover, as a UK ARPA will be funding and supporting R&D within the existing academic and business communities, continued UKRI funding for both academic and business R&D is required to ensure there is a vibrant R&D base for ARPA projects to build upon.
15. In the UK, early stage research (including blue skies research) has well-established existing sources of funding, such as Higher Education quality-related research (QR) block grants and the Research Councils. These funding streams work relatively well and support the UK's strong academic research base, which is renowned worldwide.
16. Similarly, businesses have existing funding routes through Innovate UK. However, Innovate UK's budget has historically been much smaller than the Research Councils and is currently significantly less than the QR funding budgets.⁵ To enable the UK to reach the 2.4% R&D target, private investment in R&D must increase, which is why it is crucial that Innovate UK's budget is increased so that companies can scale-up their technologies and leverage further private investment. Innovate UK should use its budget to commit to long-term funding for the Biomedical Catalyst, a funding programme for life sciences companies, which is a proven successful vehicle to leverage private investment.⁶
17. Historically, the UK has been much better at academic blue skies research than at the commercialisation of that research. The story of Solexa illustrates this very well. Its revolutionary DNA sequencing technology was developed in Cambridge. However, the company did not have sufficient access to capital in the UK and was bought by the larger US company Illumina for \$600m in 2006. Solexa's technology fundamentally reduced the cost of DNA sequencing and underpinned the commercial success of Illumina, which today is valued at over \$52bn, up from \$1bn in 2006.
18. In addition, there are some technology areas in which the UK has a strong academic base, but in which early-stage companies are struggling to secure investment. An example of this is engineering biology (also known as synthetic biology), a broad ranging platform technology. Its applications span medicine, agriculture, energy, manufacturing and almost every other industrial sector. The UK has a strong academic engineering biology field, but due to the technology's vast ranging applications and high-risk nature, many early-stage engineering biology companies have struggled to secure the funding needed to enable them to scale-up their technologies. The lack of a clear funding route has been especially evident since the discontinuation of the Industrial Biotechnology (IB) Catalyst in 2015. Technology areas with the potential to revolutionise entire industries, such as engineering biology, may hold some of the answers to the problems UK APRA will attempt to solve. However, as UK ARPA is acting within a

⁵ For example, in 2011/12, Innovate UK's budget was £301m, less than half of the Medical Research Council's budget at the time. In 2019/20, Innovate UK's budget was £695m (not counting the funding allocated through the Industrial Strategy Challenge Fund, which was determined by central UKRI) whereas the QR funding budget was £1,629m.

⁶ An independent analysis from IPSOS Mori in 2019, commissioned by Innovate UK and the Medical Research Council showed that the Biomedical Catalyst generates £4.72 in public and business value for every £1 invested by the Government. For more info see: <https://www.gov.uk/government/publications/biomedical-catalyst-impact-evaluation>

broader innovation system and actively drawing upon the UK's R&D capabilities, it is important that these technology areas are well-funded through traditional UKRI funding routes.

19. In recent years, the availability of capital for innovative companies to start and scale in the UK has improved. For example, recent data published by the BIA shows that since 2012, private investment in biotech SMEs has increased over 400%.⁷ In addition, the £200 million British Business Bank scale-up fund for life sciences, announced at the Spring Budget, is expected to enable £600 million of investment for life sciences scale-ups and is welcomed by the sector. The BIA is also continuing to work with pension funds to enable long-term investment in innovative companies. Despite these improvements, many UK life sciences companies still find access to capital, and especially scale-up capital, is one of the biggest inhibitors of growth and the successful commercialisation of R&D. This is holding the life sciences sector back and stops the UK from truly capturing the full economic, health and commercial benefits of its investments in early stage research through the Research Councils and QR funding. Without ensuring there is sufficient access to capital for companies to grow, UK ARPA will not be able to play its full role in creating a sustainable economy based on innovation and technology.
20. The Small Business Research Initiative (SBRI) is a procurement programme where government departments challenge SMEs to come up with solutions faced by the public sector, and is therefore similar to UK ARPA in the way it has an established customer at the end of the R&D project. It should also be noted that as a procurement model, SBRI also enables 100% project cost funding and avoids State Aid issues, which may be a model UK ARPA to explore. However, SBRI and UK ARPA have very different purposes. UK ARPA must differ from SBRI in terms of vision, ambition and attitudes to risk and failure. In addition, SBRI serves much shorter timelines compared to UK ARPA and do not guide projects through the R&D process in the same way as UK ARPA.

UK ARPA's focus

21. A UK ARPA should be small, flat, flexible, and centred around highly capable project managers with a high degree of autonomy over the projects they oversee. In addition, a UK ARPA must be subject to little political oversight. This means, for example, that Government Ministers should not determine the specific projects that the agency funds, as this is the role of the project managers. Central Government should have a role in setting the general themes and/or challenges that UK ARPA is to address.
22. The Industrial Strategy Grand Challenges (ageing society, clean growth, future of mobility, and AI and data) could provide a suitable and broad framework for the themes a UK ARPA should focus on. However, it is important that the Grand Challenges are only seen as a broad framework, and not a formal structure which would bind the agency to fund a certain number of projects in each Grand Challenge. This is important to avoid some high-risk, high-growth technologies, which could make significant contributions to more than one Grand Challenge, being overlooked.
23. Biotech R&D is inherently high-risk, and it often takes 10-15 years to develop an idea into a product on the market. As such, UK ARPA will have important lessons to be learned from the biotech sector, particularly from venture capital investors and biotech entrepreneurs who are experienced in driving high-risk, outsourced projects which are terminated quickly if they are not working. We recommend the Committee calls on venture capitalists in its oral evidence sessions to see what can be learnt from them and would be happy to facilitate this.

⁷ BIA (2020), 'Global and growing - UK biotech financing in 2019': <https://www.bioindustry.org/resource-listing/global-and-growing---uk-biotech-financing-in-2019.html>

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