

UCL response: A new UK research funding agency

House of Commons Science and Technology Select Committee inquiry

Summary

UCL welcomes the substantial increases in R&D funding announced in the March Budget, including £800m for the creation of an ARPA-style agency to further stimulate innovation and enrich the diverse UK research and innovation system.

It will be crucial for the Government to be absolutely clear on the **specific gaps the new agency is intended to fill**, and how it will **align with the existing research and innovation ecosystem**.

To that end, we suggest that the development of the new agency should take account of the following principles:

- A **multi-disciplinary approach**, funding research projects and programmes that stimulate mission-oriented collaboration across disciplines to tackle defined societal problems
- Clearly defined success criteria that incorporate a **high tolerance of 'failed' research projects** and **capture success over the long term**
- **Transparent and timely communication** with research and business communities regarding the establishment, governance and operation of the new agency
- **Complementarity** with (rather than duplication of) existing agencies and funding streams, in particular other challenge-focussed strategic funding initiatives
- A **financially sustainable funding model** that covers 100% of the full economic cost of research projects and adopts a 'batteries included' approach to sustaining funding
- Support for effective **coordination among both public and private stakeholders** and **clear signalling of strategic intent**
- Embedded consideration of **how to increase diversity** in research – including of people and disciplines
- Commitment to **responsible research and innovation**

The geographical location of a new agency is less important than ensuring that it seeks to strengthen research capability and deliver research impact across all regions of the UK, including by harnessing existing research strengths and encouraging greater collaboration between institutions.

About UCL

UCL is London's leading multi-faculty university, with more than 13,000 staff and 42,000 students from 150 different countries. UCL has a broad research base, champions cross-disciplinary research, and advocates a mission-based approach¹ to tackling national and global challenges.

A. What gaps in the current UK research and development system might be addressed by an ARPA style approach?

Move beyond traditional disciplinary boundaries and basic vs. applied dichotomies

1. A new advanced research agency has an opportunity to focus on funding innovative, high-risk, high-reward research that is not currently well supported by the existing funding system.

2. Its approach should move beyond any distinction between 'basic' and 'applied' research and seek to set out a broad, problem-solving framework, aligned to key societal problems, to which any discipline can respond.
3. It will be important for the remit of the new agency to span the entire spectrum of research disciplines, including the arts, humanities and social sciences – recognising that one of the core strengths of the UK research base is its breadth, including excellence in these disciplines, and that such disciplines offer critical insights for solving societal problems. There is an opportunity for the UK ARPA to target research areas that are currently underfunded, or that do not fit into traditional boxes (such as crime science).
4. The new agency should seek to stimulate multi- or cross-disciplinary responses in order to address defined societal problems. This should involve setting 'missions' to which the research and innovation community can respond, as defined by Mariana Mazzucato, Director of the UCL Institute For Innovation And Public Purpose². Such an approach should incentivise mission-oriented collaboration between universities and other research institutions, and with commercial, health and charitable organisations, to support a translational ecosystem of partners focused on shared aims.

Allocate funding with greater agility and tolerance of risk

5. We anticipate that the new funding agency could offer a number of benefits, including:
 - a. greater agility in allocating funding;
 - b. greater tolerance of risk;
 - c. greater focus on (potential) reward;
 - d. ability to support promising research programmes over the long term without interruption due to funding cycles.
6. The new agency will need to have a clear definition of success different to that used by Research Councils. If it is to deliver on the stated aim of supporting 'high risk, high reward' research, a high proportion of 'failed' projects should be seen as a metric of success, since it is indicative of a risk-taking funding approach necessary to deliver 'high reward' research. By contrast, a high 'success' rate would reflect funding decisions having been excessively risk-averse, which goes against the ethos and purpose of ARPA.
7. The success metrics to capture 'high reward' research will also need to be aligned with the agency's mission-driven goals. Each individual 'mission' will need to have clearly defined, measurable success criteria. Success measures must also acknowledge that it may take many years for the full 'reward' to become apparent and will therefore need to operate over not just years but decades.

Alignment with industry and other sectors

8. There are also significant opportunities to support greater alignment between strategic research funding and translation, including through public procurement (which can stimulate further business investment and research funding) and stronger partnerships between universities and commercial, charitable and public sector organisations. Greater consideration will be needed of how ARPA can be aligned to different parts of the R&D ecosystem and different Government agencies.
9. As mentioned in para. 4, the new agency should stimulate the research base to tackle co-developed, clearly-defined, long-term societal missions rather than adopting a sectoral or technological focus, whilst strengthening the translational capacity of other sectors. This will require early 'user' engagement in each case, as well as greater consideration of complementarity with the existing Industrial Strategy Challenge Fund.
10. There is an opportunity for ARPA to address the current gaps in the research commercialisation pipeline, by driving greater alignment and coordination with other parts of

the research and development ecosystem – particularly for the most promising research programmes.

B. What are the implications of the new funding agency for existing funding bodies and their approach?

11. The development of the new funding agency must take account of the UK's existing research funding ecosystem. It will be important to:
 - a. avoid duplication of existing Research Council or Innovate UK activity and ensure an effective relationship with UKRI;
 - b. avoid any inadvertent undermining of or conflict with existing funding programmes or centres of expertise;
 - c. ensure research funded by the agency complements that of other challenge-focussed strategic funding initiatives, including UKRI's Industrial Strategy Challenge Fund and Global Challenges Research Fund, and research institutes such as the Alan Turing Institute and Faraday Institution;
 - d. ensure alignment with more recent funding announcements in the Queen's Speech and March Budget, including the £900m to support business to invest in high-potential technologies³.
12. Careful consideration should also be given to the greater role that Research Councils could play in supporting high-risk, high-reward research, in particular through greater collaboration across UKRI and with other funders. Furthermore, it will be important to recognise the role of charities such as the Wellcome Trust, Gates Foundation, Alzheimer's Research UK and the Howard Hughes Medical Institute in supporting major research programmes such as those addressing vaccines, dementia and infectious diseases.
13. We also note the importance of QR funding in underpinning the UK research base. As well as covering overhead and infrastructure costs, QR provides the stability of core funding that supports the continuation of research careers and lines of research between grants – both vital to the UK's research base. QR enables the UK to break new research ground, including by derisking the pursuit of novel approaches to research, which drives innovation.
14. ARPA's funding model should complement the dual support funding system, and not place additional pressure on already stretched research capabilities. This should include funding research projects at 100% of full economic cost, and incorporate sizeable support for infrastructure and administration. This is particularly important in the context of the current debate around the sustainability of UK research funding, given the current £4.5bn annual deficit in UK R&D funding,⁴ which will be compounded by the severe impact of the COVID-19 pandemic on university funding.

C. What should be the focus be of the new research funding agency and how should it be structured?

15. We note that little detail has been published to date on the proposed new funding agency. We assume that it is intended to take a disruptive role within the research funding system, and presumably to operate with a greater degree of agility than existing agencies. This should not, however, preclude full scrutiny of its development and operation once established, given it will be allocating public funds. We urge the Committee to continue to take a keen interest in the development of UK ARPA as part of its ongoing scrutiny of research funding in the UK.
16. There is a need for transparent and timely communication with academic and business communities to ensure the agency is fulfilling an appropriate need; relevant partners are involved; and suitable monitoring, evaluation and improvement of processes can take place. This should include transparency regarding:

- a. the intended aims of the establishment of UK ARPA
 - b. its development and governance
 - c. decisions underlying its funding allocations, made according to published criteria
 - d. decisions on whether to continue or end funding for existing projects, based on a transparent process of regular review and in line with published criteria.
17. It will be important for the development of the agency to involve ongoing consultation with the research community, including funders, health and medical organisations, business and commercial organisations, and third sector organisations, to ensure it is meeting its intended aims whilst avoiding duplication.
18. It is not clear whether the new agency will fund people (i.e. through fellowships), programmes of research, or a combination. There is an opportunity to consider new ways of supporting:
- a. co-location of people;
 - b. greater mobility and fluidity between universities and other sectors, over both the short and long term (e.g. through jointly funded fellowships, secondments, shared research programmes etc.);
 - c. funding opportunities at all research career stages, recognising that innovative and high-risk ideas are not solely generated by those in established academic positions.
19. ARPA's processes should embed consideration of how to increase diversity in research, including of people and disciplines, and commitment to responsible research and innovation.

D. What funding should ARPA receive, and how should it distribute this funding to maximise effectiveness?

20. The budget proposed for UK ARPA is substantially less than the budget of US DARPA in absolute terms, which may limit its impact in relative terms, although they are relatively similar as a proportion of the total UK and US public R&D budgets respectively. UK ARPA's budget is £800m to be spent over five years;⁵ this averages £160m per year, which represents 1.5% of BEIS' £10.36bn public R&D budget for 2020/21⁶ (or 1.2% of the expected £13bn⁷ total public UK R&D spend across all Government departments). The \$3.56bn US DARPA budget makes up 2.65% of the US federal R&D budget for 2020, which totals \$134.1bn⁸.
21. Following the initial five years of UK ARPA, a review should take place to identify whether and to what extent it requires more annual funding in order to fulfil its purpose.
22. It will also be crucial for the development of UK ARPA to learn lessons from the establishment of strategic initiatives, many of which have been created since the formation of UKRI. This includes the Industrial Strategy Challenge Fund, particularly in terms of the transparency of the process (how ISCF areas are selected) and recently established national research institutes. UCL is a founding partner in many such institutes (Crick, Henry Royce, Alan Turing, Rosalind Franklin, Dementia Research Institute) and is aware of the complexities involved in their creation, including practical operations (e.g. different legal structures, secondments, HR and tax issues), institutional commitments, and financial sustainability.
23. The new funding agency should ensure that it signals missions and strategic intent in advance to allow teams to form around key priorities. It should avoid rapid response funding calls in quick succession with no time for the community to prepare. These are particularly problematic in the case of rapid funding announcements of major programmes that require new governance and operational structures to be quickly set up.
24. Any programmes established by DARPA must be financially sustainable in the long term.⁹ This will require:
- a. a 'batteries included' approach, i.e. provision of funding for ongoing running costs, in addition to set-up costs
 - b. provision of funding at the full economic cost of research (see para. 14)

- c. a clear pathway for continued support and future funding for the most promising research projects, including from industry.
25. As described in para. 6, a risk-taking approach to funding should be taken. This should entail appropriate devolved decision making for each societal challenge with a sufficient longer term budget to allow decisions to be made rapidly.
 26. As mentioned at 16(d), systems should be in place to ensure regular review of ARPA projects, with transparent criteria for ending or continuing funding. There should also be systems in place for scaling up funding, when initial funding has led to promising results.
 27. With current uncertainty as to whether the UK will participate in European research funding after the end of the year, consideration should be given to how ARPA might fulfil the role of a UK version of the European Research Council, as proposed in the Smith-Reid report,¹⁰ with a focus on high-quality, long-duration research grants.

E. What can be learned from ARPA equivalents in other countries?

28. While the US DARPA has seen impressive successes, caution should be taken when inferring lessons given the entirely different context, including time period (e.g. post-World War II) and funding volume (as noted in para.20). Many DARPA technologies originated at a particular point in the development of technology industries and the innovation system.¹¹
29. Consideration will need to be given to the extent to which UK ARPA should adopt each aspect of existing ARPA-like models, in particular the US DARPA model. Inevitably there will be a level of selectivity in terms of which aspects are adopted; regular review of how these are working will be essential, especially given the UK present-day context.
30. For instance, a key aspect of US DARPA has been the use of programme managers, each of which conceives and owns a research programme. Individuals in these roles are effectively risk-taking, idea-driven entrepreneurs, with near complete autonomy over decision-making within their programme.¹² This model is incompatible with peer review, which the UK research funding system depends on and values enormously. Consideration will need to be given to how the use of programme managers could or should be adapted for the UK context, and how clear accountability for the use of public funding is maintained.
31. A recent paper¹³ discussing evidence on national innovation policy practice from Finland, the Netherlands and Sweden concluded that, for innovation policy to tackle societal challenges effectively, there is a need for clear goals and effective coordination among the various actors, both public and private.
32. This is echoed in a 2012 report¹⁴ on 'lessons learned' by Sweden's Innovation Agency VINNOVA, which established an ARPA-like challenge-driven innovation programme in 2011. The report notes the value of "active collaboration programmes between companies and universities". It also highlights the importance of the agency's role in "identifying and defining new needs-driven fields of research, in dialogue with stakeholders", a role that "neither peer review nor industry-led consortia can fulfil on their own".
33. UK ARPA can also learn from public-private partnerships under Horizon 2020 that have sought to address major socio-economic challenges.¹⁵ These programmes have successfully engaged the major actors in research and innovation in relevant industrial sectors, leveraged substantial private funding and, through a long-term concerted effort, linked activities across the innovation cycle, from research to closer-to-market activities.¹⁶
34. The value of taking a missions-oriented approach to innovation (as recommended for ARPA in para. 4) is illustrated by the design of the upcoming EU Framework Programme Horizon Europe, of which missions form an integral part.¹⁷ Informed by an EU-commissioned report by

Mariana Mazzucato,¹⁸ the Horizon Europe missions each seek 'to solve a pressing challenge in society within a certain timeframe and budget'.¹⁹

F. What benefits might be gained from basing UK ARPA outside of the 'Golden Triangle' (London, Oxford and Cambridge)?

35. The geographical location of a new funding agency is less important than ensuring that it strengthens research capability and drives the application and impact of excellent research across the country, both within and beyond those regions in which it is undertaken.
36. ARPA should foster collaborations aimed at clear national benefit – this is likely to involve both forming new research clusters and drawing from existing areas of research strength, including those within the 'golden triangle'. In particular, we would welcome new incentives for interregional collaboration between research-intensive institutions (including those in the 'golden triangle') and other universities, intermediary, commercial and other organisations across the country to harness their respective strengths and address societal need.
37. Collaborations that aim to stimulate local economic development (as a primary or secondary output) should involve in depth consultation with local stakeholders who have a first-hand understanding of the issues to which the research relates. This is key to stimulate bottom-up solutions with high feasibility and potential for impact.
38. To fulfil the aim of fostering collaboration, there is value in locating ARPA and its programmes in proximity to stakeholders including universities and businesses. It will be important for ARPA to develop strong networks with other parts of the UK R&D ecosystem, including Government Departments, research charities and research-intensive businesses, to ensure it has the necessary influence to achieve its ambitions.
39. We can also learn from the value of the proximity of research and other institutions with businesses for supporting partnerships and the diffusion of innovation. Examples include:
 - a. The **Advanced Manufacturing Research Centre (AMRC) at the University of Sheffield**: The AMRC brings together staff at universities and companies, and is based around partnerships with large companies. Through its partnership with Boeing, the AMRC has attracted high value manufacturing facilities into a deindustrialised region, stimulating the rebuilding of innovation systems.
 - b. The **East London Inclusive Enterprise Zone**: A partnership between local government, universities, disability organisations and businesses, the first dedicated space for disabled entrepreneurs at the Olympic Park aims to "bring a positive impact on the local east London community, creating thriving new businesses, employment and growth, aligning with LLDC and Hackney Council goals".²⁰
40. We recognise that there are strong variations in the levels of R&D investment across UK regions. We also note the importance of the principle of funding research according to excellence. We suggest that any assessment of the geographic distribution of funding – if used to inform ARPA funding decisions – should take into account the scale and characteristics of the region, including factors such as population size, number of universities, concentration of businesses, or makeup of the workforce.^{21,22} It should also take account of where the benefits of successful projects are felt, which may involve a different set of considerations. For example, research providing a step change in digital connectivity may revolutionise life in sparsely populated areas of the UK.

References

¹ Missions (Mazzucato 2018) create cross-disciplinary, multi-actor networks to solve societal issues through a diverse range of policy actions

² https://www.ucl.ac.uk/bartlett/public-purpose/sites/public-purpose/files/iipp_policy_brief_09_missions_a_beginners_guide.pdf

³ <https://www.gov.uk/government/publications/budget-2020-documents/budget-2020>

⁴ <https://www.officeforstudents.org.uk/data-and-analysis/trac-data/published-data-2018-19/>

⁵ <https://www.conservatives.com/our-commitments/investing-in-research-and-development>

⁶ <https://www.gov.uk/government/publications/beis-research-and-development-rd-budget-allocations-2020-to-2021/beis-research-and-development-budget-allocations-2020-to-2021>

⁷ <http://www.sciencecampaign.org.uk/news-media/case-comment/beis-research-budgets-set-uk-on-the-path-to-2-4-.html>

⁸ https://www.whitehouse.gov/wp-content/uploads/2019/03/ap_21_research-fy2020.pdf

⁹ https://www.ucl.ac.uk/research/sites/research/files/principles_for_uk_research_institutes_may_2018_full_paper.pdf

¹⁰ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/844488/Changes_and_Choices.pdf

¹¹ 'Understanding the ARPA/DARPA Model and some implications for the UK research base', Dr Eoin O'Sullivan, Centre for Science, Technology & Innovation Policy, University of Cambridge

¹² Van Atta (2007)

¹³ <https://link.springer.com/article/10.1007/s10842-019-00332-1>

¹⁴ <https://www.vinnova.se/contentassets/c3cbb583e3d0470f8c78f92b5070e8/va-12-01.pdf>

¹⁵ http://ec.europa.eu/research/evaluations/pdf/20171009_a187_swd.pdf#view=fit&pagemode=none

¹⁶ Ibid

¹⁷ https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en

¹⁸ <https://op.europa.eu/en/publication-detail/-/publication/5b2811d1-16be-11e8-9253-01aa75ed71a1/language-en/format-PDF>

¹⁹ https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en

²⁰ <https://www.ucl.ac.uk/enterprise/news/2019/sep/uks-first-dedicated-space-disabled-entrepreneurs-open-queen-elizabeth-olympic-park>

²¹ There is no uniquely authoritative way of describing the geographic distribution of research funding. When taking into account regional population size, number of HEIs and GVA (local GDP), while the East of England receives a high proportion of funding on all measures and the North East, Wales, and Yorkshire and the Humber are consistently low, the pattern of distribution across other regions, including the South East, varies. For example, the 'golden triangle' regions of London, the South East and East of England contain large numbers of universities and researchers, dense populations and a large proportion of the UK economy which can help to explain the apparent 'concentration' of research funding.

See: <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/science-and-technology-committee/balance-and-effectiveness-of-research-and-innovation-spending/written/90359.pdf>

²² Chaytor, S and Reid, G (May 2019). The geography of UK R&D. Research Fortnight, 1 May 2019