

A NEW UK RESEARCH FUNDING AGENCY ROYAL SOCIETY OF EDINBURGH RESPONSE

The new agency should look to take on big, societal challenges. The timeframe for research will be important, as will confidence that funding will be available in the medium and long term.

UK ARPA should be established with a clear agenda, distinct from that of the existing Research Councils. The adoption of a high-risk culture would set it apart and add true value to the research and development ecosystem.

Coordination across relevant Government departments and the devolved administrations will be essential in the success of the new agency. UK ARPA will also require a high level of operational independence to be truly effective.

To succeed, the new agency will require strong, independent leadership; a flat structure with extensive networking; recruitment of innovative scientists, and programme directors; and capacity to proudly embrace the high-risk nature of research.

Serious consideration will be required over the choice of long-term mission and there must be genuine informed debate over which major challenges the new agency takes on.

A strategic public-sector customer of sufficient risk-appetite will be required. The UK Government will need to consider carefully what action needs to be taken to fill this role for the new agency.

While the RSE would welcome a decision to base the new agency outside the “Golden Triangle”, of greater importance is that it provides opportunities to the most talented young scientists and harnesses expertise wherever it is found within the UK. Serious consideration should be given to whether the new agency could be established as a virtual organisation.

Summary

Introduction

- 1 The Royal Society of Edinburgh (RSE) is pleased to have the opportunity to respond to the Science and Technology Committee’s inquiry into a New UK Research Funding Agency.
- 2 As Scotland’s National Academy, RSE maintains a close interest in the Scottish and UK research landscape. The Society, harnessing the multidisciplinary expertise of its Fellows, has submitted evidence to the following related inquiries in recent years:
 - **Future Frameworks for International Collaboration on Research and Innovation**¹
 - **Scottish Research Pooling**²
 - **Balance and Effectiveness of Research and Innovation Spending**³
 - **Developing a Shared Vision for a Future UK/EU Partnership for Research and Innovation**⁴
 - **Nurse Review of Research Councils**⁵
- 3 In preparing this response we have explored the operations of the Defense Advanced Research Projects Agency in the USA and consulted a variety of sources.^{6, 7, 8, 9, 10}
- 4 The RSE would welcome the opportunity to discuss the response further with the Science and Technology Committee as it continues its inquiry.

Question 1 What gaps in the current UK research and development system might be addressed by an Advanced Research Projects Agency (ARPA) style approach?

- 5 The RSE welcomes discussion around new approaches to research funding in the UK. Funding gaps do exist in the UK research and development system, particularly for research considered to be high risk and large-scale.

- 6 UK Research and Innovation (UKRI) lacks the flexibility to fund large-scale, high-risk initiatives, with near-term impact too often the focus. As the funding of high-risk research is not well catered for in the current environment, a new agency that brings an ARPA-style approach (hereafter referred to as UK ARPA) could play an important role in providing a remedy while simultaneously freeing up UKRI to focus on research to advance the frontiers of knowledge and direct industry demand-led projects through Innovate UK.
- 7 UK ARPA should, from the outset, foster a culture of taking on big, societal challenges. The timeframe for research will be equally important, as will confidence that funding will be available in the medium and long term to allow the ‘pull-through’ and realisation of the economic and societal benefits arising from innovation.
- 8 The funding gaps that currently exist in the UK landscape occur at either end of the funding spectrum. While technologies with a low Technology Readiness Level (TRL) struggle to gain support, so too do demonstrations of much higher TRL technologies that require funding to be proven at scale. Carbon Capture, Usage and Storage (CCUS) technology – having existed for some time but having never received adequate funding to prove its feasibility at scale – is a prime example of the latter. It is not difficult to envisage how an agency willing to accept high levels of risk and with a mission to combat climate change, could help pull through such technologies to market.

1 <https://www.rse.org.uk/advice-papers/future-frameworks-for-international-collaboration-on-research-and-innovation/>

2 <https://www.rse.org.uk/advice-papers/response-to-scottish-funding-council-on-research-pooling/>

3 <https://www.rse.org.uk/advice-papers/balance-and-effectiveness-of-research-and-innovation-spending/>

4 <https://www.rse.org.uk/advice-papers/revision-developing-shared-vision-future-uk-eu-partnership-research-innovation/>

5 <https://www.rse.org.uk/advice-papers/nurse-review-of-research-council/>

6 <https://policyexchange.org.uk/wp-content/uploads/Visions-of-Arpa.pdf>

7 <https://www.cbi.org.uk/media/4040/arpa-position-paper-no-watermark.pdf>

8 <https://policyexchange.org.uk/wp-content/uploads/2016/09/eight-great-technologies.pdf>

9 <https://www.wired.co.uk/article/dominic-cummings-british-darpa>

10 <https://ftalphaville.ft.com/2020/05/19/1589899964000/A-proposal-for-the-UK-s-answer-to-Darpa/>

Question 2 *What are the implications of the new funding agency for existing bodies and their approach?*

Relationship with Existing Funding Agencies

- 9** The relationship between the new agency and existing bodies will be critical. Establishing UK ARPA within the existing UKRI framework may offer some administrative efficiencies. However, this risks UK ARPA being subsumed within the existing ethos, thus hampering the adoption of the high-risk culture that would both set it apart and add true value to the research and development ecosystem.
- 10** Ensuring the new agency is established with a clear agenda, distinct from that of the existing Research Councils (RCs), is paramount. The current UK research and development landscape is complicated and if UK ARPA does not possess autonomy coupled with a clear identity and purpose there is a risk that it simply becomes one more agency amongst an already crowded field, resulting in the duplication of effort and unnecessary increases to spending.
- 11** The RSE is supportive of UK ARPA funding the type of blue skies, speculative, high-risk research with the potential for high economic returns and societal benefits that is currently struggling to win financial support under the current UKRI system. The establishment of UK ARPA could free up UKRI to continue to fund research to advance the frontiers of knowledge.
- 12** Indeed, to ensure a clear distinction between the agencies, UKRI could be tasked with adopting a role like that of the European Research Council (ERC), with UK ARPA focussing on high-risk research that will very likely require large scale up-front, flexible and longer-term investment.

Relationship with Government

- 13** To gain the most benefit, UK ARPA should be established as quickly as possible and with a clear connection to an influential UK Government department. Coordination across relevant Government departments and the devolved administrations will be essential. UK ARPA

will require a high level of operational independence to be truly effective while also having a strong and influential “sponsor” within Government.

- 14** The UK Space Agency serves as one potential illustration of how UK ARPA could be connected to Government, being an Executive agency, sponsored by the Department for Business, Energy and Industrial Strategy (BEIS), but with links into a number of other UK Government activities. Irrespective of the sponsoring department, the new agency will require safeguards to guarantee independent governance and operations.
- 15** Governments understandably, look to put their stamp on all areas of policy, including research and development. The type of research being funded by the new agency is likely to span election cycles and so cross-party buy-in for the proposals over the long-term will be key.

Question 3 *What should the focus be of the new research funding agency and how should it be structured?*

Principles and Mission

- 16** Setting out key principles on how the new agency will operate is an important first step. These should include:
 - Being driven by strong independent leadership;
 - Utilising a flat, non-hierarchical structure with extensive networking;
 - Recruiting visionary, able, decisive and innovative researchers, and programme directors;
 - Proudly embracing the high-risk nature of research;
 - Relying on a multidisciplinary and geographically broad range of expertise;
 - Empowering early career scientists and researchers with credible but high-risk ‘big ideas’.

- 17** Serious consideration will be required over the choice of long-term mission assigned to UK ARPA. While there must be genuine informed debate over which major challenge(s) UK ARPA takes on, thereafter decisions on the approach to addressing the challenges need to sit with the UK ARPA leadership. They must have the autonomy to open new avenues of research and quickly close-off those proving to be unproductive.
- 18** As stated, an ARPA-style approach is ideal for tackling big, bold, societal challenges, such as climate change, health or antimicrobial resistance. Whichever areas are selected for initial investment, UK ARPA leads must retain flexibility in their approach and be encouraged to harness expertise from any discipline.

Intelligent Customer

- 19** For UK ARPA to succeed, a strategic public-sector customer of sufficient risk-appetite will be required. While the Department of Defense has served this function in the US model, the UK Government will need to consider carefully what action needs to be taken to fill such a role for the new agency. The mission adopted by UK ARPA will likely dictate who such an intelligent customer may be.
- 20** For example, should the new agency adopt a health focus, the NHS would seem the natural body to adopt the role of customer. This will require driving significant changes in procurement policies and a change in attitude towards innovation. Meaningful engagement with those working on the frontlines of the health service would also be required to determine what research could prove of most benefit to them and to establish target product-profiles (TPPs).
- 21** Should a mission such as climate change be the focus of UK ARPA, a government department without the equivalent budget of the Department for Health and Social Care in the Health sphere would struggle to function as a strategic customer. More creative solutions to this problem will be required including changes to public procurement and buy-in from all government departments.

Industry Involvement

- 22** The type of transformational research UK ARPA is envisaged to fund more typically takes place in the private sector. Serious thought is required as to how the new agency would successfully tap into industry and the availability of funding for shared-risk projects with an accessible market would be a significant incentive.

Leadership and Staff

- 23** Strong and consistent leadership will be important to the success of UK ARPA and so establishing a structure of independent advisors and independent governance will be paramount. The overarching goals and philosophy of the organisation, however, should transcend the individuals taking stewardship of the agency.
- 24** Ensuring that the very best programme directors, early career scientists and researchers can be recruited and retained will be a significant challenge, but one that must be overcome for UK ARPA to succeed. People of the right calibre will only be attracted if they can be confident that they are taking a positive career step into an area that will allow them:
- Opportunities for progression and secondment;
 - Access to significant funding;
 - Broad freedom to follow whatever path the research may take;
 - To undertake high-risk research without fear that they may be judged on the basis of failure resulting from research avenues that simply prove to be unproductive.
- 25** Of equal importance will be ensuring that the UK is viewed as a welcoming and desirable destination for scientists and researchers from across the world and maintains an immigration system that facilitates their arrival. Indeed, by some estimates, for the UK to reach its goal of investing 2.4% of GDP in R&D by 2027 it will need to increase the number of researchers by 50%.¹¹ To this end, RSE welcomed the decision by the UK Government to remove the cap on the number of scientists entering the country through the Global Talent visa route when this was launched in February.

¹¹ <https://royalsociety.org/-/media/policy/Publications/2019/international-visa-systems-explainer-july-2019.pdf> p3

- 26** UK ARPA should consider placing an emphasis on empowering young scientists and researchers to reach their potential. Famously, the 1960s “moonshot” was staffed by young innovative people, with an average age in Mission Control during the Apollo 11 mission of just 26 years.¹²

Measuring Success

- 27** While the RSE stresses the importance of embracing the nature of high-risk research – and inherent failures that will occur – clearly there must be a level of success for an agency to add value. Deciding the metrics or criteria by which performance of the new agency will be determined is an important issue for consideration. Should UK ARPA achieve too many successes it will not be taking on projects of sufficiently high risk; too few successes and the agency will likely lose political and public support.

Question 4 What funding should ARPA receive, and how should it distribute this funding to maximise effectiveness?

- 28** The RSE strongly supports the UK Government’s commitment to increase R&D spending to 2.4% of GDP by 2027. While the Government has committed to investing at least £800 million in the new research funding agency, this backing is to be spread across the current UK Parliamentary term and hopefully represents an initial investment.¹³
- 29** UK ARPA should provide funding for the full cost of any project (Full Economic Costing / FEC), which includes all running costs for the research, day-to-day expenses, staffing, travel, and costs of access to facilities and infrastructure.
- 30** High levels of up-front funding followed by a lengthy period of follow-on funding may be required especially where initial lines of research are leading to significant progress and proving to be productive.

Question 5 What can be learned from ARPA equivalents in other countries?

- 31** There appear to be a limited number of agencies of equivalence to ARPA outside of the United States other than those that have a specific defence and security focus. In the last two years France and India have both launched new research agencies. The Defence Innovation Agency (Agence de l’Innovation de Defense) is housed within the French Government’s Defence procurement and technology agency, while the Defence Space Research Agency in India sits within the country’s armed forces in the tri-service Defence Space Agency.
- 32** In the United States, the Advanced Research Projects Agency – Energy (ARPA-E) was established in 2009, and modelled after DARPA, to facilitate breakthroughs in the energy sector. A 2017 study from the National Academies of Sciences, Engineering and Medicine (The National Academies)¹⁴ concluded that while it was still too soon to assess whether ARPA-E had achieved its mission and goals, its focus on funding “high risk, potentially transformative technologies”¹⁵ was a strength. Likewise, the report highlighted the empowerment of programme directors to take risks and found no indication that short-term project performance was reduced by this. The report did, however, note that the challenge faced by ARPA-E in taking technology through to market may prove more difficult than originally thought.¹⁶ Without (and likely even with) the Ministry of Defence as an intelligent customer for UK ARPA this will also pose a considerable challenge to the new agency in the UK.

¹⁴ <https://www.nap.edu/download/24778#>

¹⁵ <https://www.nap.edu/download/24778# p12>

¹⁶ <https://www.nap.edu/download/24778# p11>

Question 6 *What benefits might be gained from basing UK ARPA outside of the ‘Golden Triangle’?*

- 33** While RSE would welcome a decision to base UK ARPA outside the “Golden Triangle”, of greater importance is that the new agency provides opportunities to the most talented young researchers and harnesses expertise wherever it is found within the UK.
- 34** Serious consideration should be given to whether the new agency could be established as a virtual organisation. It is vital that UK ARPA is distinct from existing RCs and operating as an online, networked and geographically spread agency is just one way a new culture could be promoted. The experience of the COVID-19 pandemic has accelerated the move to wider adoption of remote operations in research and innovation – a move readily adopted by UK researchers familiar with global cooperation on major international research projects. Operating remotely could also bring other benefits, including lowering UK ARPA’s carbon footprint, reducing travel and meeting times for staff, and widening the available talent pool.
- 35** The Society accepts, however, that as UK ARPA will rely on a hands-on management style from empowered programme directors, and, particularly in its nascent years, will be creating a new culture of embracing high-risk research, face-to-face contact may be equally important in this early phase.

Additional Information

Any enquiries about the Advice Paper should be addressed to Craig Denham (cdenham@therse.org.uk).

Responses are published on the RSE website (<https://www.rse.org.uk/>)

The Royal Society of Edinburgh, Scotland's National Academy, is Scottish Charity No. SC000470

Advice Paper (Royal Society of Edinburgh) ISSN 2024-2694

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