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A new UK research funding agency

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Report, together with formal minutes relating to the report

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Science and Technology Committee

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Contacts

All correspondence should be addressed to the Clerk of the Science and Technology Committee, House of Commons, London, SW1A 0AA. The telephone number for general inquiries is: 020 7219 2793; the Committee's e-mail address is: scitechcom@parliament.uk.

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The December 2019 Queen's Speech set out the Government's intention to establish "a new approach to funding emerging fields of research and technology", which would "provide long term funding to support visionary high-risk, high-pay off scientific, engineering, and technology ideas". The previous Queen's Speech—in October 2019—had explained that this would be "broadly modelled" on the US Defense Advanced Research Projects Agency (DARPA), which was created in 1958 (initially as ARPA) with the purpose of forming and executing research and development projects to expand the frontiers of technology and science.

This Report examines the Government's proposal to establish a new UK research funding agency and sets out our findings on the need for the new agency, the role the new agency could play and how the new agency should be established and function. We also set out a small number of recommendations which relate to the current research and innovation landscape.

Key findings—a new UK research funding agency

In this Report we welcome the Government's commitment to allocate £800 million of public money for the funding of high risk, high reward research that has the potential to address a number of perceived gaps in the current UK research and innovation system. However, more than a year after its inclusion in two successive Queen's Speeches, the Government has not clearly articulated the need for, or intended remit of, the proposed agency. To date, it seems to be a brand in search of a product.

We consider on balance that there can be a role for a body that sits outside and operates in a different way to the established UK research funding mechanisms, with a different culture and which is able to operate free of some of the structures that are necessary for the dominant research funding institution.

We conclude that UK ARPA can play an important role in the research and innovation system by pursuing goal-oriented research, driven by societal need, with the potential to produce lasting, transformational changes. We recommend that UK ARPA should focus on 'mission-based' or 'challenge-led' research, aligned with the long-term goals of the nation, which has the potential to make transformative changes with implications for the economy and wider society.

Questions about UK ARPA's remit, organisation and governance would be made much more straightforward if the agency was established to serve a clear 'client'—most likely a Government department, as is the case with US DARPA, which serves the Department of Defense. Potential candidates for a UK ARPA could include the Department of Health and Social Care (for a life sciences-focussed agency), the Department for Business, Energy and Industrial Strategy (for a Clean Energy/Net Zero mission) or the Ministry of Defence.

We conclude that if the Government wants UK ARPA to pursue research programmes with the potential to have transformational effects on society—and its proposals suggest that it does—UK ARPA must, firstly, fund research that would be considered too risky

by the existing research and innovation system and be prepared for some programmes to fail. Secondly, the Government must accept that these projects will take a long time, potentially 10–15 years, to 'bear fruit'. Therefore the Government must guarantee long-term funding for the agency and the programmes it will fund.

Further, we recommend that, given the size of UK ARPA's proposed budget, the new agency should focus on no more than two central missions. The Haldane principle should not apply to how UK ARPA's overall focus is determined. Ministers should play a role in shaping ARPA's initial focus.

We call on the Government to think carefully about what the new agency's focus might be before recruiting a director. The Government should be open minded on who the agency's director might be, should not disregard anyone at this early stage, and should be open to appointing an individual with a bold vision, creativity and drive. Further, we find that the new director must be committed to creating a culture that empowers and emboldens UK ARPA's employees.

We conclude that UK ARPA should have a distinct and flexible organisational structure. The Government should seek to create an environment characterised by a high degree of autonomy and limited bureaucracy. The Government should explain how it intends to establish and foster this culture in the new agency. UK ARPA's director should play a key role in the recruitment of its personnel. We recommend that the Government explain how UK ARPA's programme managers can be appointed outside normal pay restrictions in order to ensure that they are sufficiently remunerated.

In this Report, we recognise that although there could be advantages to establishing the new UK research funding agency inside UKRI (it would be quicker and would facilitate its communication and collaboration with the existing research and innovation system), we note concerns that UK ARPA might not be able to operate effectively with sufficient freedom if it was situated inside UKRI's framework, for example, by being unable to pursue 'novel and contentious' activities without case-by-case Ministerial approval. On balance we agree with these concerns. To be effective, the new UK research funding agency must be able to pursue 'novel and contentious' activities without case-by-case Ministerial approval. If this is not possible within UKRI then we find there is merit in the Government establishing UK ARPA as a separate entity. Therefore, the Government must clarify whether it intends to establish UK ARPA as a separate body or an agency within UKRI. In doing so, it should be clear about whether this will require primary or secondary legislation and the likely timescales involved.

Key findings for the R&I system

In this Report we also explore some wider issues that apply to the existing research and innovation ecosystem, which arose in the course of our inquiry.

The multi-year funding settlement for UKRI set out in the November 2020 Spending Review is welcome and not only provides much-needed certainty to UKRI and the wider research community but helps UKRI support public and private sector contributions

to the post-coronavirus pandemic recovery. We urge the Government to maintain multi-year funding settlements for science and encourage it to build on this through additional multi-year settlements in future Budgets and Spending Reviews.

We conclude that it is right that UKRI is held accountable for the public money it spends, but the temptation to micromanage it must be considered alongside its need to operate in an agile and efficient way. We call on the Government to carry out a review, commencing before the end of the next financial year (i.e. 2021–2022), to explore how UKRI can operate with fewer bureaucratic constraints and more freedom and flexibility in how it allocates funds, while ensuring that it is held accountable.

We find in this Report that there is scope for improvements with respect to equality, diversity, inclusion and accessibility in the current research and innovation system, as illustrated by the 2014–15 to 2018–19 data from UKRI. We welcome UKRI's commitment to expanding its equality, diversity, inclusion and accessibility data collection and analysis capabilities. We recommend that UKRI set out when it will publish its equality strategy and call on the strategy to outline how UKRI intends to improve the effectiveness of its equality, diversity, inclusion and accessibility processes and policies and how the effects will be measured and demonstrated.

1 Introduction

1. The December 2019 Queen's Speech set out the Government's intention for:

> a new approach to funding emerging fields of research and technology. It will provide long term funding to support visionary high-risk, high-pay off scientific, engineering, and technology ideas.[1]

The October 2019 Queen's Speech briefing note explained that this would be "broadly modelled" on the US Defense Advanced Research Projects Agency (DARPA), which was created in 1958 (initially as ARPA) with the purpose of forming and executing research and development projects to expand the frontiers of technology and science.[2] US DARPA employs 'programme managers' on 3–5 year contracts to fund high-risk, high-reward research. Its budget in financial year 2019–20 was $3.43bn (approximately £2.65bn).[3]

2. The March 2020 Budget stated that the Government would "invest at least £800 million" in this "blue skies" funding agency, which would fund "high risk, high reward science".[4] It has been reported that this funding would be guaranteed over five years.[5] The November 2020 Spending Review, which stated that the first £50 million of the £800 million earmarked for "high risk, high-payoff" research would be included in the £350 million allocated to UKRI for 2021–22, did not mention the new agency.[6]

3. The Government's proposals for the new funding agency are set out in the written evidence it submitted to this inquiry, in addition to oral evidence from the Science Minister.[7] Both are referred to throughout this Report.

Our inquiry

4. We launched our inquiry on 9 April 2020 with a call for evidence covering the need for this new agency, what it should focus on, and how it should operate. We received over 100 written submissions and took oral evidence from 12 witnesses, including representatives from international research agencies (including US DARPA), UK research and innovation policy experts, a former Science Minister, the current and former CEOs of UK Research and Innovation—as well as its current Chair—and the Minister for Science, Research and Innovation, Amanda Solloway MP. We are grateful to everyone who contributed to our inquiry.

Aims of this Report

5. In this Report, we explore the rationale for a new UK research funding agency, what it should focus on, how it should operate, where it might fit in the current research and innovation system and, finally, its implications for the wider system. Specifically:

1 Prime Minister's Office, The Queen's Speech December 2019 background briefing notes (December 2019), p106
2 Prime Minister's Office, Queen's Speech Lobby Pack 2019 (December 2019), p93
3 Defense Advanced Research Projects Agency, Budget, accessed 7 January 2021
4 HM Treasury, Budget 2020, HC (2019–21) 121, March 2020, p 60
5 Policy Exchange, Visions of Arpa (January 2020), p 23; UK drops pledge on new innovation funding body, Science Business, 19 December 2019
6 HM Treasury, Spending Review 2020, Cm 330, November 2020, p 79
7 Department for Business, Energy and Industrial Strategy (RFA0052)

- in Chapter 2, we begin by providing an overview of the existing research and innovation system and the recent changes to its form and function followed by an assessment of the need for this new agency and the gaps in the current system that it might fill;
- in Chapter 3, we consider what UK ARPA should focus on, how its focus should be determined, and how the agency should operate. This is followed by an appraisal of its potential place in the current research and innovation system—whether it should be situated inside or outside UKRI—and how UK ARPA should interact with existing parts of the system; and
- in Chapter 4 we set out UK ARPA's implications for the current system, i.e. how it can be improved and address some of the gaps in it identified by the evidence submitted to this inquiry.

6. Unless stated otherwise, the recommendations in this Report ask the Government to set out its plans in a distinct policy paper that should be published before the end of the next financial year (i.e. 2021–2022).

2 Is there a need for a new UK research funding agency?

7. This Chapter explores the rationale for a new UK research funding agency, in the form of a UK ARPA, and considers whether there is a need for it. It does so by assessing the existing UK research and innovation system and the perceived gaps that a new research funding agency might fill.

The UK research and innovation system

8. The UK research and innovation landscape has changed significantly in recent years:

- in November 2017, the then Government published its White Paper *Industrial Strategy: building a Britain fit for the future*, which set a target of investing 2.4% of GDP in R&D by 2027;[8] and
- following Sir Paul Nurse's Review of UK Research Councils in 2015—which characterised the research and innovation system as providing three main 'types' of research (see paragraph 18 for a description of the different types of research)—UK Research and Innovation (UKRI) was formed in April 2018.[9] UKRI is a non-departmental public body and it brought together the seven UK Research Councils, Innovate UK and Research England.[10]

9. In the March 2020 Budget, the Chancellor announced that public investment in R&D would reach £22 billion by 2024–25. The Royal Society welcomed this "significant increase" in R&D investment,[11] as did the membership organisation CaSE (the Campaign for Science and Engineering).[12] Eight months later, the 2020 Spending Review confirmed that the Government would invest £14.6 billion in R&D in 2021–22.[13] CaSE Assistant Director Daniel Rathbone stated that this level of investment would keep the UK "on track" to reach the Government's £22 billion goal.[14]

Industrial strategy

10. The Government's 2017 Industrial Strategy white paper set out a "long-term plan to boost the productivity and earning power of people throughout the UK", including R&D investment.[15] It used a 'blended' approach combining (i) horizontal, (ii) sectoral and (iii) mission-based policies.[16] 'Horizontal' policies address market-wide issues; 'sectoral' (or 'selective') policies address a specific sector of the economy; and a mission-driven strategy uses economic policy to pursue solutions to particular public policy challenges. The Five Foundations—'horizontal' policies that underpinned the strategy—sought to have an impact on all sectors of the economy.

8 HM's Government, Industrial Strategy: building a Britain fit for the future (November 2017), p 66
9 Sir Paul Nurse, Ensuring a successful research endeavour (November 2015), p 4
10 The Royal Society, UKRI Explainer (October 2019), p 2
11 The Royal Society, Budget response 2020, accessed 7 January 2021
12 Campaign for Science and Engineering, CaSE reflections on the 2020 budget, accessed 7 January 2021
13 HM Treasury, Policy paper: Spending Review 2020, accessed 7 January 2021
14 Campaign for Science and Engineering, CaSE responds to 2020 spending review, accessed 7 January 2021
15 HM's Government, Industrial Strategy: building a Britain fit for the future (November 2017)
16 Industrial Strategy, Briefing Paper CBP7682, House of Commons Library, August 2019

11. In addition, the Industrial Strategy set out four 'Grand Challenges' which aimed to "put the UK at the forefront of the industries of the future, ensuring that the UK takes advantage of major global changes".[17] They were:

- artificial intelligence and data;
- ageing society;
- clean growth; and
- future of mobility.

12. The Industrial Strategy Challenge Fund (ISCF), which is managed by UKRI, provides funding for projects that fall within these four themes. As of 23 November 2020, around £5.6 billion (£2.6 billion of public money and £3 billion in matched funding from the private sector) had been invested in projects through the ISCF.[18] UKRI's former CEO, Professor Sir Mark Walport, described the ISCF as a "completely new form of funding" that has "a number of ARPA-like features".[19]

UKRI

13. Six months after the Government published its Industrial Strategy, UKRI was formed (in April 2018). It was formally established through the Higher Education and Research Act 2017 following Sir Paul Nurse's Review of UK Research Councils in 2015.[20] The Research Councils and Innovate UK operate across the UK. Funding of higher education institutions, however, is a devolved matter.[21] As such, Research England effectively replaced the Higher Education Funding Council for England, while the devolved equivalents remained in place.[22,23]

UKRI's purpose

14. The purpose of UKRI was to create a joined-up, cross-disciplinary funder of research and innovation in the UK.[24] The Government argued that its creation offered "an opportunity to strengthen the strategic approach to future challenges and maximise value from the Government's investment of over £6 billion per annum in research and innovation".[25] It sought to deliver:

17 Department for Business, Energy and Industrial Strategy, Policy Paper: The Grand Challenges, accessed 7 January 2021
18 UK Research and Innovation, What is the Industrial Strategy Challenge Fund, accessed 7 January 2021
19 Q71
20 Sir Paul Nurse, Ensuring a successful research endeavour (November 2015)
21 Arts and Humanities Research Council; Biotechnology and Biological Sciences Research Council; Engineering and Physical Sciences Research Council; Economic and Social Research Council; Medical Research Council; Natural Environment Research Council; and Science and Technology Facilities Council
22 Department for the Economy, Northern Ireland (DfE NI); Scottish Funding Council (SFC); Higher Education Funding Council for Wales
23 The Royal Society's UKRI explainer provides a helpful overview of UKRI's responsibility, oversight and budget: The Royal Society, UKRI Explainer (October 2019)
24 The Royal Society, UKRI Explainer (October 2019), p 1
25 Department for Business, Innovation and Skills, Case for the creation of UK Research and Innovation (June 2016), p 4

- a greater focus and capacity to deliver on cross-cutting issues that were outside the core remits of the current funding bodies, such as multi- and inter-disciplinary research;
- a strengthened, unified voice for the UK's research and innovation funding system, facilitating the dialogue with Government and partners on the global stage;
- improved collaboration between the research base and the commercialisation of discoveries in the business community, ensuring that research outcomes can be fully exploited for the benefit of the UK;
- more time for research and innovation leaders to focus on strategic leadership through the centralisation of back and middle office functions and the reduction of administrative responsibilities; and
- improved quality of evidence on the UK's research and innovation landscape through the pooling of multiple datasets and information sources, underpinning effective funding decisions.[26]

It was intended that the establishment of UKRI would "help to maximise the effectiveness of the system" and "remove unnecessary duplication across the research funding landscape".[27] UKRI's aim of reducing bureaucracy has been built on by its recent 'reducing unnecessary bureaucracy' drive as part of the 10 September 2020 *Reducing bureaucratic burden in research, innovation and higher education* BEIS policy paper.[28]

How UKRI operates

15. UKRI is a non-departmental public body (NDPB) sponsored by the Department for Business, Energy and Industrial Strategy (BEIS). The Secretary of State for BEIS allocates funding to UKRI and constituent Councils through grants. UKRI cannot change these allocations.[29]

16. As set out in the Higher Education and Research Act 2017, when allocating funding the Secretary of State must have regard to:

- the 'Haldane principle', i.e. the principle that decisions on individual research proposals are best taken following an evaluation of the quality and likely impact of the proposals e.g. a peer review process (it does not apply to Innovate UK);[30]
- the 'balanced funding principle', which requires the Secretary of State to consider the importance of the 'dual support system' (see paragraph 17) when allocating funding; and
- advice from UKRI.[31]

26 Department for Business, Innovation and Skills, Case for the creation of UK Research and Innovation (June 2016), p 4
27 Department for Business, Innovation and Skills, Case for the creation of UK Research and Innovation (June 2016), p 4
28 UK Research and Innovation, UKRI reducing unnecessary bureaucracy, accessed 7 January 2021
29 The Royal Society, UK Research and Innovation (October 2019),
30 Department for Business, Energy and Industrial Strategy, UKRI Framework Document (May 2018), p 9
31 Higher Education and Research Act 2017, section 103

If the Secretary of State does not 'have regard' to the above principles, parliamentarians can question them.

17. The dual support system comprises two 'pillars':

- competitive grant funding for specific projects through the seven Research Councils; and
- block grant funding allocated to higher education institutions through Research England (i.e. quality-related research funding).

18. Sir Paul Nurse's Review of UK Research Councils in 2015 characterised the research and innovation system as providing three main 'types' of research:

a) discovery research (also known as 'pure' or 'basic' research), which aims at acquiring new knowledge about the natural world and ourselves;

b) applied research, which is goal directed and aimed at achieving specific objectives and outcomes; and

c) translational research, which aims to bridge discovery and application research, i.e. research carried out with the expectation that it will produce a base of knowledge likely to form the background to the solution of current or future problems or possibilities.[32]

Innovate UK

19. Unlike other parts of UKRI, Innovate UK is not subject to the Haldane principle, and works with businesses to fund business and research collaborations and drive business investment into R&D.[33] Since being founded in 2007, Innovate UK has invested around £2.5 billion to help businesses across the country innovate. This figure increases to £4.3 billion when 'match funding' from industry is included.[34]

20. Innovate UK is responsible for the 'Catapult' network of R&D centres which connect businesses with research and academic communities. They comprise physical sites where UK businesses, scientists, technical specialists and engineers work collaboratively on late-stage research and development, transforming high potential ideas into new products and services. There are ten Catapult centres,[35] with a total budget of around £100 million.[36] Innovate UK also delivers the Small Business Research Initiative, which aims to address challenges faced by the Government using innovative solutions derived from business, and in turn improve the delivery of public services.[37]

32 Sir Paul Nurse, Ensuring a successful research endeavour (November 2015), p 4
33 GOV.UK, Innovate UK: About Us, accessed 7 January 2021
34 GOV.UK, Innovate UK: About Us, accessed 7 January 2021
35 Cell and Gene Therapy, Digital, Future Cities, High Value Manufacturing (a network of another seven centres), Offshore Renewable Energy, Satellite Applications, Transport Systems, Medicines Discovery, Compound Semiconductor Applications, and Energy Systems
36 Science and Technology Committee, Twenty-First Report of Session 2017–19, Balance and effectiveness of research and innovation spending, HC 1453, p 22
37 Science and Technology Committee, Twenty-First Report of Session 2017–19, Balance and effectiveness of research and innovation spending, HC 1453, para 51

UKRI's budget

21. The vast majority of the funding allocated to UKRI's individual councils comes from the BEIS Research and Innovation budget. There are significant differences between the funding allocations received by UKRI's constituent parts. For example, in 2019/20, the Engineering and Physical Sciences Research Council was allocated over six times more funding than the Arts and Humanities Research Council.[38]

Perceived gaps in the UK research and innovation system

22. The evidence to our inquiry highlighted a number of perceived gaps in the UK research and innovation system. The need for the new agency can in part be determined by its potential to address these gaps.

Risk aversion

23. Many written evidence submissions argued that the current UK research and innovation system could be described as risk-averse and conservative in nature. For example, Universities Scotland, University College London and Cardiff University agreed that the criteria for UKRI funding schemes were risk-averse and that there was a gap in the system for innovative, high-risk, high-reward research.[39] In her oral evidence, Professor Mariana Mazzucato, Professor in the Economics of Innovation and Public Value at University College London, made a similar observation: "[f]or that high-risk basic R&D, which is guided by mission-oriented thinking, there is currently a gap in the UK".[40] The University of Oxford's evidence submission summarised this point:

> [T]he UK lacks a mechanism to identify, build and deliver truly ambitious, high-risk/high-reward funding programmes with sufficient funding resource over the extended time-spans required to realise the benefits fully. Most current UK funding programmes tend to focus on incremental advancements, and highly ambitious investments are mostly considered too high risk for public funds.[41]

However, former UKRI CEO Sir Mark Walport strongly disagreed with this characterisation, stating "I would not share it at all".[42]

24. Sir Mark pointed to UKRI's "fellowship programmes" which "support the most talented researchers at the very earliest stages of their career", arguing that these "are all about risk".[43] He told us that the current system and UKRI in particular did provide for high-risk research:

> One of the things that worries me is the idea that an ARPA would be high risk/high return, where the implication is that UKRI is the opposite of that. That could not be further from the case.[44]

38 Department for Business, Energy & Industrial Strategy, The allocation of funding for research and innovation (July 2018), p 11
39 Universities Scotland (RFA0010); University College London (RFA0011); Cardiff University (RFA0018).
40 Q50
41 University of Oxford (RFA0079)
42 Q95
43 Q95
44 Q75

The University of Manchester's written evidence provided some support for Sir Mark's comments:

> Quality Related (QR) research funding, awarded to universities based on their success in the Research Excellence Framework (REF), and securing grants from charities and funding for PhD students, is intended to provide core funding including for research that might be too early or too risky to secure grants through standard pathways.[45]

While this suggested that the current system did provide for some 'riskier' research, the University of Manchester's submission went on to say that QR funding had "been eroded over time".[46]

25. Finally, UKRI's current CEO Professor Dame Ottoline Leyser has suggested that the current research and innovation system could be considered conservative. She stated that UKRI's "responsibility to make the whole system work" made it "harder to do the wild experimental things", and that "the notion of an agency whose job it is to do that is very attractive".[47]

Difficulty securing funding

26. The research and innovation system's risk-averse nature was linked to a perceived difficulty in securing funding. The University of Manchester argued that:

> In the UK, the normal processes of securing funding are lengthy, extremely time consuming and, with relatively low success rates, often quite inefficient, requiring significant amounts of preliminary data and highly credible plans for success.[48]

The lengthy and time-consuming nature of securing funding—in addition to its low success rates has, according to the UK Research Computing Committee, encouraged a "'factory farming' approach to grant writing where teams specialise in writing to deadlines rather than creating innovative proposals". They argued that:

> [The] typical time from starting to write a grant application to start of grant is a year. There have been initiatives to increase responsiveness but these have reduced the time between a call being issued and the proposal deadline. This increases pressure on researchers.[49]

Not only does this system create pressure on researchers, CaSE suggested that it dissuaded private sector actors, particularly small and medium-sized enterprises because "application processes and decision times for public funding grants are too long to meet the needs of small businesses in particular".[50]

45 University of Manchester (RFA0024)
46 University of Manchester (RFA0024)
47 ScienceMag, COVID-19 and Brexit disruption offer chance to build stronger system, accessed 7 January 2021
48 University of Manchester (RFA0024)
49 UK Computing Research Committee (RFA009)
50 Campaign for Science and Engineering (CaSE) (RFA0025)

27. Further, the UK Computing Research Committee argued that the current peer review system "limits the success of more adventurous ideas", pointing to "numerous reports of proposals not being funded" despite receiving "reviews with three top ratings" and only "one objection".[51] Sir Mark Walport provided some support for this view. He told us that "the peer review system can sometimes be rather unimaginative". He pointed out that in the case of US DARPA (which the proposed new UK research funding agency is "broadly modelled" on[52]) "peer review is done by the programme managers and project leaders", i.e. "the most imaginative people", which he described as "absolutely critical".[53] Former Science Minister Lord Johnson agreed with Sir Mark's comments, stating that the peer review system "could be seen as overly conservative".[54] It should be noted however that the peer review system was valued for ensuring scientific and ethical rigour in research and fairness and transparency in funding decisions.[55]

Limited strategic focus

28. Several submissions argued that the current system did not fund enough projects that—as put by AIRTO (Association for Innovation, Research and Technology Organisations)—"drive delivery of a strategic UK imperative", i.e. long-term research projects targeting transformational change.[56] An example given included projects contributing to the achievement of the UK's targets for Net Zero carbon emissions. The Royal Academy of Engineering agreed, arguing that the UK, despite being a "global leader in research", is not particularly good at "exploiting innovation and delivering research driven by industry strategic needs".[57]

29. The University of Manchester argued that this gap could be filled by putting more emphasis on strategic research, i.e. research that "addresses a specific problem or class of problems" such as "defined 'missions'".[58] Indeed, Professor Mariana Mazzucato stated that there was not currently "an agency that can oversee this challenge-based approach" in the UK.[59] However, Sir Mark Walport challenged this assertion:

> It is not true, as Mariana said, that UKRI has not been formed with challenges in mind […] the Industrial Strategy Challenge Fund was a completely new form of funding that UKRI took on from the very beginning and has a number of ARPA-like features and a number of lessons to learn from it.[60]

51 UK Computing Research Committee (RFA009)
52 Prime Minister's Office, Queen's Speech Lobby Pack 2019 (December 2019), p 93
53 Q96
54 Q95
55 Universities Scotland (RFA0010); The Physiological Society (RFA0020)
56 AIRTO (Association of Innovation, Research and Technology Organisations) (RFA0013)
57 Royal Academy of Engineering (RFA0021)
58 University of Manchester (RFA0024)
59 Q54
60 Q71

Commercialising and translating research

30. UCL's written evidence argued that the current research and innovation system suffered from "gaps in the research commercialisation pipeline".[61] The former Minister of State for Universities and Science (2010–2014) Lord Willetts agreed, stating that the UK was "weak" in the areas of "technology and commercialisation".[62] Professor Mariana Mazzucato made similar comments:

> The UK's national system of innovation is particularly strong in universities but weak compared to international competitors in translational or applied research, typically conducted in applied research centres and national laboratories.[63]

31. Professor Dame Julia King (Baroness Brown of Cambridge) described this problem as a failure to get ideas out of the laboratory and into the world:

> The gap I see in our research and innovation landscape is 'science push': helping great scientific ideas escape from the laboratory into applications which enable a step change in the way current technologies or processes work, or into applications no one has yet thought of.[64]

AIRTO made a similar point arguing that there were too few programmes and projects funded in the UK with genuine market 'pull', i.e. those that will "lead more easily to successful exploitation of the results and the economic or societal benefit".[65]

32. However, existing parts of the UK research and innovation system are focused on this. For example, as Professor Dame Nancy Rothwell, Chair of the Russell Group, pointed out, the Small Business Research Initiative (SBRI)—a pre-commercial procurement scheme—was in part designed to address this issue by stimulating the development of innovative solutions, derived from business, to address challenges faced by the Government and in turn improve the delivery of public services. However, Dame Nancy stated that these schemes had "generally failed to be followed up with actual purchases".[66] Innovate UK—which delivers the SBRI—had its funding "heavily cut" in the 2015 Spending Round.[67] Given that Innovate UK is—according to Lord Willetts—the "business-facing part of UKRI", cuts to its budget have the potential to adversely affect the commercialisation and translation of research.[68]

33. In addition, the University of Oxford argued that "many Innovate UK programmes are too short-term".[69] The Royal Academy of Engineering attributed this to the current research and innovation system incentivising the publication of papers in peer-reviewed journals over "[i]nvestment to turn research into real world solutions and successful businesses". Further, it added that "late-stage development and demonstration", which is "crucial to bring new products and services into use"—because "most need to be

61 University College London (RFA0011)
62 Policy Exchange, Visions of Arpa (January 2020), p54
63 UCL Institute for Innovation and Public Purpose (RFA0085)
64 Policy Exchange, Visions of Arpa (January 2020), p36
65 AIRTO (Association of Innovation, Research and Technology Organisations) (RFA0013)
66 Policy Exchange, Visions of Arpa (January 2020), p52
67 Policy Exchange, Visions of Arpa (January 2020), p56
68 Policy Exchange, Visions of Arpa (January 2020), p56
69 University of Oxford (RFA0079)

extensively tested and demonstrated at scale in real-world environments before they can succeed in application"—was neglected. Thus, the UK was, as a result, comparatively "poor at supporting this crucial stage of development".[70]

Lack of interdisciplinarity

34. Finally, another perceived gap in the research and innovation system, which has implications for the commercialisation and translation of research outputs, was its scope for interdisciplinary research projects. AIRTO argued:

> The ability to develop and fund projects across different scientific and non-technical disciplines that are necessary for the development of products and services that can readily be introduced and adopted for use in public and private sectors.[71]

Facilitating interdisciplinary research was a big part of the rationale for creating UKRI.[72] Indeed, giving oral evidence, the former Science Minister Lord Johnson—who oversaw the creation of UKRI—argued that UKRI was successful in bringing "greater coherence" to the Research Councils and that they were "now working together much more effectively than they did before, to the benefit of interdisciplinary and multidisciplinary research". The University of Oxford acknowledged this stating that UKRI had been "making progress" in this area. However, it also argued that "UKRI continues to struggle with cross-disciplinary research".[73] Professor Richard Jones, Chair in Materials Physics and Innovation Policy at the University of Manchester, agreed. He told us that the UK system "needs to have something that supports interdisciplinary research better" and that "in principle" UKRI "should do that" but it is "perhaps too early to see whether it is able to deliver it".[74] This reflects oral evidence from Lord Johnson and Sir Mark Walport, who both described UKRI as a "young organisation".[75]

35. Further, Cardiff University argued that the majority of research projects were "tightly defined within narrow remits or academic disciplines".[76] UCL stated that, as a result, certain "research areas" that "do not fit into traditional boxes" are "currently underfunded".[77] One means of stimulating "multi- or cross-disciplinary" research—according to Professor Mariana Mazzucato—was to organise research around 'missions', which should "incentivise mission-oriented collaboration between universities and other research institutions, and with commercial, health and charitable organisations".[78]

36. **The creation of UKRI has established a more coherent framework for the organisation of Government funding for research and innovation. There are reasons to think that UKRI, following its initial period of being established, could benefit from refreshing its processes and ways of working, specifically to reduce bureaucracy, increase agility and make it easier for external organisations to engage with it in**

70 The Royal Academy of Engineering (RFA0021)
71 AIRTO (Association of Innovation, Research and Technology Organisations) (RFA0013)
72 Department for Business, Innovation and Skills, Case for the creation of UK Research and Innovation (June 2016), pp 11–12
73 University of Oxford (RFA0079)
74 Q52
75 Qq73,75
76 Cardiff University (RFA0018)
77 University College London (RFA0011)
78 University College London (RFA0011)

research involving translation and commercialisation of discoveries. The question is whether such changes would make redundant the role of an ARPA-like agency. We consider on balance that even in a better functioning system, there can be a role for a body that sits outside and operates in a different way to the established mechanisms, with a different culture and which is able to operate free of some of the structures that are necessary for the dominant research funding institution.

Current proposals for a new UK research funding agency

The rationale for a UK ARPA

37. The written evidence submitted to this inquiry by the Department for Business, Energy and Industrial Strategy (BEIS) showed that its proposals for the new UK research funding agency were broadly aligned with the perceived gaps in the system outlined earlier in this Chapter. The Government suggested that UK ARPA would:

- have a strategic focus, i.e. "tackling ambitious technical challenges for a clear purpose";
- prioritise projects with translational potential, i.e. "where succeeding produces transformational change in the economy and wider society"; and
- make it easier to secure funding, i.e. "by experimenting with new funding models".[79]

Indeed, giving oral evidence to this inquiry, the Science Minister Amanda Solloway MP stated, several times, that the Government wanted to provide "an agile and quick-to-use funding pot […] as if it were the private sector".[80]

38. In addition, the BEIS submission to our inquiry stated that:

> The new funder, UK ARPA, will be an agile organisation […] it will take a novel approach to programmatic funding that includes the freedom to pursue rare opportunities in a responsive and flexible way, without undue bureaucratic constraints […] Setting up UK ARPA recognises the high cost of missed technological opportunity. These opportunities bring risks of failure–and some programmes will fail.[81]

Much emphasis was placed on the importance of UK ARPA operating in an "agile" way, unburdened by "bureaucratic constraints" and there was explicit recognition of the fact some of the programmes it funds "will fail". Minister Solloway reiterated the Government's commitment to ensuring that UK ARPA's "bureaucracy is as limited as it can be".[82] This contrasted with the perception—outlined at paragraph 23—that the current research and innovation system was overly conservative and risk-averse.

79 Department for Business, Energy and Industrial Strategy (RFA0052)
80 Qq151,161
81 Department for Business, Energy and Industrial Strategy (RFA0052)
82 Q161

Is there a need for a new UK research funding agency?

39. In his oral evidence to this inquiry, UKRI Chair Sir John Kingman stated, in reference to the proposals for UK ARPA, that "[t]here absolutely is a case for the sort of concept that is being advanced".[83] Giving evidence in the same session, UKRI CEO Professor Dame Ottoline Leyser welcomed the prospect of a "protected pot of money to experiment with alternative funding models".[84] Much of the written evidence was equally supportive, welcoming the Government's plans to establish the new agency.[85] The Confederation of British Industry (CBI), for example, claimed that creating UK ARPA—"if done right"—represents an "exciting opportunity to make the UK the envy of the world in research". The Royal Society, too, welcomed the announcement of funding for the new agency as evidence of the Government being willing to "try new things", but added the caveat that "further detail is required in order to make an informed assessment upon how its creation will affect the existing R&D system".[86]

40. UKRI's former CEO Professor Sir Mark Walport and former Science Minister Lord Johnson were more circumspect. Sir Mark argued that UKRI would be "perfectly capable of running ARPA-like programmes".[87] As outlined earlier, the Industrial Strategy Challenge Fund—which is managed by UKRI—has "a number of ARPA-like features", he said.[88] Lord Johnson agreed:

> Sir Mark mentioned the Industrial Strategy Challenge Fund. This is a £2 billion vehicle, approximately, with many of the missions that you would expect ARPA, when it is eventually formed, to be focusing on.[89]

Sir Mark told us that the Industrial Strategy Challenge Fund personnel—the 'challenge directors'—were "based on the model of DARPA".[90] However, he noted two important differences, the first being that while DARPA's challenge directors were "extremely well paid", this "has not proved possible with challenge directors for the Industrial Strategy Challenge Fund". Second, one of their "frustrations" was that "they have not had that degree of freedom in being able to run their programmes" which, he said, was "a challenge UKRI faces".[91] Thus, Sir Mark argued that the levels of freedom and pay enjoyed by US DARPA staff currently could not be replicated inside UKRI. The Government recognised this challenge: BEIS's Deputy Director for UKRI Sponsorship and Advanced Research Projects Agency Sarah Hodgetts told us, in relation to recruitment for senior roles in UK ARPA, that "remuneration will be key", adding that appointments will likely be made "outside the normal pay restrictions".[92] In addition, Dame Ottoline cast doubt on UKRI's ability to give staff the "extraordinary freedoms" they needed to carry out ARPA-like activities, explaining that "novel and contentious" activity requires "a whole raft of extra sign-off measures, through Government".[93]

83 Q114
84 Q115
85 For examples see: Anonymous (RFA0028); Catapult Network (RFA0047); Cardiff University (RFA0018); University of Manchester (RFA0024).
86 The Royal Society (RFA0044)
87 Q72
88 Q71
89 Q73
90 Q71
91 Qq71,92
92 Q158
93 Q115

41. Sir Mark expressed concerns that UK ARPA could threaten the coherence of the research and innovation system, telling us that "UKRI was created to bring together the ecosystem".[94] Lord Johnson added:

> There is a risk that we start fragmenting the coherence of funding and oversight that UKRI was intended to bring to our system if we start creating new bodies left and right that reduce UKRI's ability to act as an overall strategic guide to where we need to invest more and where we need to increase our capacity and capabilities as a country.[95]

42. In addition, Lord Johnson argued that the creation of UK ARPA carried a risk of duplication of effort that the research and innovation system—even in the context of increased funding—could not afford:

> The bigger issue is how we clearly define its [UK ARPA's] mission so that it is complementary rather than duplicative of other activities, whether through the Industrial Strategy Challenge Fund, in Innovate UK or in other bits of our publicly funded research system, or indeed the charitable sector.[96]

43. Former Science Minister (2010–2014) Lord Willetts has made a similar point, stating that Innovate UK "was supposed to be—and indeed for a while functioned—as the home of strategic horizon scanning on new technologies emerging from the UK research base".[97]

44. In addition, Lord Johnson called on the Government to clearly set out why a new funding agency was needed and what it was for, highlighting that more than a year had passed since the agency was announced in the October 2019 Queen's Speech[98] and there had not been much detail on the proposals:

> To say "high risk, high reward" is not a clear enough mission statement. It is not a clear enough defining purpose. We need to know how it [UK ARPA] is going to be different from the mission that is funded by the £2 billion Industrial Strategy Challenge Fund and how it is going to be different from the nearer-to-market innovation support provided by Innovate UK and its network of Catapults, for example.[99]

The National Audit Office's written evidence underlined this point. With respect to its guidance on creating new public bodies, it stated that "[t]here should be a clear advantage in establishing a new organisation".[100] Giving evidence to this inquiry in mid-November, Minister Solloway was unable to say when the agency would be established, and admitted that "we are still working our way through quite a few particular questions".[101] The July 2020 UK Research and Development Roadmap suggested UK ARPA would be established in the autumn of 2020,[102] however, it was reported on 22 November that it had been

94 Q72
95 Q73
96 Q77
97 Policy Exchange, Visions of Arpa (January 2020), p56
98 Prime Minister's Office, Queen's Speech Lobby Pack 2019 (December 2019), p 93
99 Q89
100 National Audit Office (RFA0050)
101 Q146
102 Department for Business, Energy and Industrial Strategy, UK Research and Development Roadmap, accessed 7 January 2021

delayed further.[103] Professor Richard Jones called for more clarity, stating that he was unsure if the Government had "thought through what the agency is for".[104] The 2020 Spending Review added to this uncertainty, allocating £50 million (of £350 million given to UKRI) for "high-risk, high-payoff research", but failed to mention anything about a new UK research funding agency or 'UK ARPA'.[105]

45. **It is strange that more than a year after its inclusion in two successive Queen's Speeches, the Government has not clearly articulated the need for, or intended remit of, the proposed agency. To date, it seems to be a brand in search of a product. That said, evidence that we have taken does provide a case for an ARPA-like institution and in this Report we set out the guidance that our witnesses have given. We note that it is unusual that, having proposed a new body, it has been left to others to fill in the gaps as to its intended function and form.**

103 'UK's flagship new science funder delayed', Politico, 22 November 2020
104 'UK's flagship new science funder delayed', Politico, 22 November 2020
105 HM Treasury, Spending Review 2020, Cm 330, November 2020, p 54

3 UK ARPA's form, function and place in the system

46. This Chapter considers UK ARPA's form and function, as well as its place in the UK research and innovation landscape. It begins by addressing the matter of whether UK ARPA should have a 'client'. It then considers what UK ARPA should do, i.e. what it should focus on, and how it should do it, i.e. how it should operate, with particular attention paid to the role of its director. The final part of the Chapter considers UK ARPA's place in the UK research and innovation system.

What UK ARPA should focus on

Commercial engagement

47. The evidence was clear that UK ARPA's success would in part depend on whether it can translate and scale its research outputs and innovations. Professor Mazzucato argued that the agency should "aim to leverage procurement and demand-side policies to "pull" technologies and innovation".[106] In the case of US DARPA, the Department of Defense—the military—serves as an end-customer.[107] Professor Mazzucato acknowledged this: "the UK does not have a vast defence sector to perform this role as in the US". As such, she suggested that the UK should "look to where past policies such as 'Contracts for Difference' in offshore wind, for example, have shaped demand".[108]

48. Whatever UK ARPA focuses on (some potential areas are outlined at paragraphs 65–68), several evidence submissions emphasised the importance of effective engagement with commercial partners. Professor Richard Jones argued that although UK ARPA "should not have a core commercialisation goal or targets, since this would distract from its core strategic missions", it should seek to engage with "the commercial sector, including small and medium sized companies as well as the larger, research and development focused organisations".[109] This reflects oral evidence which argued that, in the absence of a dedicated customer (like the Department of Defense for DARPA), the UK should—according to former DARPA director and Wellcome Leap CEO Dr Regina Dugan—focus on "commercial and industrial activities that can create these transitions and pull-throughs".[110]

49. Similarly, CaSE (the Campaign for Science and Engineering) stressed the importance of a "clearly identified market for the research born from projects in order to pull the technology or innovation through to the market".[111] Adding that: "[i]t is hard to imagine a positive outcome for a new funding agency in the UK without a comprehensive public procurement strategy developed alongside".[112] Professor Sir Mark Walport agreed. He argued that, to be effective, UK ARPA "needs an environment where the products of innovation are sought, procured" and that "there needs to be a long time horizon for doing

106 UCL Institute for Innovation and Public Purpose (RFA0085)
107 Q10
108 UCL Institute for Innovation and Public Purpose (RFA0085)
109 Soft Machines, UK ARPA: An experiment in science policy?, accessed 7 January 2021
110 Q29
111 Campaign for Science and Engineering (CaSE) (RFA025)
112 Campaign for Science and Engineering (CaSE) (RFA025)

it"—this is because "[t]he market tends to be quite risk-averse".[113] Lord Johnson made similar comments, stressing the need for UK ARPA to be "different from the nearer-to-market innovation support provided by Innovate UK".[114] BEIS's written evidence did not provide specific information regarding UK ARPA's strategy for commercial engagement. It only stated that "the role of any specific 'customer' in providing pull-through for technologies […] need[s] to be tailored to the UK's research and innovation landscape".[115]

50. **Questions about UK ARPA's remit, organisation and governance would be made much more straightforward if the agency was established to serve a clear 'client'—most likely a Government department, as is the case with US DARPA, which serves the Department of Defense. Potential candidates could include the Department of Health and Social Care (for a life sciences-focussed agency), the Department for Business, Energy and Industrial Strategy (for a Clean Energy/Net Zero mission) or the Ministry of Defence.**

A clear, well-defined purpose

51. Written and oral evidence submitted to this inquiry stressed the need for the new agency to have a clearly defined purpose. As put by the University of Manchester:

> [C]larity over its [UK ARPA's] aims, core activities and management are essential if it is succeed. There is a risk that ARPA-like funding is seen to serve many different purposes by different players so clarity of purpose and mission is absolutely essential.[116]

The former Minister of State for Universities, Science, Research and Innovation, Lord Johnson, similarly argued that the Government must "establish a clear purpose for [UK ARPA] that is distinct from what UKRI is already doing or able to do".[117] Failure to do so may result in researchers applying for different pots of public money with identical proposals, running the risk of duplication of efforts.[118]

52. Professor Richard Jones, Chair in Materials Physics and Innovation Policy at the University of Manchester, agreed, suggesting that UK ARPA should have "a strong and enduring clarity of purpose".[119] Invoking the US Defense Advanced Research Projects Agency (DARPA), he argued that:

> Part of [US D]ARPA's success is complete clarity on both its fundamental purpose and who it is there to serve. Its purpose was, and is, to ensure the technological superiority of the US armed forces.[120]

Professor Jones went on to say that, although the benefits of DARPA's innovations have spread beyond the military, i.e. to wider industry, the whole economy, and members of

113 Q71,86
114 Q89
115 Department for Business, Energy and Industrial Strategy (RFA0052)
116 University of Manchester (RFA0024)
117 Policy Exchange, Visions of Arpa (January 2020), p47
118 University of Manchester (RFA0024); Policy Exchange, Visions of Arpa (January 2020), p47
119 Soft Machines, UK ARPA: An experiment in science policy?, accessed 7 January 2021
120 Soft Machines, UK ARPA: An experiment in science policy?, accessed 7 January 2021

the public, it had—as put by its Deputy Director Dr Peter Highnam—"always had a very clear mission", which was "to avoid and impose technological surprise" (prompted by the launch of the first artificial satellite, *Sputnik*, in 1957).[121]

53. Dr Highnam extolled the virtues of DARPA's singular focus, arguing that: "to have national security as the mission helps; it frames everything".[122] The Royal Society and Cardiff University agreed, with the latter stating that the new agency should focus on "a small number of missions supporting a clear aim".[123]

54. The importance of having a clear purpose was articulated by Dr Regina Dugan, CEO of Wellcome Leap—a recently established £250 million research funding agency backed by the Wellcome Trust—and a former DARPA director (from 2009–12), who argued in oral evidence that UK ARPA's purpose should take account of where the UK has a "right to win", i.e. where there is an existing "robust ecosystem", drawing on the UK's "good tradition in basic science" and its "commercial and industrial activities that can create transitions and pull-throughs".[124] This is broadly aligned with statements made in the July 2020 UK Research and Development Roadmap: "[t]his new research body [UK ARPA] will target areas where the UK can gain competitive advantage and lead the world in the creation of new technologies".[125]

55. The need to define UK ARPA's purpose was clearly articulated by Professor Sir Mark Walport and Lord Johnson. Both lamented the lack of clarity surrounding it, with Sir Mark stating that:

> I found the discussion about ARPA rather curious because I have always been taught that form should follow function, yet we are having a discussion about a form—ARPA—without actually being clear on what its function is, which is critical.[126]

This reflected the National Audit Office's evidence, which noted that arms-length bodies require "[c]larity of purpose and an appropriate form a structure to reflect that purpose."[127] Giving evidence to us in October 2020, Lord Johnson referenced the fact that little more information had been provided on UK ARPA since its original announcement in the 2019 Queen's Speech in October:

> We are now well over a year on but are still having some fairly high-level discussions about its exact purpose. That is important […] we seriously need something that resembles a Green Paper or a White Paper from Government, setting out clearly the purpose of a UK ARPA.[128]

56. Proposals for UK ARPA—outlined in the written evidence submitted by the Department for Business, Energy and Industrial Strategy (BEIS)—only gave an indication of its purpose, putting a lot of emphasis on plans to support "breakthrough technology"

121 Q2
122 Q15
123 The Royal Society (RFA0044); Cardiff University (RFA0018)
124 Q29
125 Department for Business, Energy and Industrial Strategy, Policy Paper: UK Research and Development Roadmap, accessed 7 January 2021
126 Q71
127 National Audit Office (RFA0050)
128 Q73

over "long time horizons" and "ambitious research".[129] Giving oral evidence, the Science Minister Amanda Solloway MP reiterated this stating that UK ARPA would "explicitly support ambitious, long-term science that cuts bureaucracy.[130]

57. ***The Government must, in its response to this Report, clearly define UK ARPA's purpose. This will, necessarily, be tied to and shaped by a specific client the Government identifies for ARPA.***

Mission-based research with transformative potential

58. The evidence submitted to our inquiry generally agreed that the new agency should be driven by 'missions' or 'challenges'. Professor Mariana Mazzucato, Chair in the Economics of Innovation and Public Value at University College London, argued that UK ARPA should take a "challenge-led approach to innovation policy and industrial strategy", adding that it should start by "picking the problem" it wants to solve, rather than "specifying the technology or solution" first.[131] Professor Richard Jones agreed. If UK ARPA wanted the same "longevity and political staying power" as US DARPA, he argued that its purpose must be "closely coupled to the strategic goals of the nation".[132] Indeed, the University of Manchester's submission to this inquiry highlighted the fact that US DARPA "supports strategic research" as one of its "important" features; it focused on:

> research that addresses a specific problem or class of problems (including defined 'missions'), developing knowledge, insights, methods or technologies that may underpin innovative solutions.[133]

The emphasis placed on a 'mission-based' approach is analogous to the comments from Professor Mazzucato outlined above and reflects written evidence submitted by Universities Scotland, Cardiff University, the University of Oxford, and the Royal Society, which variously recommended that UK ARPA should focus on challenges or 'missions' driven by societal and technological need with transformative potential.[134] Former Science Minister Lord Johnson agreed that UK ARPA should have a mission-based focus, prioritising the identification of: "a technology that we know we are going to need but does not exist today, and developing the research that will enable us to create those applications in future".[135]

59. Science Minister Amanda Solloway MP appeared to endorse this approach and invoked some of US DARPA's most significant discoveries, e.g. 'ARPANET' (a foundation of the Internet), she stated: "[w]hen we think about ARPA, and when we think about what we are aiming to achieve, we probably do not know what it is, because it might not exist yet".[136] In addition to this, proposals for UK ARPA—outlined in written evidence submitted by BEIS—suggested the agency would prioritise strategic, goal-oriented

129 Department for Business, Energy and Industrial Strategy (RFA0052)
130 Q153
131 UCL Institute for Innovation and Public Purpose (RFA0085)
132 Soft Machines, UK ARPA: An experiment in science policy?, accessed 7 January 2021
133 University of Manchester (RFA0024)
134 Universities Scotland (RFA0010); Cardiff University (RFA0018); University of Oxford (RFA0079); The Royal Society (RFA0044).
135 Q87
136 Q149

research with UK ARPA tackling: "ambitious technical challenges for a clear purpose, at a scale where succeeding produces transformational change in the economy and wider society".[137]

60. **UK ARPA can play an important role in the research and innovation system by pursuing goal-oriented research, driven by societal need, with the potential to produce lasting, transformational changes. *UK ARPA should focus on 'mission-based' or 'challenge-led' research', which has the potential to make transformative changes with implications for the economy and wider society.***

Long-term research projects that embrace risk

61. There was agreement in the written and oral evidence that in order to effectively pursue strategic, goal-oriented research with transformative potential, research projects must be carried out over the long-term and embrace risk. Giving oral evidence, US DARPA's Deputy Director, Dr Peter Highnam,[138] its former director Dr Regina Dugan (now CEO of Wellcome Leap),[139] and Massachusetts Institute of Technology (MIT) lecturer William Bonvillian,[140] cautioned that transformational change can take a long time—a decade or more—and requires a risk-tolerant approach. In line with this, the University of Oxford's written evidence argued that:

> ARPA offers the opportunity to undertake long-term, larger-scale, risky and ambitious projects with the potential to be 'game-changing' in a broadly defined area, along with increased flexibility, and a tolerance of the necessary high failure rate that goes with this approach.[141]

Professor Mazzucato agreed.[142]

62. The University of Manchester argued that a long-term outlook was as necessary as its appetite for risk:

> As important as ARPA's approach to risk is that its funding is long-term. The funding for UK ARPA should also be of longer duration to allow radical ideas the time to reach a level of maturity without being stifled by premature scepticism.[143]

Cardiff University made similar recommendations. It advocated "long-termism", i.e. "10–15 year programmes", arguing that the agency's focus should be on "longer-term programmes rather than projects", the rationale being that: "[l]onger horizons are also conducive to the kind of transformative breakthroughs the agency is looking to support".[144] Giving oral evidence to this inquiry, former Science Minister Lord Johnson agreed with

137 Department for Business, Energy and Industrial Strategy (RFA0052)
138 Q21
139 Q28
140 Q23
141 University of Oxford (RFA0079)
142 UCL Institute for Innovation and Public Purpose (RFA0085)
143 University of Manchester (RFA0024)
144 Cardiff University (RFA0018)

this timescale, suggesting that UK ARPA should "identify a couple of technologies that we know we are going to need as a society in 10 or 15 years' time".[145] Indeed, several submissions specifically recommended a 10–15 year timescale.[146]

63. The written evidence submitted by BEIS aligned with the evidence outlined in paragraphs 61 and 62. It explicitly recognised the need to embrace risk, noting that the opportunities UK ARPA will pursue will "bring risks of failure–and some programmes will fail".[147] Further, the submission repeatedly emphasised the Government's aim for UK ARPA to pursue "long-term research and innovation" projects.[148] In addition, referencing the March 2020 Budget, the BEIS evidence stated that £800 million of funding would "support the first years of UK ARPA's operation".[149] It has been reported that this funding will be guaranteed over five years.[150] The longer-term future of UK ARPA is less certain, with the BEIS written evidence stating that: "[f]uture funding decisions can then be made in light of how effectively ARPA has embedded itself in the UK research landscape, and any initial successes from the research projects it has supported".[151] It is therefore unclear if UK ARPA will be able to guarantee funding to research programmes over the 10–15 year timelines that were recommended by the evidence.

64. **It is clear that the new funding agency should embrace risk—and be prepared for some of its projects to fail. Further, this should be combined with a long-term outlook, with research programmes spanning 10–15 years. Currently, it appears that funding is only guaranteed for the agency's first five years, which could limit its scope for making truly transformational breakthroughs.** ***If the Government wants UK ARPA to pursue research programmes with the potential to have transformational effects on society—and its proposals suggest that it does—UK ARPA must, firstly, fund research that would be considered too risky by the existing research and innovation system and be prepared for some programmes to fail. Secondly, the Government must accept that these projects will take a long time, potentially 10–15 years, to 'bear fruit'. The Government must meet this ambition with long-term funding for the agency and the programmes it will fund.***

Potential areas of focus

65. Former DARPA director and current CEO of Wellcome Leap, Dr Regina Dugan, recommended that UK ARPA's focus should be shaped by the UK's relative strengths, highlighting the presence of the NHS and the potential for "fluid transition pathways to breakthroughs in health across your health system".[152] The CBI made similar comments:

> The Department of Health seems especially well suited to act as the key driver for the new agency and serve as a buyer for future commercialisation. As one of the highest sources of government expenditure as a percentage of GDP in the UK, public health is undoubtedly an area that would benefit from greater innovation.[153]

145 Q89
146 Northumbria University (RFA0049); University of the West of Scotland (RFA0096); Norwich Research Park (RFA0099); WMG (RFA0100).
147 Department for Business, Energy and Industrial Strategy (RFA0052)
148 Department for Business, Energy and Industrial Strategy (RFA0052)
149 Department for Business, Energy and Industrial Strategy (RFA0052)
150 Policy Exchange, Visions of Arpa (January 2020), p 23
151 Department for Business, Energy and Industrial Strategy (RFA0052)
152 Q29
153 The Confederation of British Industry (CBI) (RFA0004)

Referencing the launch of the Sputnik satellite—widely credited as the impetus for US DARPA—Dr Dugan argued that the coronavirus pandemic "might inspire what we consider to be a health age".[154] Indeed, when asked what UK ARPA should focus on, Professor Richard Jones commented that "[t]here are huge challenges in healthcare".[155] Written evidence from Universities Scotland and Cardiff University also recognised the potential contribution that UK ARPA could make to healthcare generally and post-pandemic recovery specifically.[156]

66. UKRI's former CEO Professor Sir Mark Walport argued that understanding the physiology of human cognition is the greatest scientific challenge that faces us". He continued:

> In order to solve that problem, you need to solve a whole series of intermediate problems, such as developing artificial general intelligence, developing an autonomous transport system for a big city, creating a digital plan for the UK, greening the planet—how one could improve photosynthesis, improve food and capture CO2 from the air. Material sciences offer huge possibilities.[157]

He suggested that "any one" of those challenges "could absorb an ARPA of the size of what is proposed".[158]

67. Professor Mariana Mazzucato argued that the new funding agency should look to the 2017 Industrial Strategy's four 'Grand Challenges' (outlined at paragraph 11).[159] Several other submissions agreed that UK ARPA should take inspiration from the Grand Challenges.[160] Northumbria University, however, disagreed; it argued that UK ARPA's focus "should be independent of the Government of the day".[161]

68. A number of written evidence submissions—as well as oral evidence from Professor Jones—singled-out the Government's target of achieving 'Net Zero' by 2050 as a potential suitable focus.[162] Professor Mazzucato also singled-out climate change, arguing that it represented the right type of "very broad challenge" that would suit a UK ARPA.[163] In addition, the University of Oxford, the Royal Society and Professor Jones recommended a focus on sovereign capability issues, i.e. cyber security and defence, and threats from hostile state and non-state actors.[164]

Determining UK ARPA's focus

69. The evidence was divided on how UK ARPA's focus should be determined. Professor Richard Jones argued that the organisation should not choose its own remit. Instead, it

154 Q28
155 Q57
156 Universities Scotland (RFA0010); Cardiff University (RFA0018)
157 Q84
158 Q84
159 UCL Institute for Innovation and Public Purpose (RFA0085)
160 The Royal Society (RFA0044); Universities Scotland (RFA0010); WMG (RFA0100); The Alan Turing Institute (RFA0087); University of Manchester (RFA0024).
161 Northumbria University (RFA0049)
162 Q57; The Royal Society (RFA0044); The Royal Academy of Engineering (RFA0021); Cardiff University (RFA0018)
163 Q56
164 University of Oxford (RFA0079); The Royal Society (RFA0044); Soft Machines, UK ARPA: An experiment in science policy? (30 January 2020), accessed 7 January 2021

should be the result of "some long thinking by Government", but also that it "should be a wider discussion with many people feeding into it".[165] Others, however, including for example Northumbria University, argued that UK ARPA's focus was not for the Government to decide.[166] Indeed, if the Government did decide the agency's focus, there was a risk—they argued—that it could contravene the Haldane principle, i.e. the principle that decisions on individual research proposals are best taken following an evaluation of the quality and likely impact of the proposals e.g. a peer review process.[167] However, the John Innes Centre argued that, with respect to UK ARPA, "the Haldane principle is irrelevant" and that "Ministers should prioritise the initial strategic foci of the agency".[168]

70. The Science Minister, Amanda Solloway MP, told us that UK ARPA's direction would be decided by scientists—not politicians.[169] She stated that "it is so important that we have an expert scientist leading ARPA" and, regarding its focus, that "[i]t will be about the scientists defining that".[170] Further, she argued that it was difficult to define UK ARPA's focus because: "when we think about what we are aiming to achieve, we probably do not know what it is, because it might not exist yet".[171] However, former DARPA director and current Wellcome Leap CEO Dr Dugan stressed the importance of having a clear concept and purpose for UK ARPA before appointing its director. She explained that the "clarity of thought" shown by the Wellcome Trust was "an important part" of why she accepted the offer to become Wellcome Leap's first CEO. She went on to say that, once the initial focus was decided, it could develop and evolve with its appointed director:

> You want it to have a certain area of focus, you want there to be clarity about the mission of the organisation, which is necessary for getting the right talent, and that talent will help you further shape the strategy.[172]

Budget constraints

71. The majority of the evidence we received argued that UK ARPA's proposed budget of £800 million over five years would restrict its focus to—as put by former Science Minister Lord Johnson—"a very distinct single or dual mission".[173] Former UKRI CEO Sir Mark Walport and MIT lecturer William Bonvillian agreed.[174] Similar points were made by several written evidence submissions, which warned against UK ARPA's funding being spread too thinly, as this would likely result in it failing to achieve anything.[175]

72. **It is clear that UK ARPA's proposed budget limits it to pursuing one or two central missions—any more than this would risk spreading its budget too thin, thus undermining its effectiveness. *Given the size of UK ARPA's proposed budget we recommend that the new agency focuses on no more than two strategically important***

165 Q58
166 Northumbria University (RFA0049)
167 Higher Education and Research Act 2017, section 103
168 John Innes Centre (RFA0042)
169 Q150
170 Q152
171 Q149
172 Q42
173 Q89
174 Q85; Q18
175 King's College London (RFA0053); Aston University (RFA0045); Royal Society of Biology (RFA0073); John Innes Centre (RFA0042); Aerospace Technology Institute (RFA0012).

missions. This will increase the agency's chances of delivering on its stated aims of making breakthroughs with transformative implications for the economy and wider society.

73. ***The Government must think carefully about what the new agency's focus might be before recruiting a director. It should consider the potential areas of focus recommended in the written and oral evidence submitted to this inquiry. It could also consider aligning UK ARPA's focus with other identified priorities and reviews, for example the Industrial Strategy, Net Zero or the Integrated Review of Security, Defence, Development and Foreign Policy. Clarity in this regard will ensure that the agency is led by the best person possible who can, in turn, help to refine and shape the organisation's focus.***

74. ***The Haldane principle should not apply to how UK ARPA's overall focus is determined. Ministers should play a role in shaping ARPA's initial focus.***

Organisational structure

75. Written and oral evidence repeatedly referenced US DARPA's organisational structure, arguing that UK ARPA should seek to replicate it. For example, Professor Mariana Mazzucato highlighted DARPA's "flat internal structure" as one of its "key characteristics".[176] Former US DARPA director Dr Regina Dugan elaborated on the benefits of its flat structure:

> Here you have an organisation that moves extremely fast, and needs to. It is very flat. It takes on the strategic intent, the personality and the style of the individuals inside the organisation. That is a necessary attribute of that kind of speed and agility, that kind of independence.[177]

Thus, DARPA's flat, non-hierarchical structure facilitated quick, unilateral decision-making, they argued. Dr Dugan partly attributed this to its lean structure:

> DARPA is a $3.5 billion-a-year agency with about 100 programme managers but about 250 full-time staff. That is about $15 million per FTE. That is extremely lean. There is no ability to have a lot of process and bureaucracy in that. There must be speed, it must be highly agile, and it must operate independently.[178]

76. In line with this, evidence from BEIS and the Science Minister Amanda Solloway MP emphasised the need for UK ARPA to be agile with as limited bureaucracy as possible.[179] Further, the evidence from BEIS suggested UK ARPA would be lean: "[t]he organisation itself will be small, with a limited number of specialised directors and programme managers".[180] However, it did not specify whether the new agency would have a flat, non-hierarchical structure, as recommended by the evidence. Correspondence from

176 Q68
177 Q39
178 Q30
179 Department for Business, Energy and Industrial Strategy (RFA0052); Q163,161
180 Department for Business, Energy and Industrial Strategy (RFA0052)

Minister Solloway stated that the Government would "create a structure that enables the organisation to operate", but did not elaborate on how it would do this—or what it would look like.[181]

77. **US DARPA and its 'clones' have shown the advantages of having a small, lean organisation with limited bureaucracy. *Nevertheless, we think that the ultimate form and structure of the organisation should be shaped by and evolve with its appointed director.***

Operational independence

78. As noted at paragraph 75, US DARPA's operational independence was also considered key. Professor Mazzucato pointed out that DARPA is "flexible and independent from branches of Government".[182] University College London's Institute for Innovation and Public Purpose argued that "[D]ARPA was successful because it was given the space within the American bureaucracy to take risks and to make big bets on technologies.[183] Former DARPA Director Dr Dugan agreed. If UK ARPA wanted to make potentially transformative breakthroughs—and the BEIS evidence explicitly stated that it did—she argued that it would be important to recognise that:

> in their earliest phases those breakthroughs or the activities associated with creating those breakthroughs can feel quite controversial. Having the independence to make those decisions separate from political influence is an important attribute. The agency must operate independently for its decisions on individual programmes.[184]

79. Former UKRI CEO Professor Sir Mark Walport argued that, in order for UK ARPA to effectively tackle "ambitious technical challenges",[185] "the critical question" was whether it would "have the freedom to take the risks over the timescales that will enable these challenges to be tackled":[186]

> It will take the paymasters—Government and the Treasury—to make the body truly arm's length in a way that it can tackle the challenges over the timescales that are necessary and not micromanage.[187]

These comments underlined a point made by the University of Manchester, who argued that UK ARPA:

> needs to be given sufficient time (at least 10 years) to bed in and prove its effectiveness. Constant chopping and changing of organisational structures, remits and priorities will not work, however well intentioned.[188]

181 Correspondence from Amanda Solloway MP, Minister for Science, Research & Innovation, relating to A New Research Funding Agency, 16 October 2020
182 Q68
183 UCL Institute for Innovation and Public Purpose (RFA0085)
184 Q49
185 Department for Business, Energy and Industrial Strategy (RFA0052)
186 Q71
187 Q71
188 University of Manchester (RFA0024)

Other evidence submissions made similar points.[189] Former Science Minister Lord Johnson stated that there were "mechanisms that you could try to include" to protect against "ministerial interests du jour chopping and changing and leading to a certain short-termism in how projects are identified".[190]

80. Correspondence from Minister Solloway explicitly recognised that "[f]or this new UK funding agency to be successful it must have independence, over both operational and strategic matters".[191] Evidence from the National Audit Office however highlighted that "getting the balance between independence and control right" was "[o]ne of the biggest challenges in setting up any new public body".[192] Its evidence stated that:

> Getting the best from arm's-length bodies means balancing assurance and control with an appropriate degree of independence consistent with an arm's-length body's function, for example freedom to form impartial judgements and apply technical or operational expertise. This is, in itself, not an easy balance to strike.[193]

Further, it warned that "if independence reduces too far, the benefits which arm's-length bodies are intended to bring might be restricted, and the very point of having an arm's-length body compromised".[194]

81. **We welcome the Government's commitment to give UK ARPA independence over both operational and strategic matters. With that said, there will still be a need for appropriate Government oversight of the organisation's operations—given that £800 million of public money has been allocated to it—but UK ARPA will require bespoke Government scrutiny arrangements to operate effectively. *The Government should set out, drawing on precedents such as scrutiny of the Security Services by the Intelligence and Security Committee, how this oversight will work in practice.***

Organisational culture

82. There was agreement in the evidence that getting UK ARPA's culture right would be central to its success, and that getting it right "at the outset is absolutely critical", according to MIT lecturer William Bonvillian.[195] The University of Oxford stated that the 'right' culture for UK ARPA was "a research environment in which innovation is incentivized and rewarded".[196] The evidence was clear that UK ARPA's leadership would be crucial to establishing the right culture. Witnesses with first-hand experience of US DARPA (i.e. Dr Peter Highnam, Dr Regina Dugan and Mr William Bonvillian) recommended that UK ARPA's director should ideally be someone with experience of US DARPA itself. Dr Highnam said: "[i]f the goal is to create something that is close to DARPA, I do not see another way of doing it, except having people there who have been through it and believe

189 Universities Scotland (RFA0010); Institute for Development Studies (RFA0015); University of Oxford's Future of Humanity Institute and University of Cambridge's Centre for the Study of Existential Risk (RFA0061)
190 Q98,97
191 Correspondence from Amanda Solloway MP, Minister for Science, Research & Innovation, relating to A New Research Funding Agency, 16 October 2020
192 National Audit Office (RFA0050)
193 National Audit Office (RFA0050)
194 National Audit Office (RFA0050)
195 Q17
196 University of Oxford (RFA0079)

in it".[197] The Government has stated that UK ARPA would be "broadly modelled" on US DARPA.[198] Current UKRI CEO Professor Dame Ottoline Leyser suggested that UK ARPA debates were overly focused on DARPA and that more focus should be on its potential role as a funder of experimental research.[199]

83. The Government has not stated who will lead UK ARPA. Minister Solloway made clear to us that she wants to appoint an "expert scientist" to lead it.[200] Correspondence from the Minister stated that "an exceptional leader" would be appointed "in due course".[201] There was no mention, however, of whether it would be someone with DARPA experience.

84. **The pool of potential candidates for director should not necessarily be restricted to expert scientists.** ***The Government should be open minded on who the new agency's director might be, should not disregard anyone at this early stage, and should be open to appointing an individual with a bold vision, creativity and drive.***

Significant freedoms

85. Whoever leads UK ARPA, the evidence was clear that they should play an important role in the recruitment of its personnel. For example, Professor Richard Jones argued that "the major job of the director will be to recruit the programme leaders". University College London's Institute for Innovation and Public Purpose told us that UK ARPA's programme leaders—or managers—should, like the organisation itself, be given "independence of decision-making and program management".[202] Professor Jones agreed. He recognised that UK ARPA's programmes should be set up with "considerable rigour and scrutiny" but once established: "the programme leaders should have very considerable discretion in assigning and redirecting the funding without further bureaucratic overheads".[203] The current and former UKRI CEOs—Dame Ottoline Leyser and Sir Mark Walport—took the same view. They both stressed the importance of UK ARPA being staffed by "visionary researchers" given the freedom they need to pursue their vision, with the former likening its environment to a 'skunkworks' (i.e. an organisation with a high degree of autonomy and limited bureaucracy).[204] BEIS's evidence explicitly recognised the need for UK ARPA to by staffed by "programme managers who are given significant freedoms to manage its R&D activities".[205] This was consistent with the views expressed in the vast majority of written evidence.

86. **UK ARPA should have a distinct and flexible organisational structure.** ***The Government should seek to create an environment characterised by a high degree of autonomy and limited bureaucracy. The Government should explain how it intends to establish and foster this culture in the new agency.***

87. **It is clear that the agency's director will play a crucial role in defining its culture.** ***The new director must therefore be committed to creating a culture that empowers and***

197 Q19
198 Prime Minister's Office, Queen's Speech Lobby Pack 2019 (December 2019), p 93
199 Q114
200 Q152
201 Correspondence from Amanda Solloway MP, Minister for Science, Research & Innovation, relating to A New Research Funding Agency, 16 October 2020
202 UCL Institute for Innovation and Public Purpose (RFA0085)
203 Soft Machines, UK ARPA: An experiment in science policy? (30 January 2020), accessed 7 January 2021
204 Q114,Q75
205 Department for Business, Energy and Industrial Strategy (RFA0052)

emboldens UK ARPA's employees. Depending on how closely the Government wants UK ARPA to replicate US DARPA, it should consider appointing a director with first-hand experience, or at least a good understanding, of DARPA in the US.

Outstanding talent

88. The evidence we received was clear that UK ARPA's programme managers must be of the highest calibre. Sir Mark argued that recruiting the "very best" constituted the "real challenge for setting up an ARPA-like organisation".[206] Professor Mazzucato argued that US DARPA did this successfully by "making it an honour for scientists to work towards solving grand challenges". She argued that "[t]his must be a consideration for UK ARPA".[207] Professor Jones acknowledged that "it will be a hard job to find them" because: "[t]hey will be enormously high-calibre people, and probably enormously successful in academia or industry, or preferably both."[208] Former DARPA director Dr Regina Dugan outlined the scale of the challenge:

> They very often are entrepreneurial in their ambitions. They are impact oriented […] They are very much focused on the advancement of the science and engineering but they have CEO-like qualities […] they are the best in class scientists, engineers and CEOs.[209]

In addition, several submissions suggested that UK ARPA personnel should be 'disruptors' with ideas "which are born not only from institutions which have stood for centuries".[210]

89. MIT lecturer William Bonvillian argued that the "special kinds of hiring authority" given to US DARPA were essential for getting the best people. The consensus was that UK ARPA would require a similar level of privilege, as Sir Mark Walport argued:

> ARPA/DARPA recruited many people from the private sector, and in order to do that they needed two things. First, they needed the freedom to operate. Secondly, they needed a competitive salary.[211]

90. Former Science Minister, Lord Johnson, made a similar point, stating that "[t]he qualities required are going to be hard to secure, certainly at the normal rates of pay that we are used to."[212] The Government recognised in evidence the need for the agency's staff to be high-calibre and well-paid: BEIS's Deputy Director for UKRI Sponsorship and Advanced Research Projects Agency Sarah Hodgetts told us that: "We recognise that remuneration will be key, because attracting the calibre of person the Minister has just described is likely to be outside the normal pay restrictions".[213]

91. Government proposals do not specify how many programme managers UK ARPA would employ, though BEIS's evidence stated it would be a "limited number".[214] MIT

206 Q75
207 UCL Institute for Innovation and Public Purpose (RFA0085)
208 Q68
209 Q31
210 Northumbria University (RFA0049). See also: Unilever (RFA0069); ORCA Computing (RFA0095); University of Birmingham (RFA0035).
211 Q82
212 Q82
213 Q158
214 Department for Business, Energy and Industrial Strategy (RFA0052)

lecturer William Bonvillian pointed to the DARPA 'clone' Advanced Research Projects Agency–Energy, or ARPA-E, which had a budget "roughly twice the size" of what has been proposed for UK ARPA and employed "about 12 programme managers".[215] He suggested UK ARPA should seek to replicate this. Written evidence largely agreed with this.[216]

92. **UK ARPA's director should play a key role in the recruitment of its personnel. Programme managers should be ambitious 'disruptors', from a range of backgrounds, who are impact oriented, focused on the advancement of science and have CEO-like qualities. Attracting these people will require sufficient remuneration.** ***The Government should explain how UK ARPA's programme managers can be appointed outside normal pay restrictions in order to ensure that they are sufficiently remunerated.***

UK ARPA's place in the research and innovation system

Should UK ARPA sit inside or outside UKRI?

93. The Department for Business, Energy and Industrial strategy told us that the new UK research funding agency would be: "an addition to the funding landscape that will complement existing funding arrangements provided by UKRI and others".[217] This indicated that UK ARPA might not sit inside the UKRI 'umbrella'. However, the November 2020 Spending Review stated that the first £50 million of the £800 million earmarked for "high risk, high-payoff" research would be included in the £350 million allocated to UKRI for 2021–22 and there was no mention of a new agency.[218] This suggested that UK ARPA might be created inside UKRI. Former Science Minister, Lord Johnson, strongly argued for creating UK ARPA within UKRI: "I do not see any reason why UKRI, as a young organisation, could not quite easily incubate an ARPA-like body in a way that enabled it to do high-risk, high-reward, use-inspired research".[219] Former UKRI CEO, Professor Sir Mark Walport, took a similar view, arguing that UKRI would be "perfectly capable of running APRA-like programmes".[220] Further, Professor Richard Jones argued that there was "no compelling reason why the UK ARPA shouldn't be set up within UKRI".[221] Bournemouth University and Northumbria University also agreed, while Loughborough University gave qualified support to this argument.[222]

94. However, the majority of the evidence which offered a view on this issue agreed that UK ARPA should sit outside UKRI.[223] For example, CaSE stated that "there is no obvious place for [UK ARPA] to 'slot in' to UKRI".[224] Former Minister of State for Universities and Science Lord Willetts has advocated keeping UK ARPA and UKRI as "distinct identities".[225] The current CEO and Chair of UKRI took a similar view: Professor Dame Ottoline Leyser

215 Q18
216 For examples see Universities Scotland (RFA0010) and Royal Society of Chemistry (RFA0017)
217 Department for Business, Energy and Industrial Strategy (RFA0052)
218 HM Treasury, Spending Review 2020, Cm 330, November 2020, p 79
219 Q73
220 Q72
221 Soft Machines, UK ARPA: An experiment in science policy? (30 January 2020), accessed 7 January 2021
222 Bournemouth University (RFA0032); Northumbria University (RFA0049); Loughborough University (RFA0037).
223 For examples see: Royal Society of Biology (RFA0073); University of Edinburgh (RFA0036); Fraunhofer UK Research Ltd (RFA0093); University of Birmingham (RFA0035); Cardiff University (RFA0018); Aston University (RFA0045).
224 Campaign for Science and Engineering (CaSE) (RFA0025)
225 Policy Exchange, Visions of ARPA: Embracing Risk, Transforming Technology (2020), p 57

has argued that there is a "strong argument for an independent organisation", while Sir John Kingman stated that he was "sympathetic" to idea that UK ARPA should sit "outside the UKRI structure".[226]

Reasons for and against situating the new agency inside UKRI

95. Arguments in favour of situating the new agency inside UKRI centred on speed. For example, former Science Minister Lord Johnson said it would be "much less disruptive than legislating to create a new standalone quango", adding that it "could make use of the general functions and legislative arrangements that any new body requires but that are already in place for UKRI", allowing it to "become rapidly operational and begin disbursing money".[227] Professor Richard Jones, as well as the University of Edinburgh and Professor Jim Watson and Anna Watson, made the same argument.[228] Further, Bournemouth University argued that UK ARPA would be "best placed within UKRI" as this would help facilitate collaboration and cross-fertilisation across projects with other parts of the research system. This would reduce the risk of the same application being submitted to several Government agencies.[229] Northumbria University took a similar view.[230]

96. We heard that creating UK ARPA outside of the UKRI 'umbrella' would require the use of primary legislation and could take more than a year to establish.[231] Situating it inside UKRI, however, would only require secondary legislation and could take around three months, according to Lord Johnson.[232] He argued that because more than a year had passed since proposals for the agency were announced (in the October 2019 Queen's Speech)—without significant progress being made—it was incumbent on the Government to "let UKRI use the powers it has to get this thing going quickly".[233] He recommended that "for the initial period of its existence, it should be incubated in UKRI", adding that if "it is found that it needs a greater degree of autonomy" it could be "spun out as a standalone organisation".[234]

97. As Lord Johnson alluded to, the principal argument for creating a new independent agency was to ensure that UK ARPA had sufficient freedom to operate which—as outlined earlier in paragraphs 78–80—was considered essential for it to be effective. We note National Audit Office guidance on establishing new public bodies which states that there should be "a clear advantage in establishing a new organisation".[235] In line with this, the University of Edinburgh argued that a new independent agency would have a "blank sheet" allowing it to be "innovative in approach, culture and thinking".[236] The University of Birmingham agreed, stating that UK ARPA programmes would need "different

226 ScienceMag, COVID-19 and Brexit disruption offer chance to build stronger system, says new U.K. funding head, 13 August 2020, accessed 7 January 2021; Q114
227 Policy Exchange, Visions of ARPA: Embracing Risk, Transforming Technology (2020), p 48
228 Soft Machines, UK ARPA: An experiment in science policy? (30 January 2020), accessed 7 January 2021; University of Edinburgh (RFA0036); Professor Jim Watson and Anna Watson (RFA0092).
229 Bournemouth University (RFA0032)
230 Northumbria University (RFA0049)
231 Q80,81
232 Q99
233 Q73
234 Q73
235 National Audit Office (RFA0050)
236 University of Edinburgh (RFA0036)

structures and mechanisms for selection management and reporting".[237] Similarly, CaSE, Fraunhofer UK Research Ltd and Professor Jim Watson and Anna Watson raised concerns about UK ARPA's independence and ability to take risks if it were embedded in the UKRI framework.[238] The current UKRI CEO and Chair, Dame Ottoline Leyser and Sir John Kingman both agreed. Dame Ottoline stated that "[h]aving some money that is protected to do only things that are novel and contentious is quite a valuable part of the landscape". While Sir John argued that creating UK ARPA outside UKRI would allow it "the freedom to operate in a more freewheeling way".[239] Even those who argued that the agency should sit inside UKRI acknowledged—for example as Lord Johnson did—that it would require a "far greater degree of autonomy than we are used to".[240]

98. Another reason given by CaSE centred on the risk of overcomplicating UKRI's portfolio whose creation represented "an already significant shift in the UK's research funding landscape".[241] Indeed, the Minister was clear that the Department for Business, Energy and Industrial Strategy was still "working [its] way through quite a few particular questions", stressing the importance of listening to stakeholders' concerns "carefully" and the need to make sure that UK ARPA was "absolutely fit for purpose".[242] Notably, the current UKRI CEO and Chair were clear that, wherever it was located, UK ARPA could work effectively as part of the research and innovation system. Sir John Kingman pointed out that UKRI already worked "very closely with massive funders of research who are not part of UKRI".[243] Dame Ottoline was similarly supportive but stressed that, if UK ARPA is situated inside UKRI, it must be given certain assurances so that it can effectively pursue 'novel and contentious' research:

> It is absolutely crucial that it has protections in the context of its budget. It needs to be able to make long-term very stable investments. It needs to work very freely and fluidly. If those protections can be delivered inside UKRI, so that it is not being asked endlessly whether something is novel or contentious, it could operate entirely effectively inside UKRI. It could also operate entirely effectively outside UKRI.[244]

99. **We recognise that there could be advantages to establishing the new UK research funding agency inside UKRI: it would be quicker; facilitate its communication and collaboration with the existing research and innovation system; and reduce the risk of threatening the coherence of funding and research brought by UKRI. However, we note concerns that UK ARPA might not be able to operate effectively and with sufficient freedom if it was situated inside UKRI's framework, for example, being unable to pursue 'novel and contentious' activities without case-by-case Ministerial approval. On balance, we agree with these concerns. *To be effective, the new UK research funding agency must be able to operate independently and pursue 'novel and contentious' research without case-by-case Ministerial approval. If this is not possible within UKRI then there is merit in the Government establishing UK ARPA as a separate***

237 University of Birmingham (RFA0035)
238 Campaign for Science and Engineering (CaSE) (RFA0025); Fraunhofer UK Research Ltd (RFA0093); Professor Jim Watson and Anna Watson (RFA0092).
239 Qq114,115
240 Qq73,71
241 Campaign for Science and Engineering (CaSE) (RFA0025)
242 Q146
243 Q126
244 Q126

entity. Therefore, the Government must clarify whether it intends to establish UK ARPA as a separate body or an agency within UKRI. In doing so, it should be clear about whether this will require primary or secondary legislation and the likely timescales involved.

The new agency's relationship with existing bodies

100. Former Science Ministers Lord Johnson and Lord Willetts have expressed concerns that UK ARPA will overlap with Innovate UK and the Industrial Strategy Challenge Fund in particular. Lord Willetts has described how UK ARPA will relate to Innovate UK as a "tricky organisational issue" given that the latter has functioned as a means of "strategic horizon scanning on new technologies", which bears similarities to UK ARPA proposals.[245] Similarly, it was pointed out that UK ARPA's stated aims were not "a million miles away" from the Industrial Strategy Challenge Fund (ISCF).[246] Indeed, much of the evidence argued that UK ARPA's areas of focus should be aligned with those in the Industrial Strategy.[247] Lord Johnson argued that the Government must think through how UK ARPA would "relate to Innovate UK" and how it would "differentiate [UK] ARPA's role from those of the much larger missions within the ISCF in a way that is not confusing and duplicative".[248] Further, he recommended that the legislation used to create the new agency "must ensure" that it has: "the power–and, where appropriate, the duty–to cooperate and share information with UKRI to ensure that the two bodies work together most effectively".[249] Others including Professor Richard Jones, the University of Oxford and the Royal Society made similar points.[250]

101. ***The vehicle used to establish UK ARPA (i.e. legislation) must allow for clear lines of communication between it, UKRI and the wider system. This could be established through a memorandum of understanding (MoU) that both parties agree to. It should ensure that UK ARPA has the power—and, where appropriate, the duty—to cooperate and share information with UKRI to ensure that the two bodies work together effectively, and vice versa. What is deemed appropriate in this context must be weighed against UK ARPA's requirement for operational independence, which will necessitate bespoke oversight arrangements, including possibly less formal co-ordination with existing parts of the system than what is customary.***

245 Policy Exchange, Visions of ARPA: Embracing Risk, Transforming Technology (2020), p 54
246 Q89
247 See paragraph 67 and 68.
248 Q73
249 Policy Exchange, Visions of ARPA: Embracing Risk, Transforming Technology (2020), p 45
250 Soft Machines, UK ARPA: An experiment in science policy? (30 January 2020), accessed 7 January 2021; University of Oxford (RFA0079); Royal Society (RFA0044)

4 Learning opportunities for the UK research and innovation system

102. Having addressed the need for a new UK research funding agency, what it should focus on, how it should operate, and where it might fit into the landscape, this final Chapter considers UK ARPA's implications for the research and innovation system. The evidence outlined in Chapter Two identified a number of perceived gaps in the research and innovation system including: risk aversion; difficulty securing funding; limited strategic focus; limited commercialisation and translation of research; and limited scope for interdisciplinarity. The proposals for a new UK research funding agency suggest it would aim to, at least in part, address these gaps. However, we also heard that the existing system should, where possible, seek to address these gaps itself.

103. Firstly, this Chapter considers the value of multi-year funding settlements to the UK research and innovation system before looking at gaps in the existing system which itself could address, in addition to the scope for improving equality, diversity, inclusion and accessibility.

Multi-year funding settlements

104. The current CEO and Chair of UKRI, Professor Dame Ottoline Leyser and Sir John Kingman, sent a clear message regarding the importance of having a multi-year funding settlement. Dame Ottoline told us that although it was "not impossible" to "work with short-term settlements", a "long-term budget settlement" would "provide a lot more opportunity to plan longer-term commitments in a thoughtful and robust way".[251] She continued:

> One area that we are particularly concerned about is the large infrastructure commitments; they are very lumpy and very difficult to manage on one-year budgets, and, because of that, one needs to be able to integrate those kinds of costs over multiple years.[252]

She told us that, amongst the "huge number of benefits" that a "longer-term settlement" would offer, it would help UKRI support "the Government's ambition to build back through an inclusive knowledge economy that will support levelling up". Further, it would help stimulate the private sector, which accounts for "two thirds of our R&D spend" and is currently experiencing "serious Covid shock".[253] Sir John agreed, adding that he believed "the case for a multi-year settlement is well understood in Government".[254]

105. The Government—in the Spending Review 2020—later announced:

- an uplift of over £400 million on average per year until 2023–24 for core UK Research and Innovation science, building on our outstanding science base in a range of areas;

251 Q104
252 Q106
253 Q107
254 Q109

- at least £490 million in 2021–22 for Innovate UK core programmes and infrastructure to support ground-breaking technologies and businesses; and
- £350 million in 2021–22 for UK Research and Innovation to support strategic government priorities, build new science capability and support the whole research and innovation ecosystem.[255]

CaSE welcomed this "multi-year settlement for UKRI" in particular the "substantial increases over the next three years" which it argued would help with "protecting and growing the UK's world class research base".[256]

106. **We welcome the multi-year funding settlement for UKRI set out in the November 2020 Spending Review, which not only provides much-needed certainty to UKRI and the wider research community, but it should also help UKRI support public and private sector contributions to the post-coronavirus pandemic recovery. *We urge the Government to maintain multi-year funding settlements for science and encourage it to build on this through additional multi-year settlements in future Budgets and Spending Reviews to aid the UK's post-pandemic recovery.***

Addressing gaps in the UK research and innovation system

UKRI's strategic focus

107. Dame Ottoline suggested that that a multi-year funding settlement for UKRI could help facilitate a longer-term, strategic approach. She told us that she was "keen to build the horizon-scanning function of UKRI much more strongly".[257] She added that she was "very comfortable" with UKRI being "core to the industrial strategy" and argued that "having brought together UKRI into a single umbrella organisation" that there was a "tremendous opportunity" for it to contribute to large-scale national challenges such as "supporting prosperity, high-quality public sector services, and economic growth more generally" and "drive productivity, levelling-up and a healthy and well-supported society".[258] This could help address the problem—identified by ABB, a global technology company—related to "the fact there is little certainty of long-term funding for particular areas".[259]

108. It should be pointed out that UKRI manages the Industrial Strategy Challenge Fund (ISCF) and the Strategic Priorities Fund which are both intended to focus on strategic priorities. However, the National Physical Laboratory told us that while they were "originally set up with universities in mind", they "have not been fully adapted to support the involvement of the wider UK research and innovation landscape".[260] Further, despite the existence of these funds, Professor of Engineering Policy at University College London, Brian Collins, told us that "an uplift of money to support strategic research aimed at nationally significant objectives is undoubtedly needed".[261] He cited the recommendations of the Government Chief Scientific Adviser's November 2019 report to

255 HM Treasury, Spending Review 2020, Cm 330, November 2020, pp 78–79
256 "CaSE responds to 2020 spending review", CaSE press release, 25 November 2020
257 Q112
258 Q110
259 ABB (RFA0003)
260 National Physical Laboratory (RFA0019)
261 Professor Brian Collins (RFA0103)

support this.[262] He went on to say that "it is not self-evident that a new agency is needed in order to justify and achieve that objective", adding that "a programme office that handles and coordinates nationally strategic programs" would suffice.[263] Finally, British Telecom argued that the ISCF's capacity to deliver on its strategic objectives is hampered by the fact that its 'challenge directors' "do not have the autonomy or mechanisms to hand to direct strategic R&D programmes as industry would understand them".[264]

Freedom to take risks

109. As alluded to at paragraph 97, there was a view that UKRI should be able to operate with more freedom and autonomy. UKRI's former CEO Professor Sir Mark Walport told us: "I hope that, over time, UKRI gains greater freedom".[265] Specifically, he highlighted the ISCF's 'challenge directors', whose role was based on the US DARPA model. He told us that they became frustrated due to a lack of freedom "to run their programmes" in addition to a lack of pay.[266] Former Science Minister Lord Willetts has made similar comments. He has argued that "many of the freedoms envisaged for [US] DARPA could and should be extended to UKRI" but said this would require "a bold move towards pay and financial freedoms to liberate it truly and enable it to take decisions and risks with the agility of the DARPA model".[267] Although Sir Mark argued that UKRI would be "perfectively capable of running ARPA-like programmes", he also acknowledged that UKRI's "future success" will be "critically dependent" on its "freedom to operate", adding that "on those freedoms there is still quite a way to go".[268]

110. The current CEO and Chair of UKRI, Dame Ottoline Leyser and Sir John Kingman made similar appeals for greater freedom. The latter argued that the ISCF portfolio "needs to be managed in a dynamic way" and that UKRI should be able to "take grown-up decisions about deprioritising, or even stopping, some elements of the portfolio to allow us to fund those that are the most promising" and to fund them "more ambitiously".[269] Dame Ottoline agreed, stating that UKRI had "done extremely well over the last couple of years" in bringing its budgets "within a 1% tolerance limit" as well as doing a "very high-quality job in managing the large amounts of money" it is entrusted with. She added:

> I hope that building on that relationship will give us the opportunity to develop greater flexibilities in the way we allocate our money so that we can work more dynamically in the way John described.[270]

This aligns with written evidence from PraxisAuril—a professional association for Knowledge Exchange practitioners—which asked why existing parts of the system could not be given "more freedom to take risks".[271]

262 Government Office for Science, Realising our ambition through science: A review of government science capability, November 2019, p 7
263 Professor Brian Collins (RFA0103)
264 British Telecom (RFA0101)
265 Q79
266 Q71
267 Policy Exchange, Visions of ARPA: Embracing Risk, Transforming Technology (2020), p 54
268 Qq72,82
269 Q112
270 Q113
271 PraxisAuril (RFA0084)

Less bureaucratic processes

111. We heard that existing parts of the system could gain greater freedom to take risks through reductions in bureaucratic constraints. Sir John Kingman told us that now that the Government was "thinking about the right way to construct ARPA", that it was an opportune time for it to "think carefully about the panoply of controls that apply to UKRI" and the "best framework" available to:

> balance the perfectly legitimate need for public accountability around the absolutely massive sums of money required for topics that are hugely relevant to all sorts of Government priorities, with the need for us to operate in a way that is agile, so that we can move at the speed we ideally need to be able to move at.[272]

Evidence from the Welsh Government Office for Science agreed and argued that:

> As [UK] ARPA is designed to be less bureaucratic there may be some learning opportunities for other agencies. The current funding councils have a smaller risk appetite; if ARPA is successful this could change.[273]

Similarly, the University Alliance suggested that discussions about a new UK funding agency could prompt the Government to "look at ways of addressing bureaucracy issues within UKRI", while Bournemouth University told us that the "excellent" proposal that UK ARPA will "work on a low bureaucracy, high trust model" should be the "norm for all UKRI funds".[274] Others made similar points.[275]

112. Sir Mark Walport agreed, suggesting that the Government had monitored UKRI too closely:

> Being completely frank with the Committee, one of the challenges for UKRI has been, because it is new and a lot of money is associated with it, that there has been a desire across Government for quite a lot of micromanagement of UKRI's activity.[276]

This view was shared by the former Science Minister Lord Willetts, who has argued that UKRI has been subject to "heavy-handed and intrusive supervision", which has made it difficult to "manage its budget efficiently".[277] Current UKRI CEO Dame Ottoline Leyser took a similar view, explaining that "when starting a new programme", if it is "novel and contentious" she requires a "whole raft of extra sign-off measures, through Government" which "leads to a slowing down of the process". She told us that if UKRI was able to "make long-term very stable investments"—the multi-year funding settlement in the 2020 Spending Review could, arguably, help this—and it was able to "work very freely and

272 Q114
273 Welsh Government Office for Science (RFA0068)
274 University Alliance (RFA0080), Bournemouth University (RFA0032)
275 King's College London (RFA0053); Norwich Research Park (RFA0099)
276 Q75
277 Policy Exchange, Visions of ARPA: Embracing Risk, Transforming Technology (2020), p 54

fluidly" without "being asked endlessly whether something is novel or contentious" then it could perform ARPA-like activities in-house.[278] Currently—as per the *UKRI Framework Document*—'novel' or 'contentious' work requires escalation to BEIS and HM Treasury.[279]

113. The 10 September 2020 policy paper—*Reducing bureaucratic burden in research, innovation and higher education*—published by BEIS and the Department for Education suggested that the Government was aware of the need to address bureaucratic constraints affecting UKRI.[280] It put in place a "root and branch review programme" which sought, in part, to simplify "criteria for organisations to be eligible to apply to UKRI" and implement a "streamlined, two stage application process for standard grant rounds".[281]

Interdisciplinary research

114. Although the purpose behind creating UKRI was, in part, to better facilitate interdisciplinary research—indeed, the Strategic Priorities Fund explicitly aims to do this—there was a view that it has struggled in this respect.[282] It was acknowledged that this may be due to UKRI still being a "young organisation".[283] Professor Richard Jones told us that "in principle" UKRI should be able to do it but that it "might be too early to see whether it is able to".[284] The University of Birmingham agreed. While it welcomed the prospect of the new UK funding agency supporting interdisciplinary research, it also argued that because UKRI "brings together under one agency the previously discipline-specific research councils, as well as the UK's innovation agency [Innovate UK]", it is well placed to do this, adding that "[i]t is critical that this focus and mission is not distracted or eroded".[285]

115. Dame Ottoline was clear that the "extraordinary breadth and depth of reach across the system" that UKRI provides is "exactly what we need now" given that research and innovation is "very heavily interdisciplinary these days, and requires those disciplines and sectors to be working together closely". She told us that "the creation of UKRI is an opportunity to connect things up", adding "[t]hat is my top priority".[286] Relatedly, she said that she was "very keen" to tackle the "big issues" that the UK faces—such as 'Net Zero' by 2050—which "require interdepartmental, multi-departmental, cross-governmental thinking and policy join-up" and that UKRI was well-placed to do this.[287]

116. **While the Government is thinking about the best way to establish a new UK research funding agency and acting on its pledge to reduce unnecessary bureaucracy in the UK research and innovation system, it is a good time for it to reflect on the bureaucratic constraints that apply to the funding bodies operating under the UKRI framework. It is right that UKRI is held accountable for the public money it**

278 Q126
279 Department for Business, Energy and Industrial Strategy, UKRI Framework Document (May 2018), para 12
280 Department for Business, Energy and Industrial Strategy and Department for Education, Reducing bureaucratic burdens on research innovation and higher education, September 2020
281 Department for Business, Energy and Industrial Strategy and Department for Education, Reducing bureaucratic burdens on research innovation and higher education, September 2020 , section 3
282 UKRI, Strategic Priorities Fund, Accessed 7 January 2021; University of Oxford (RFA0079); School of Advanced Study (RFA0063)
283 Qq73,75
284 Q52
285 University of Birmingham (RFA0035)
286 Q100
287 Q113

spends, but the temptation to micromanage it must be considered alongside its need to operate in an agile and efficient way—for example regarding decisions on which projects should be started or stopped—and its potential, through the coordination of interdisciplinary research and innovation efforts, to strategically tackle the large-scale national challenges facing the UK. The Government's policy paper on reducing the bureaucratic burden in research is a step in the right direction.

117. ***The Government should carry out a review, commencing before the end of the next financial year (i.e. 2021–2022), to explore how UKRI can operate with fewer bureaucratic constraints and more freedom and flexibility in how it allocates funds, while ensuring that it is held accountable for its expenditure. Specifically, it should consider (i) the implications of modifying or removing UKRI's requirement to seek Ministerial approval, on a case-by-case basis, for anything deemed 'novel' or 'contentious', (ii) the extent to which the Industrial Strategy Challenge Fund's 'challenge directors' have been unnecessarily hampered by bureaucratic constraints in their work and whether this can be addressed, (iii) UKRI's capacity to tackle the UK's strategic challenges through its coordination of public and private sector research and innovation, and finally (iv) how effectively UKRI facilitates interdisciplinary research and the scope for improving it.***

Equality, diversity, inclusion and accessibility

118. While the evidence welcomed the potential opportunity for the new UK research funding agency to bring a "fresh approach" to the related issues of equality, diversity, inclusion and accessibility, it was argued that the current system could benefit from more diversity.[288] The Royal Academy of Engineering pointed to evidence which linked diversity and improved financial performance and innovation and creativity.[289] The Association of Research Managers and Administrators told us that there was a "need for more female leadership" and that there were "concerns regarding progress on this".[290] Similarly, PraxisAuril argued that there was "a growing awareness of the need for diversity in innovation", with "much more to be done on supporting diversity beyond gender". They claimed that "this is a gap which affects our R&D landscape", and that the system should "support ideas from many different backgrounds and cultures".[291]

119. Dame Ottoline endorsed this view. She argued that research and innovation benefits from diversity:

> There are a number of ways to look at [equality, diversity, inclusion and accessibility] policy. The way I view it is that high-quality research and innovation needs diversity. You have to have people with different ideas and different backgrounds coming together to create the kind of environment where extraordinary things happen. It is disagreement that is almost the fuel of creativity. Building cultures and environments where disagreement is valued as an engaging thing, where, if someone disagrees with you, you are pulled in to discuss the disagreement rather than pushed away by anxiety about a confrontation, is key to underpinning the whole process.

288 Association of Research Managers and Administrators (RFA0067); PraxisAuril (RFA0084)
289 Royal Academy of Engineering, Diversity and inclusion in engineering survey report 2015 (2015), p 25
290 Association of Research Managers and Administrators (RFA0067)
291 PraxisAuril (RFA0084)

She indicated that ensuring that the current system allowed for this would be a priority for her, adding that: "I am very keen to think about that more broadly across the UKRI system". It is worth pointing out that UKRI has committed to "expanding its data collection analysis capabilities" and that the "next diversity data release is scheduled for 2021".[292] This commitment followed the publication of data that showed inequalities between men, women and ethnic minorities. Specifically, the "median award value for female awardees is approximately 15% less than the median award values of males (£336,000 vs £395,000)". Further, "the median award value for ethnic minority awardees is approximately 8% less than that of white awardees (£353,000 vs. £383,000)".[293] When asked, Dame Ottoline was unable to say when UKRI would publish its equality strategy.[294]

120. **There is scope for improvements with respect to equality, diversity, inclusion and accessibility in the current research and innovation system, as illustrated by the 2014–15 to 2018–19 data from UKRI. The system benefits from having people with different ideas, different backgrounds and different characteristics working together. We therefore welcome UKRI's commitment to expanding its equality, diversity, inclusion and accessibility data collection and analysis capabilities. *UKRI should set out, in the Government's Response to this Report, when it will publish its equality strategy. The strategy should outline how UKRI intends to improve the effectiveness of its equality, diversity, inclusion and accessibility processes and policies and how the effects will be measured and demonstrated.***

292 UKRI, Diversity results for UKRI funding data: 2014–15 to 2018–19 (June 2020), p 3
293 UKRI, Diversity results for UKRI funding data: 2014–15 to 2018–19 (June 2020), p 3
294 Q139

Conclusions and recommendations

Is there a need for a new UK research funding agency?

1. The creation of UKRI has established a more coherent framework for the organisation of Government funding for research and innovation. There are reasons to think that UKRI, following its initial period of being established, could benefit from refreshing its processes and ways of working, specifically to reduce bureaucracy, increase agility and make it easier for external organisations to engage with it in research involving translation and commercialisation of discoveries. The question is whether such changes would make redundant the role of an ARPA-like agency. We consider on balance that even in a better functioning system, there can be a role for a body that sits outside and operates in a different way to the established mechanisms, with a different culture and which is able to operate free of some of the structures that are necessary for the dominant research funding institution. (Paragraph 36)

2. It is strange that more than a year after its inclusion in two successive Queen's Speeches, the Government has not clearly articulated the need for, or intended remit of, the proposed agency. To date, it seems to be a brand in search of a product. That said, evidence that we have taken does provide a case for an ARPA-like institution and in this Report we set out the guidance that our witnesses have given. We note that it is unusual that, having proposed a new body, it has been left to others to fill in the gaps as to its intended function and form. (Paragraph 45)

UK ARPA's form, function and place in the system

3. Questions about UK ARPA's remit, organisation and governance would be made much more straightforward if the agency was established to serve a clear 'client'—most likely a Government department, as is the case with US DARPA, which serves the Department of Defense. Potential candidates could include the Department of Health and Social Care (for a life sciences-focussed agency), the Department for Business, Energy and Industrial Strategy (for a Clean Energy/Net Zero mission) or the Ministry of Defence. (Paragraph 50)

4. *The Government must, in its response to this Report, clearly define UK ARPA's purpose. This will, necessarily, be tied to and shaped by a specific client the Government identifies for ARPA.* (Paragraph 57)

5. UK ARPA can play an important role in the research and innovation system by pursuing goal-oriented research, driven by societal need, with the potential to produce lasting, transformational changes. *UK ARPA should focus on 'mission-based' or 'challenge-led' research', which has the potential to make transformative changes with implications for the economy and wider society.* (Paragraph 60)

6. It is clear that the new funding agency should embrace risk—and be prepared for some of its projects to fail. Further, this should be combined with a long-term outlook, with research programmes spanning 10–15 years. Currently, it appears that funding is only guaranteed for the agency's first five years, which could limit its scope for making truly transformational breakthroughs. *If the Government wants UK ARPA*

to pursue research programmes with the potential to have transformational effects on society—and its proposals suggest that it does—UK ARPA must, firstly, fund research that would be considered too risky by the existing research and innovation system and be prepared for some programmes to fail. Secondly, the Government must accept that these projects will take a long time, potentially 10–15 years, to 'bear fruit'. The Government must meet this ambition with long-term funding for the agency and the programmes it will fund. (Paragraph 64)

7. It is clear that UK ARPA's proposed budget limits it to pursuing one or two central missions—any more than this would risk spreading its budget too thin, thus undermining its effectiveness. *Given the size of UK ARPA's proposed budget we recommend that the new agency focuses on no more than two strategically important missions. This will increase the agency's chances of delivering on its stated aims of making breakthroughs with transformative implications for the economy and wider society.* (Paragraph 72)

8. *The Government must think carefully about what the new agency's focus might be before recruiting a director. It should consider the potential areas of focus recommended in the written and oral evidence submitted to this inquiry. It could also consider aligning UK ARPA's focus with other identified priorities and reviews, for example the Industrial Strategy, Net Zero or the Integrated Review of Security, Defence, Development and Foreign Policy. Clarity in this regard will ensure that the agency is led by the best person possible who can, in turn, help to refine and shape the organisation's focus.* (Paragraph 73)

9. *The Haldane principle should not apply to how UK ARPA's overall focus is determined. Ministers should play a role in shaping ARPA's initial focus.* (Paragraph 74)

10. US DARPA and its 'clones' have shown the advantages of having a small, lean organisation with limited bureaucracy. *Nevertheless, we think that the ultimate form and structure of the organisation should be shaped by and evolve with its appointed director.* (Paragraph 77)

11. We welcome the Government's commitment to give UK ARPA independence over both operational and strategic matters. With that said, there will still be a need for appropriate Government oversight of the organisation's operations—given that £800 million of public money has been allocated to it—but UK ARPA will require bespoke Government scrutiny arrangements to operate effectively. *The Government should set out, drawing on precedents such as scrutiny of the Security Services by the Intelligence and Security Committee, how this oversight will work in practice.* (Paragraph 81)

12. The pool of potential candidates for director should not necessarily be restricted to expert scientists. *The Government should be open minded on who the new agency's director might be, should not disregard anyone at this early stage, and should be open to appointing an individual with a bold vision, creativity and drive.* (Paragraph 84)

13. UK ARPA should have a distinct and flexible organisational structure. *The Government should seek to create an environment characterised by a high degree of autonomy and limited bureaucracy. The Government should explain how it intends to establish and foster this culture in the new agency.* (Paragraph 86)

14. It is clear that the agency's director will play a crucial role in defining its culture. *The new director must therefore be committed to creating a culture that empowers and emboldens UK ARPA's employees. Depending on how closely the Government wants UK ARPA to replicate US DARPA, it should consider appointing a director with first-hand experience, or at least a good understanding, of DARPA in the US.* (Paragraph 87)

15. UK ARPA's director should play a key role in the recruitment of its personnel. Programme managers should be ambitious 'disruptors', from a range of backgrounds, who are impact oriented, focused on the advancement of science and have CEO-like qualities. Attracting these people will require sufficient remuneration. *The Government should explain how UK ARPA's programme managers can be appointed outside normal pay restrictions in order to ensure that they are sufficiently remunerated.* (Paragraph 92)

16. We recognise that there could be advantages to establishing the new UK research funding agency inside UKRI: it would be quicker; facilitate its communication and collaboration with the existing research and innovation system; and reduce the risk of threatening the coherence of funding and research brought by UKRI. However, we note concerns that UK ARPA might not be able to operate effectively and with sufficient freedom if it was situated inside UKRI's framework, for example, being unable to pursue 'novel and contentious' activities without case-by-case Ministerial approval. On balance, we agree with these concerns. *To be effective, the new UK research funding agency must be able to operate independently and pursue 'novel and contentious' research without case-by-case Ministerial approval. If this is not possible within UKRI then there is merit in the Government establishing UK ARPA as a separate entity. Therefore, the Government must clarify whether it intends to establish UK ARPA as a separate body or an agency within UKRI. In doing so, it should be clear about whether this will require primary or secondary legislation and the likely timescales involved.* (Paragraph 99)

17. *The vehicle used to establish UK ARPA (i.e. legislation) must allow for clear lines of communication between it, UKRI and the wider system. This could be established through a memorandum of understanding (MoU) that both parties agree to. It should ensure that UK ARPA has the power—and, where appropriate, the duty—to cooperate and share information with UKRI to ensure that the two bodies work together effectively, and vice versa. What is deemed appropriate in this context must be weighed against UK ARPA's requirement for operational independence, which will necessitate bespoke oversight arrangements, including possibly less formal co-ordination with existing parts of the system than what is customary.* (Paragraph 101)

Learning opportunities for the UK research and innovation system

18. We welcome the multi-year funding settlement for UKRI set out in the November 2020 Spending Review, which not only provides much-needed certainty to UKRI and the wider research community, but it should also help UKRI support public and private sector contributions to the post-coronavirus pandemic recovery. *We urge the*

Government to maintain multi-year funding settlements for science and encourage it to build on this through additional multi-year settlements in future Budgets and Spending Reviews to aid the UK's post-pandemic recovery. (Paragraph 106)

19. While the Government is thinking about the best way to establish a new UK research funding agency and acting on its pledge to reduce unnecessary bureaucracy in the UK research and innovation system, it is a good time for it to reflect on the bureaucratic constraints that apply to the funding bodies operating under the UKRI framework. It is right that UKRI is held accountable for the public money it spends, but the temptation to micromanage it must be considered alongside its need to operate in an agile and efficient way—for example regarding decisions on which projects should be started or stopped—and its potential, through the coordination of interdisciplinary research and innovation efforts, to strategically tackle the large-scale national challenges facing the UK. The Government's policy paper on reducing the bureaucratic burden in research is a step in the right direction. (Paragraph 116)

20. *The Government should carry out a review, commencing before the end of the next financial year (i.e. 2021–2022), to explore how UKRI can operate with fewer bureaucratic constraints and more freedom and flexibility in how it allocates funds, while ensuring that it is held accountable for its expenditure. Specifically, it should consider (i) the implications of modifying or removing UKRI's requirement to seek Ministerial approval, on a case-by-case basis, for anything deemed 'novel' or 'contentious', (ii) the extent to which the Industrial Strategy Challenge Fund's 'challenge directors' have been unnecessarily hampered by bureaucratic constraints in their work and whether this can be addressed, (iii) UKRI's capacity to tackle the UK's strategic challenges through its coordination of public and private sector research and innovation, and finally (iv) how effectively UKRI facilitates interdisciplinary research and the scope for improving it.* (Paragraph 117)

21. There is scope for improvements with respect to equality, diversity, inclusion and accessibility in the current research and innovation system, as illustrated by the 2014–15 to 2018–19 data from UKRI. The system benefits from having people with different ideas, different backgrounds and different characteristics working together. We therefore welcome UKRI's commitment to expanding its equality, diversity, inclusion and accessibility data collection and analysis capabilities. *UKRI should set out, in the Government's Response to this Report, when it will publish its equality strategy. The strategy should outline how UKRI intends to improve the effectiveness of its equality, diversity, inclusion and accessibility processes and policies and how the effects will be measured and demonstrated.* (Paragraph 120)

Formal minutes

Tuesday 9 February 2021

Members present:

Greg Clark in the Chair

Aaron Bell	Carol Monaghan
Dawn Butler	Graham Stringer
Mark Logan	Zarah Sultana

Draft Report (*A new UK research funding agency*), proposed by the Chair, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 120 read and agreed to.

Summary agreed to.

Resolved, That the Report be the Third Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available (Standing Order No. 134)

[Adjourned till Wednesday 10 February at 9.30am.

Witnesses

The following witnesses gave evidence. Transcripts can be viewed on the inquiry publications page of the Committee's website.

Wednesday 23 September 2020

William Bonvillian, Lecturer, Massachusetts Institute of Technology; **Dr Peter Highnam**, Deputy Director, Defense Advanced Research Projects Agency — Q1–25

Dr Antoine Petit, Chairman and CEO, French National Centre for Scientific Research (CNRS); **Dr Regina Dugan**, Chief Executive Officer, Wellcome Leap — Q26–49

Wednesday 7 October 2020

Professor Mariana Mazzucato, Chair in the Economics of Innovation and Public Value, University College London; **Professor Richard Jones**, Chair in Materials Physics and Innovation Policy, University of Manchester — Q50–70

Professor Sir Mark Walport, Former CEO, UK Research and Innovation (2017–2020); **Jo Johnson**, Former Minister of State for Universities, Science, Research and Innovation (2016–2018 and July–September 2019) — Q71–99

Wednesday 11 November 2020

Amanda Solloway, Minister for Science, Research and Innovation, Department for Business, Energy and Industrial Strategy; **Sarah Hodgetts**, Deputy Director for UKRI Sponsorship and Advanced Research Projects Agency, Department for Business, Energy and Industrial Strategy — Q100–145

Professor Dame Ottoline Leyser, Chief Executive, UK Research and Innovation (UKRI); **Sir John Kingman**, Chair, UK Research and Innovation (UKRI) — Q146–167

Published written evidence

The following written evidence was received and can be viewed on the inquiry publications page of the Committee's website.

RFA numbers are generated by the evidence processing system and so may not be complete.

1 ABB (RFA0003)

2 ADS (RFA0086)

3 AIRTO Ltd (RFA0013)

4 Adam Smith Institute (RFA0107)

5 Aerospace Technology Institute (RFA0012)

6 Alzheimer's Research UK (RFA0072)

7 Anonymous (RFA0028)

8 Association of Research Managers and Administrators—ARMA UK (RFA0067)

9 Aston University (RFA0045)

10 BT Group (RFA0101)

11 Bostrom, Nick (Director, Future of Humanity Institute); Haydn Belfield (Academic Project Manager, The Centre for the Study of Existential Risk); and Sam Hilton (Research Affiliate, The Centre for the Study of Existential Risk) (RFA0061)

12 Bournemouth University (RFA0032)

13 British Neuroscience Association (RFA0071)

14 British Standards Institution (RFA0089)

15 Bruce, Prof Toby (RFA0027)

16 Bruntwood SciTech (RFA0082)

17 Burrington, Tessa (RFA0104)

18 CBI (RFA0004)

19 Campaign for Science and Engineering (RFA0025)

20 Cardiff University (RFA0018)

21 Catapult Network (RFA0047)

22 Collins, Professor Brian (RFA0103)

23 Coventry University (RFA0091)

24 Cruelty Free International (RFA0102)

25 Davison, Professor Andrew (RFA0006)

26 Department for Business, Energy and Industrial Strategy (RFA0052)

27 Diaz Anadon, Professor Laura (Professor of Climate Change Policy, University of Cambridge); Dr. Anna Goldstein (Senior Research Fellow, University of Massachusetts Amherst); Professor Erin Baker (Professor and Associate Dean of Engineering, University of Massachusetts Amherst); and Professor Claudia Doblinger (Assistant Professor of Innovation and Technology Management, TU Munich) (RFA0065)

28 Durham University (RFA0038)

29 EPSRC UK Robotics and Autonomous Systems Network (RFA0046)

30 Eoin, Dr (Babbage Fellow of Technology & Innovation Policy, University of Cambridge) (RFA0094)

31 Ferguson, Professor Sir Michael (RFA0008)

32 Flinders, Professor Matthew (Professor, The University of Sheffield) (RFA0106)

33 Fraunhofer UK Research ltd (RFA0093)

34 Fuller, Steve (RFA0097)

35 Future Flight Concepts Ltd (RFA0090)

36 Gregory, Dr Jane (RFA0002)

37 Grindrod CBE, Professor Peter (Professor, Mathematical Institute, University of Oxford) (RFA0108)

38 Hack Partners Limited (RFA0048)

39 Higher Education Funding Council for Wales (HEFCW) (RFA0057)

40 Institute of Development Studies (RFA0015)

41 Institute of Mathematics and its Applications (RFA0078)

42 Institute of Physics (RFA0070)

43 John Innes Centre (RFA0042)

44 King's College London (RFA0053)

45 Lord Dowding Fund for Humane Research (RFA0016)

46 Loughborough University (RFA0037)

47 Manchester Metropolitan University (RFA0026)

48 Meggitt PLC (RFA0056)

49 Nanayakkara, Dr Thrishantha (RFA0007)

50 National Audit Office (RFA0050)

51 National Centre for Universities and Business (RFA0058)

52 National Physical Laboratory (RFA0019)

53 Newcastle University (RFA0059)

54 Northumbria University (RFA0049)

55 Norwich Research Park (RFA0099)

56 Nuffield Council on Bioethics (RFA0005)

57 OGTC (RFA0022)

58 ORCA Computing (RFA0095)

59 People for the Ethical Treatment of Animals Foundation (RFA0075)

60 Photonics Leadership Group (RFA0041)

61 PraxisAuril (RFA0084)

62 Prospect (RFA0055)

63 Prostate Cancer Research Centre (RFA0060)

64 Pupils 2 Parliament (RFA0029)

65 Queen Mary University of London (RFA0034)

66 Queen's University Belfast (RFA0098)

67 RSPCA (RFA0014)
68 Rosseinsky, Professor Matthew (Professor, University of Liverpool) (RFA0083)
69 Royal Academy of Engineering (RFA0021)
70 Royal Astronomical Society (RFA0033)
71 Royal Society (RFA0044)
72 Royal Society of Biology (RFA0073)
73 Safer Medicines Trust (RFA0066)
74 School of Advanced Study, University of London (RFA0063)
75 School of Life Sciences, University of Warwick (RFA0040)
76 Shore, Paul (RFA0001)
77 The Alan Turing Institute (RFA0087)
78 The British Academy (RFA0074)
79 The National Measurement Institute at LGC (RFA0023)
80 The Physiological Society (RFA0020)
81 The Royal Society of Chemistry (RFA0017)
82 The Royal Society of Edinburgh (RFA0051)
83 The University of Sheffield (RFA0077)
84 Tokamak Energy Ltd (RFA0076)
85 UCL (RFA0011)
86 UCL Institute for Innovation and Public Purpose (RFA0085)
87 UK Computing Research Committee (RFA0009)
88 UK Deans of Science (RFA0054)
89 UK Research and Innovation (UKRI) (RFA0109)
90 Unilever (RFA0069)
91 Universities Scotland (RFA0010)
92 Universities UK (RFA0031)
93 Universities Wales (RFA0088)
94 University Alliance (RFA0080)
95 University of Birmingham (RFA0035)
96 University of Bristol (RFA0105)
97 University of Cambridge (RFA0039)
98 University of Edinburgh (RFA0036)
99 University of Glasgow (RFA0043)
100 University of Leicester (RFA0064)
101 University of Manchester (RFA0024)
102 University of Oxford (RFA0079)
103 University of Wolverhampton (RFA0030)
104 University of the West of Scotland (RFA0096)

105 Watson, Professor Jim (Research Director, UCL Institute for Sustainable Resources); and Ms Anna Watson (Doctoral researcher, SPRU, University of Sussex) (RFA0092)

106 WMG (RFA0100)

107 Welsh Government (RFA0068)

List of Reports from the Committee during the current Parliament

All publications from the Committee are available on the publications page of the Committee's website.

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Number	Title	Reference
1st	The UK response to covid-19: use of scientific advice	HC 136
2nd	5G market diversification and wider lessons for critical and emerging technologies	HC 450
1st Special	Balance and effectiveness of research and innovation spending: Government and UK Research and Innovation Responses to the Committee's Twenty-First Report of Session 2017–19	HC 236
2nd Special	Commercial and recreational drone use in the UK: Government Response the Committee's Twenty-Second Report of 2017–19	HC 270