The National Physical Laboratory response to the Science and Technology Select Committee – A new UK research funding agency inquiry

Context to NPL's response

1. The National Physical Laboratory (NPL) is the UK's National Metrology Institute, developing and maintaining the national primary measurement standards. NPL is owned and funded (in part) by BEIS. NPL sits at the heart of the UK's National Measurement System (NMS) which provides the UK with a national measurement infrastructure and delivers the UK Measurement Strategy on behalf of BEIS. NPL works in partnership with government, academia, applied research labs and industry to deliver the greatest societal and economic benefit for the UK and the world.

2. We conduct world class measurement science and provide products and services that enable businesses and public organisations to make reliable measurements and have confidence in the decisions they make based on them. We support businesses to innovate, improve productivity and to grow, as well as enable public organisations to protect and improve the quality of life of the public.

3. NPL has been the recipient of government grant funding to deliver research. We are often part of a consortia with academia and industry and have been involved in, and are currently delivering, programmes funded through the Strategic Priorities Fund and Industrial Strategy Challenge Fund.

4. Below we set out NPL's responses to the questions that we consider most relevant to its area of expertise.

Summary

5. UK ARPA could be a great opportunity to invest **additional funding into the development end of R&D** and **fund large scale multidisciplinary holistic approaches** bringing on board industry, academia, research institutes and Public Sector Research Establishments (PSREs) to work together.

6. It should be open to **fund all organisations that have the right capabilities to deliver the research, making the most of the UK's unique expertise** where-ever it resides.

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

7. The UK science, research and innovation community must be successfully leveraged to support the UK through the current COVID crisis. R&D ultimately drives the creation and improvement of new products, services and processes – all of which can contribute to increasing business productivity, an important part of the UK economic recovery.

8. UK funding for R&D is heavily skewed, it primarily focuses on fundamental research and technologies that are at early technology readiness levels (TLR) with the balance being 85:15 in favour of research to development. [1]

9. Fundamental research is important; it can can be the basis of future innovation. An advance in research today can enable an advance in technology in the future, but to see a better return on R&D investment there needs to be a change in approach. Alongside support for the UK's world leading science base, there needs to be **equal support for development** to drive innovation and to progress technologies further along the TRL scale, to get them to market. This does not mean reducing funding for research, but additional investment for development.

10. When looking at R&D policy it is often perceived as one discrete activity, however research and development consist of distinctly different activities, require different types of expertise and different types of facilities. There needs to be a delineation between the two and further investment into the infrastructures and technologies that support the development process, this will accelerate innovation and boost productivity.

11. Infrastructure technologies, known as 'infra-technologies', are technologies and core services which underly and support R&D. These technologies are little noticed, but vital to enabling innovation. One example of infra-technologies is measurement, as measurement services support a range of activities which develop economic benefits. Our measurement infrastructure is agreed globally and implemented locally. It covers everything in the measurement chain from the definition of measurement units agreed globally by governments, through agreed standard methods for measurement, to the reliability of end user measurements in the field, in hospitals or in factories.

12. Development can consist of a wide of range of technical activities which are enabled by the infra-technology of measurement, not limited to: development of prototypes, refining of processes, testing and validation of new products, services and processes including safety testing and ensuring that products meet the required standards and regulations, testing at scale, scaling up manufacturing and dissemination of products.

13. R&D can be more productive if one of its sub-activities is made more productive, by investment into the underpinning infra-technology. Testing, verification, process refinement, prototype design and many other activities involve an aspect of measurement. The Office for National Statistics has an estimate of 14.3% of R&D activity involving measurement (calibration, analysis and testing) based on employment data analysing the roles of employees working within scientific research and development industry[2].

14. By improving the infra-technology of measurement, we can improve productivity, reducing the time taken to get from research to application to market.

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[1] AIRTO (2020) More D position statement – a more development focused strategy for paving the way to impact. http://www.airto.co.uk/wp-content/uploads/2020/03/AIRTO-More-D-Position-Statement-31-MARCH-2020-web.pdf

[2] King, M. Renedo, E. (2020) Achieving the 2.4% GDP target: the role of measurement in increasing investment in R&D and innovation. National Physical Laboratory. http://eprintspublications.npl.co.uk/8653/

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

15. The Nurse Review of UK Research Councils (2015)[3] recommends that there should be **opportunities for all appropriate institutions to be involved in delivering research**, where they have the right expertise. Additionally, the Government Office for Science 2019 report "Realising our ambition through science"[4] – has identified that there needs to be **greater utilisation of government science capabilitie**s – for example through public sector research establishments (PSREs) like the National Physical Laboratory.

16. NPL have faced issues in eligibility to participate in research programmes – even when the government has funded us to build expertise and capability in the particular area of research focus and where it would be a natural lead organisation for the work.

17. The challenge lead programmes such as the Industrial Strategy Challenge Fund and the Strategic Priorities Fund are utilising the breadth of UK research and innovation skills, bringing together UK expertise from a wider pool than just the university sector. However, these funding systems were originally set up with universities in mind, and have not been fully adapted to support the involvement of the wider UK research and innovation landscape. A new UK research agency would be an opportunity to set up new funding streams that are not constrained by legacy processes and protocols, but are **open to all innovation, research and technology organisations** that are able to meet the challenge.

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

18. The new agency should provide opportunities to fund **large scale multidisciplinary holistic approaches** bringing on board industry, academia, research institutes and Public Sector Research Establishments (PSREs) to work together.

19. There has been systematic underinvestment in the development end of R&D. To boost productivity there needs to be a greater focus on supporting development and the infrastructure technologies that support the UK innovation ecosystem.

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

20. It is important that any new funding agency makes use of the world class institutions and infrastructures that already exist within the UK.

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[3] Nurse, P. (2015) Ensuring a successful research endeavour: A review of the UK Research Councils https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/478125/BIS-15-625-ensuring-a-successful-UK-research-endeavour.pdf

[4] Government Office for Science (2019) Realising our ambition through science: a review of government science capability https://www.gov.uk/government/publications/government-science-capability-review

21. Infra-technologies are underpinning technologies that support a wide range of sectors, they are often expensive to develop and maintain and as such, do not attract private investment, Consequently, these need to be invested in by the public to support the whole UK innovation landscape, as the benefits of these are not limited to one user and spill across sectors.

What can be learned from ARPA equivalents in other countries?

22. One of the most successful ARPA programmes is in the United States, where they make good use of their national assets. This includes utilising their National Laboratories – often with these labs leading programmes, for example NIST, the US equivalent of NPL leads many projects and national initiatives.

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

23. For ARPA to be successful it needs to actively bring together world class capability in the UK wherever it resides, especially where this capability is critical and unique. Some of this will be within the golden triangle – however there will be much that also resides outside of it.

24. It is important for UK industry to have direct access to science and research expertise – ideally within a local vicinity. We are seeing successful innovation clusters across the country where businesses and research institutions are working closely together, innovating together, and converting research into applications that can be taken to market.

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