**WMG response to the House of Commons Science and Technology Committee inquiry: the nature and purpose of the new UK research funding agency**

## About WMG

Established in 1980 at the University of Warwick, WMG (formerly Warwick Manufacturing Group) was founded to help reinvigorate UK manufacturing and help businesses overcome barriers to growth via the application of innovation, new technologies and skills deployment to industry, bringing academic rigour to industrial and organisational practice.

Four decades later, we continue to drive innovation through our pioneering research and education programmes in fields as diverse as digital health, cyber-security, battery technology and materials, working in partnership with organisations, in both the private and public sectors, in order to deliver real impact to economic growth, society and the environment. We are home to the National Automotive Innovation Centre, the lead centre for Vehicle Electrification and Connected and Autonomous Vehicles (CAV) within the HVMC network and the International Institute for Nanocomposites Manufacturing, among others.

## Introduction

Currently, two-thirds of commercial R&D in the UK is performed in the manufacturing sector. However, the global pandemic is reducing manufacturing output by up to fifty-five per cent, which is placing the industrial landscape for innovation at significant risk. Many businesses will now have restricted funds to invest in innovation. Therefore, it is critical that investment in the proposed new research funding agency supports the UK's economic recovery (post-coronavirus) through science and innovation. The current model for publicly funded R&D in the UK comes with a significant risk of wasted investment, particularly as Research Councils tends to fund the 'best' academically with little thought to potential exploitation in the UK. There is a need to ensure that ARPA is joined up with the wider research and innovation landscape in the UK, particularly the industrial innovation sector, in order to turn science into innovation which will deliver jobs, skills and infrastructure. Undoubtedly, the UK would benefit from a new model, ARPA, to support ground-breaking new research and provide longer term commitments that are not focused on one institution or place, but have greater freedom and flexibility to develop solutions to grand challenges. It is important that we learn from US ARPA as they have focused on technology push without addressing barriers to market adoption, this is where WMG's approach to innovation comes into play, as our research also ensures that business processes and social/behavioural are a key part of programmes as enablers of technology exploitation.

*Margot James, WMG Executive Chair*

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

Whilst being a global leader in research, it is widely accepted that the UK has a poor track-record in exploiting innovation. To address this, a number of mechanisms (including High Value Manufacturing Catapults) have been introduced to bridge the gap between invention and application. These play a vital role in ensuring home-grown science is exploited in the UK and exported globally. However, the lack of long-term investment in research in the UK encourages short-termist approaches, where funding is chased down based on the next 'in-vogue' topic. Often developed through a 'call for proposals' process that stimulates a large demand against very limited allocated funding; frustrating applicants. Looking at a 10-15 year horizon will allow a specific focus on advanced/transformative technologies, and long-term application of these in industry. The beneficial outcomes of research projects for wider society and consumers are often not measurable beyond 10 years. This means a significant shift in thinking is required, compared to the current UK system based on value for money calculations on a project by project basis. The UK has tried before to implement principles for ambitious, autonomous and fast-paced innovation funding, so there are lessons to be learnt from the Industrial Strategy Challenge Fund. Primarily, it is essential that the new agency can embrace autonomy, risk-taking and decision-making speed. To achieve this will require independence from HM Treasury, Ministerial and UKRI control, as this will be pivotal to the success of UK-ARPA.

There is currently limited funding available for research where the risks of failure are high or where the outcomes are uncertain, as shown in Figure 1. Spending through UKRI is linked to annual planning cycles, and major commitments are in danger of getting caught between government spending periods. This can make planning long- term research programmes more challenging. Some research questions are so significant that they could benefit from a portfolio approach, funding a wide range of different projects and people in areas where a large boost in funding could have a catalytic effect and create a linked cohort of the best but diverse scientists tackling a big problem. For example, the Industrial Strategy identifies AI and data as a grand challenge. As part of an ARPA equivalent we would expect this research to explore new capabilities - robust AI, explainable/safe AI, High Performance AI and next generation AI - to enable the UK to establish and mature its technological edge in this critical area.

**What are the implications of the new funding agency for existing funding bodies and their approach?**
ARPA should be driven by evidence-based models for identifying its programmes, drawing in the wider scientific and industrial community. There is likely to be overlapping areas of interest, therefore there is a clear need to actively engage with other funding bodies to make the most of work across the scientific community and the wider landscape in the UK including Catapult Centres (as shown in Figure 1).

Since 2018, Innovate UK has become the business-facing part of UKRI. This has helped to position UKRI as the body which can span fundamental research to business-led innovation. There are various ways that a technology-focused ARPA could expand and extend on the work of Innovate UK and UKRI. For example, the InnovateUK model is on the basis of match funding from industry. ARPA will need the freedom to approach challenges that do not immediately offer clear economic benefit for a sector but have the potential to be transformative. It would therefore be risky to incorporate Innovate UK into ARPA (or vice-versa). Ensuring UK ARPA has a clear focus on specific technology missions would provide clarity for the academic and business community.

The Industrial Strategy focused on employing Challenge Directors, however, the track record with this approach has not played out as well as anticipated. We need to understand from lessons learned and ensure there is the autonomy to take decisions and risks with the agility of the US DARPA model. There is a case for ARPA and UKRI to keep distinct identities.. UK-ARPA should focus on clearly defined technical problems, with end-users for the technological solution being developed and their preparedness to try new innovative solutions in the early stages of development. Technology development plans will play a central role and they should be aligned with Catapult roadmaps etc. We can learn from WMG and the HVM Catapult network who deliver research programmes in close collaboration with end-users and deliver through strategic alliances between industry, academics and public sector agencies. Broad engagement with stakeholders, i.e. local authorities, manufacturers, exporters, local communities, will ensure that technical problems are fully understood.

**Figure 1. UK-ARPA in context**

Consideration needs to be given to how UK-ARPA aligns with DIT. For example, one strand of DIT sponsors workshops for UK academics to take their IP to Chinese venture capitalists. This approach is at odds with the need to exploit IP in the UK, therefore UK-ARPA should include their own exploitation route, which will need careful consideration in the light of potential changes to State Aid rules as we leave the Post-EU transition period.

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

ARPA should have a tight remit and focus on a small number of missions, each addressing a major societal challenge or scientific area, for example Safe AI, novel battery chemistries), where the greatest economic gains can be had. These missions should be co-created with cross-sectional experts to ensure technical challenges are fully scoped and there is a joined-up approach across stakeholder road-mapping and priority setting, to ultimately ensure a balanced investment portfolio. This approach of co-creation should allow for probing into the 'next big thing' in their fields, pushing the boundaries of new challenges and potential solutions.

A restructure and refocus of the Industrial Strategy Grand Challenges would be an appropriate starting point for UK-ARPA as the current strategy is focussed on the UK achieving technological leadership in key strategic priorities (AI and data, Clean Growth, Future of Mobility and Ageing Society), global challenges (climate emergency) and major export opportunities. For example, an ARPA mission focus on energy and health research could see programmes funded that were previously considered too risky.

A significant barrier to exploitation and innovation in the UK is a 'disconnect' between research and skills. No agency supports the latter but it is a prime mechanism in knowledge transfer. For example, WMG is a leading partner in 'Operation Great' and the 'Speed to Scale Regional Programme' to protect

automotive expertise, post-coronavirus. These programmes incorporate skills delivery to transfer the knowledge created by those involved in the R&D directly into the supply chain. In addition, UK-ARPA will need access to delivery mechanisms and should not compete with existing funding agencies.

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

The Funding of ARPA needs to be significant enough to deliver impact on key mission objectives. The precise figure will depend on the number of missions in the ARPA mandate. Providing the scale to focus on each mission is sufficient, it is perhaps more helpful to focus on how the funding is offered and certainty for long term investment that an ARPA would offer.

As noted above, spending through UKRI is linked to annual planning cycles, and major commitments are in danger of getting caught between government spending periods. This can make planning long- term research programmes more challenging. The ARPA working with a 10-15 year budget horizon will allow a specific focus on advanced/transformative technologies, and long-term application of these in industry. Further, ARPA equivalents do not provide funding on the basis of formal requirements for bidding rounds, peer review and evaluations. Therefore, there is a need for high levels of confidence in the ARPA leads, working in parallel with Government and Catapult Centres, who develop the strong commercial pull-through to bring ARPA-developed technologies to the market.

A number of current, strategic calls require match funding from industry, but against the back-drop of long-lasting financial constraints in industry this will impact their contributions to research programmes. In addition, some technology challenges for the UK benefit may be in sectors that currently operate very leanly and cannot invest. UK-ARPA will need to consider these factors.

**What can be learned from ARPA equivalents in other countries?**

The success of equivalent approaches is centred on an innovation ecosystem that includes academic, corporate and governmental partners. This interlocking ecosystem of diverse collaborators has proven to be a nurturing environment for intense creativity. WMG is one of the few current example of this way of working in the UK but for many HEI's this approach will challenge the way that they do research.

The success of ARPA equivalents depends on the extraordinary individuals who are at the top of their fields and are hungry for the opportunity to push the limits of their disciplines. These leaders come from academia, industry and government agencies for limited stints (generally three to five years). In the UK we need to be on the front foot to identify and attract these individuals.

Learning from the US model, UK-ARPA should have a higher risk appetite than other funding agencies, expecting and tolerating a certain rate of failure in its projects and initiatives. It should focus sustained funding on a small number of project teams working on broad missions (programme areas) over periods of

5-15 years. UK ARPA should have a close and active relationship with the research teams it funds, challenging progress and overall operating in a more intensive way than other funding bodies. The framework should nurture and develop research communities in emerging fields of research in the UK, supporting their development into established new fields. These will be largely focussed on basic research but may have a technological focus. They will generally be far from market at the outset but have industry pull-through, making use of mechanisms such as Catapult Centres. Successful research teams should be able to get full funding for their work via UK-ARPA to avoid them having to apply for other grants or call on other institutional funding for overheads.

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

This is a key opportunity to leverage business engagement and innovation to meet the challenges identified by UK-ARPA. The benefits of UK-ARPA being based outside the Golden Triangle would be social, economic and educational and support the government's aim to build a more equal and cohesive UK. This is not simply about the physical location of offices, however. As we have noted above, a key challenge for ARPA will be to build strong links with researchers, industry and project teams in their key mission areas, in order to build collaborative understanding of the challenges involved in their key missions and identify the individuals and partnerships with a high probability of success. In order to identify and address these mission-related challenges it will be helpful if ARPA teams are located close to clusters of innovation related to their fields, especially those in industry, where there is a current gap in support. For example, the East and West Midlands and the North West have strong existing industrial innovation and R&D networks but currently receive limited public research support compared to the "Golden Triangle". A recent NESTA report by Tom Forth and Prof Richard Jones estimates the overall scale of the interventions needs to rebalance R&D spending to the levels seen in London, the East of England and the South East at more than £4 billion per year. They state *"For the North as whole, nearly £1.6 billion extra annual spending in government laboratories and universities would be needed; for the Midlands the total is only a little less, at just over £1.4 billion. The South West, Wales and Northern Ireland together would need another £1.2 billion"*.[1] Embedding ARPA teams alongside existing innovation clusters in these regions will help identify talent, speed progress and grasp opportunities to support emerging work. Nor is it vital that there be a single ARPA presence only in one region. A hub and spoke model, with mission teams co-located alongside existing innovation cluster could support the drive for levelling up to aid economic recovery at the regional level – this is akin to the model adopted by ATI and APC.

[1] Tom Forth and Professor Richard Jones, 'The Missing £4 Billion: Making R&D work for the whole UK' (NESTA, 2020) 52