25 March 2022

AIRTO response: The House of Lords' Science and Technology Committee's Inquiry - Delivering a UK science and technology strategy

- **Preface**

AIRTO (the Association of Innovation, Research and Technology Organisations), on behalf of its members, has prepared the following response to the questions posed in the Call for Evidence. However, as previously contended by AIRTO, the term "Science and Innovation Superpower" more appropriately captures the government's ambition, to show that the application of science is as important as its basic understanding. This ambition is welcomed by AIRTO, but it is important that the critical actions by government are planned, implemented and followed through to ensure it is not only aspirational but fully realised.

Responses

1. What would it mean for the UK to be a "science superpower"?

In some aspects, the UK already is a "Science Superpower"; in its academic reputation/achievements/outputs it is a world-class nation 'punching above its weight'. However, the UK is considered to be relatively weak at the exploitation of its science base, despite its' world-class innovation organisations, thereby lacking the benefit to competitiveness, productivity and addressing societal challenges. This must be addressed if the 'Science (and Innovation) Superpower ambition is to be fully realised.

- ***What would a "science superpower" look like?***

i. Delivering world-leading science and innovation outputs.
ii. 'Punching above its weight' in applied research and innovation, leading to significantly improved national competitiveness, productivity and prosperity.
iii. Achieving the 2.4% target, and playing a key role in the levelling up agenda.
iv. Being the first choice for inward investment from overseas industry in developing science and technology, and implementing innovation. This inward investment in technical support will, in many cases, lead to inward investment for commercial developments.
v. Having a comprehensive STEM education and training system (schools and universities) to provide the required skilled personnel (from apprentice up to doctorate levels) including, in particular, degree and degree apprenticeships.
v. Attracting world-class scientists and technologists to work in the UK (short or long-term).
vi. Being the partner of choice for international science and technology collaborations, whether public or privately driven.
vii. A world-wide reputation as a leading nation, i.e., 'top 5' ranking in science/ innovation.
viii. Public recognition that the UK leads the world on science and innovation, and the general public able to reference innovations that have improved their lives.
ix. Being an exemplar to and influencing the behaviour of other countries in their science, innovation and technology-based activities.

- ***Does the Government have a coherent strategy and sufficient existing policies to make the UK a "science superpower"?***

There are significant changes to the structure of science and innovation strategy being introduced, including the new Innovation Strategy, the plans for National Science and Technology Council, the Office for Science and Technology Strategy, and the Advanced Research and Invention Agency. These, together with modifications to the existing infrastructure, have the potential for generating coherent strategy and policies. It is crucial that this work is supported by a comprehensive understanding of how the complete science, innovation and commercialisation ecosystem works and all the key organisations involved. The implementation of the strategy must utilise all the available national science and innovation assets (some of which are already acknowledged by Government as being underutilised), and include plans for the enhancement and expansion of infrastructure, resources, skills and manpower where necessary to achieve the science superpower ambition.

- ***What measures should determine whether the UK has become a "science superpower"?***

Realistic Key Performance Indicators, KPIs, should be implemented to measure factors such as innovation, economic benefit and level of inward investment, in addition to academic outputs, with accuracy and longevity. This will allow progress to be monitored. Reporting of this progress should be made public, but the frequency of gathering data and reporting must be at extended intervals to avoid inappropriate time consuming and micromanagement. Metrics should include some form of public recognition of the economic and societal benefits derived from being a science superpower.

- ***Are the Office for Science and Technology Strategy's four scientific and technological priorities the right ones for the UK?***
  The four scientific and technological priorities are all important areas for the UK, and are certainly appropriate. However, only high-level priorities have been published and more detail will be needed to focus on matching national needs with the UK's research and innovation system's key areas of expertise. Clearly, the four priorities are not exhaustive and flexibility will be needed to address more immediate challenges as they arise either within or outside of these priorities. There is also the need to consider market-led applied research and innovation (i.e., addressing the needs of industry) in the government's strategy to support the UK's competitiveness and productivity. This will often be nearer to market, and based on existing underpinning research. Again, these may fall within or outside of the four priorities.
- ***What could be done to ensure that the Government's science and technology strategy is long-term and pursued across administrations? What have been the consequences of a frequently changing science policy?***
  Now is the time to put in place the infrastructure and coherent strategy to deliver the science superpower ambition, with both the new and existing organisations involved. It is crucial that the infrastructure is established with coordinated and clear roles and interactions. An effective infrastructure with a long-term strategy and long-term funding policies (both of a minimum of 10 years), operating efficiently, will 'future proof' against changes from different administrations. Frequent changes of science policy should be avoided as this could greatly damage the progress of the science superpower ambition and the ensuing national benefit. The long-term strategy for science and innovation must be a consideration in all aspects of government policy if its ambition is to be achieved.
  Public understanding of the relevance and importance of science and innovation to national prosperity and competitiveness must be addressed as an integral part of the government strategy.

2. Are the right structures in place in Government to implement a science and technology strategy?
As discussed above, with the new organisations being implemented, this question cannot be currently answered. However, there is the opportunity to put the right structure in place.

- ***How should Government coordinate science policy across different departments, with different strategic priorities such as levelling up? What role could the National Science and Technology Council play?***
  A coherent strategy and effective infrastructure will allow science (and innovation) policy across different departments to be coordinated and for science and innovation to play its full part in achieving related priorities such as 'Levelling Up'. Different strategic priorities can often be incorporated in one science and innovation programme. The National Science and Technology Council will have a key advisory role in understanding these priorities and ensuring they are incorporated into the overall government vision for science and technology. Membership of the Council will need to be representative of the wide range of priorities and the different components of the science and technology system, including the end-users both from public bodies and industry.
- ***How should the National Science and Technology Council and the Office for Science and Technology Strategy interact with existing bodies like the UKRI Council and the Council for Science and Technology?***
  The National Science and Technology Council needs to establish a high-level vision for the UK, which the Office for Science and Technology Strategy then translates into a long-term, overall coordination of national science and innovation strategy across government departments.
  This vision provides the direction for existing bodies such as UKRI, and also for the new organisation ARIA. As well as vision, the strategy should also define the intended scope that these organisations have.
- ***Are the right levers and mechanisms in place for the delivery of a science and technology strategy?***
  Not fully, but there is the potential to achieve this if the infrastructure comprising new and existing organisations is effectively developed.
- ***Who should be accountable for the delivery of a science and technology strategy?***
  The leader of the Office for Science and Technology Strategy should be accountable for the delivery of the strategy. Its implementation will be the responsibility of relevant government departments.
- ***What ministerial representation should science and technology have?***
  There should be one minister with overall responsibility for science and technology strategy and publicly funded activities. Currently, much of this is the responsibility of the Parliamentary Under Secretary of State (Minister for Science, Research and Innovation), reporting to the Secretary of State for Business. There does need to be clarity on which is the key ministerial position, and whether this has a high enough profile to realise the government's ambition because the Minister for Science, Research and Innovation is not a Cabinet level position. However, it is also vital that all senior government ministers see the promotion of the UK's science and technology prowess as a part of their

ambassadorial responsibilities, and that Science and Innovation sit alongside the economy and national security in terms of government priorities.

3. Does the introduction of a science and technology strategy challenge the Haldane principle and UKRI's commitment to fund outstanding research?

No, the Haldane principle does not conflict with the introduction of a science and technology strategy.

- ***Should the Government take further steps to preserve and enhance the Haldane principle?***

The Haldane principle can and should be maintained as currently operated for curiosity-driven research. Setting an overall strategy for science and technology will not define which individual projects are supported with public money. However, the peer review process should be widened to include a more representative range of reviewers including those from outside academia. This will maintain the principle, but avoid decisions made based on a too narrow focus. The Haldane principle is less relevant when considering applied research and industry-led innovation, development and demonstration projects. National and end-user considerations become more relevant, but fair unbiased assessments are still needed for allocation of public money.

- ***How should the Government balance support for bottom up, curiosity-driven research with support for research focused on its strategic priorities?***

Bottom up, curiosity-driven research and research focused on government strategic priorities are not necessarily mutually exclusive. Often curiosity-driven research addresses the long-term, underpinning scientific aspects of national strategic priorities.

However, the responsive mode of Research Council grants enable projects that are purely curiosity-driven and not related to government strategic priorities to be considered, and this mode of application should be continued.

4. Is the UK realising the potential of its research investment?

No. There is an imbalance with the investment of public funding in science and technology, with a strong bias to funding basic science rather than applied research, development and innovation. This results in poor exploitation of the results of research investment (see AIRTO's Position Statement on 'More D!').

- ***Do bureaucratic processes hinder research and development in the UK? Are there examples of where these could be removed without compromising oversight?***

Some bureaucracy in the management of R&D is necessary to ensure proper oversight, fairness and accountability of granting of funding. However, there are areas where such bureaucracy is excessive and hinders effective R&D activities, such as:

i. Excessive length of time in assessing proposals and awarding funding.
ii. Excessive financial and technical monitoring of projects.
iii. Inflexibility in the direction of projects as results of R&D become available.

Overall, project awarding and monitoring should be based on dealing with exceptions rather than constant review. The government is often the slowest 'actor' in the funding of science and innovation, with excessive sequential steps in approving and allocating finding for programmes. The response to the Covid19 pandemic has shown that this complex bureaucracy can be highly truncated if necessary, and such a shorten process should be the norm rather than the exception.

- ***Could the bureaucracy reducing principles of the Advances Research and Invention Agency be extended to other public sector research establishments?***

It is currently unclear what the bureaucracy reducing principles of ARIA will be, and whether they are ARIA specific or can be applied to other organisations. However, reducing bureaucracy in the UK's science and technology infrastructure will be welcome. An Independent review of research bureaucracy in UKRI is currently being led by Adam Tickell.

- ***How can the Government better incentivise and support interdisciplinary research and innovation?***
- i. A better balance between early-stage funding and that for applied research, development and innovation. The increase in government funding will allow this to happen without compromising the funding of academic research.
  ii. Programmes specifically targeting interdisciplinary research.
  iii. Programmes that address society's and industry's problems and opportunities, that will need interdisciplinary input.
  Awarding these programmes to Innovation, Research & Technology (IRT) sector organisations, industry or other relevant bodies will enable R&D to be commissioned across a full range of relevant interdisciplinary participants.
- ***Does the Government's strategic direction and the current allocation of research funding align with the UK's scientific and economic strengths?***

No. As previously discussed, the allocation of funding needs to be more balanced to enhance exploitation of research.

5. How should state funding for research and development be allocated between different organisations, who should make that decision and by what criteria?

The allocation of public funding for R&D must be linked to the national science and technology strategy, which implies roles for in the National Science and Technology Council and the Office for Science and Technology Strategy in establishing priorities for the allocation of state funding. However, the actual allocation of funding should be the responsibility BEIS and organisations such as UKRI and ARIA. This allocation must take account of the need to increase the funding of applied research, development and innovation, as discussed previously.

- ***Should Government departments commission and fund more research and development directly?***
- Yes, in coordination with the national science and technology strategy.

What role should public sector research establishments play?

Public sector research establishments, PSREs, are an important independent asset and delivery mechanism science and innovation programmes of national importance. These organisations should have a route for feeding their perspectives and expertise into the National Science and Technology Council and the Office of Science and Technology Strategy. GO Science's PSRE forum has an important role to play in enabling communication. As AIRTO represents both PSREs and other IRT sector organisations, it is willing to work with these two new vehicles to provide a conduit to key sector-based laboratories, as they seek to consult during the development their vision and strategy.

- ***What role should universities play?***

Universities should have a route for feeding their views into the National Science and Technology Council and the Office of Science and Technology Strategy. They have key expertise to contribute on some of the key priorities that are under consideration, and how they can be addressed.

- ***How should state funding be used to leverage private sector funding?***

The use of state funding to support generic applied R&D will result in leverage by private sector funding. IRT sector organisations can demonstrate significant leverage of state funding from their private sector clients.

6. What more should be done to encourage private-sector investment in research and development in the UK?

- ***What policies could incentivise private sector research spending in the UK? Are there international examples the UK could learn from?***

Private sector research spending will be incentivised if public spending on research is targeted at applied research, development, demonstration, and innovation, and consistently applied in the long-term, to provide confidence for the private sector to invest. Currently the UK's public research spending is 85% basic research and 15% applied research. This compares to 50/50 in many competitor nations. As discussed above, addressing this imbalance will lead to more effective exploitation of the UK's science base. More effective exploitation will lead directly to increases in private sector research spending. The opportunity presented by the increases in public funding of research must be used to address this imbalance without a detrimental effect on the UK's academic base.

- ***What more could be done to incentivise collaborations between academics and industry? Are there barriers preventing this collaboration that could be removed?***

There have been a significant number of reports looking at how to enhance university/industry collaboration, yet there has been little change in the status quo. It is AIRTO's contention that this is because the underlying approach to stimulating university-industry collaborations is flawed. The UK has a world-class academic base, with researchers undertaking basic research. Pushing these researchers to act as industry facing 'consultants' risks damaging our national academic base. With some significant exceptions, the answer lies in supporting an alternative knowledge exploitation infrastructure that can work with both academics and industry – a space in the ecosystem where IRT sector organisations currently operate successfully, albeit with the potential for significant increases in their level of activity.

- ***What can be learnt from local innovation ecosystems, such as the Cambridge Science Park?***

There are more than 10 major research parks in the Cambridge area, together with scientific consultancies and the two universities, one of which is consistently ranked in the top five worldwide. A significant amount of the infrastructure existed before the Cambridge Science Park was founded, and it built on an existing ecosystem. Many factors were involved in bringing this ecosystem into being, but it did not involve national or local government strategic planning. However, local government support was needed to approve its construction.

Therefore, what can be learnt from the Cambridge Phenomenon is limited if lessons are required on how national innovation strategy can create local innovation ecosystems. More relevant models to consider are campuses such as Harwell and Culham, where public strategy and funding have supported their development, and activities in the North East, North West, South Yorkshire and the West Midlands where local and national strategic planning and funding has

directly supported such developments. There are also clusters in Northern Ireland, Wales and Scotland that provide examples of how such initiatives can be catalysed.

- ***What stage of the pipeline, from innovation to industry, is presenting the most significant problems for commercialising discoveries in the UK?***

  The concept that there is a simple pipeline from research to innovation to industry is a significant problem for commercialising discoveries in the UK. This model really only frequently materialises via spin-outs and some start-ups, which are a small proportion of the UK's industrial base.

  A more accurate model for innovation in the UK is market-led (or societal needs led), where solutions to problems or opportunities are sought, and the relevant organisation only consults as far as it needs to find these. Companies may use their own resources, but in many cases involve IRT sector organisations. The academic based often provides the underpinning research that can then be tailored to address specific issues by IRT sector organisations or industry itself. This alternative, more realistic, paradigm then shows that the problem in the 'pipeline' is the lack of support for the activities that take information from the reservoir of knowledge and apply it to real issues. In some cases, this is undertaken by universities, but the main actors in this area are IRT sector organisations and industries own internal resources. As discussed above, the key is to correct the imbalance in funding between basic research and applied research, development and innovation.

- ***What contribution should public procurement make to achieving the aims of science and technology strategy?***

  The use of public procurement should be a vital part of the UK's science and technology strategy. Incorporation of innovation in any government tendering or licensing procedure should be mandatory. There needs to be consistency across government departments in their use of procurement to the strategy.

  The effective use of public procurement will demonstrate that the Government's ambition to be a science superpower is not just rhetoric. It must be an 'early adopter' of new technologies, and have sophisticated procurement rules that take account of holistic/whole life costs and best value rather than just initial price.

7. How well does the UK collaborate on research with international partners and what can be learn from other countries?

The UK has a strong reputation concerning collaboration with international partners, particularly under the European Framework programme. Therefore, the UK associating with the current Horizon Europe programme must be a priority for government. The UK has proved to be an effective and welcomed partner over more than 30 years of research in a full range of programmes.

Outside of the European Framework programme, large initiatives such as CERN and ITER have shown effective collaboration with the UK as a welcome and often leading partner.

Smaller, often bilateral, projects can be more problematical where multiple funding sources from different governments can be difficult to coordinate. Programmes and projects where funding is place in one 'pot' before being awarded reduces this difficulty. Alternatively, the UK will benefit from the flexibility to coordinate terms and conditions of appraisal/funding with partner countries.

- ***In which areas of science and technology is collaboration, or negotiating access to existing projects, more appropriate than competition or seeking comparative advantage?***

  i. Where complementary skills, knowledge or facilities are available in a partner that are not available in the UK. This is relevant to curiosity-driven research, but can also apply to underpinning, industry specific, generic research, and also nearer to market applied R&D where such collaborations can lead to future commercial partnerships.

  ii. Where the challenges are of a scale that need the pooling of international resources to be effectively addressed.

  iii. Where a threat/challenges for a specific industry sector exists that can be tackled in a pre-competitive way.

  iv. Where collaborating within an industrial sector leads to beneficial results for all involved, such as the development of standards and codes of practice.

  v. Where organisations within a specific supply chain collaborate to mutual commercial benefit.

About AIRTO

AIRTO, the Association of Innovation, Research & Technology Organisations, represents the UK's extensive Innovation, Research and Technology (IRT) sector, which employs 57,000 highly skilled people, has a combined annual turnover of £6.9Bn and contributes £34Bn to UK GDP. Organisations in this critical sector work with industry, government and academia to promote and implement innovation, and provide technical solutions to challenges and crises. Members include independent Research and Technology Organisations (RTOs), Catapult Centres, Public Sector Research Establishments, National Laboratories, and some privately held innovation companies.

Contact: Dr Jane Gate, Executive Director, AIRTO Ltd., email: enquiries@airto.co.uk