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Submitted to **R&D Survey**

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Are you happy for your response to be published?

Yes

Raising our research ambitions

1 How can we best increase knowledge and understanding through research, including by achieving bigger breakthroughs?

Please comment here (500 words max):

AIRTO, the Association of Innovation, Research & Technology Organisations (WWW.AIRTO.CO.UK) welcomes the publication of the R&D Roadmap, and it is keen to play its part in developing the UK's R&D vision/strategy, as the government builds upon it. AIRTO is independent of academia and industry, and can bring a refined, unbiased view of how innovation actually works to the development of the UK's R&D strategy - which will be key to effectively triggering an increase in knowledge and understanding through research. A key part of developing this strategy will be shape a vision and hierarchy for R&D in the UK which is comprehensive, coherent, and long-term (and defines mission, goals, objectives, implementation plan, budget, performance measurement and overall policy).

o This will be based on:

o The government's overarching objectives

o Economic, environmental and societal objectives

o A comprehensive understanding of all the relevant UK resources (academic, research, and innovation organisations, in addition to industry, and public and private finance)

o A sound grasp of how innovation really works

o An Understanding of the deficiencies in the current UK system that have resulted us in having world-class academic research, but being relatively weak at direct exploitation of the knowledge within the UK.

Specific points in answer to the question:

o Increasing knowledge and understanding through research is not an area where the UK is deficient. We have world-class academic research and "punch well above our weight" in the traditional measures of academic success.

o The key issue for the UK is achieving national benefit from this research excellence.

o An objective for universities is therefore to make their research more appropriate and understandable beyond the academic community by:

- Focusing on the needs of national objectives and UK business, UK industry and societal priorities

- Communicating results to wider audiences – which will often require intermediaries

- Reducing the domination and influence of peer review and publication in measuring academic research success

- Collaborating more with those organisations that can take academic research and exploit it.

o Bigger breakthroughs will depend on defining real issues of importance to the UK.

o These breakthroughs will be achieved if programmes are designed to incorporate all the relevant players in the UK's innovation infrastructure.

o Breakthroughs will only create impact if followed up/complemented with relevant incremental advances through applied research, development and demonstration.

o Breakthroughs will need effective coordination – a key role for the proposed UK ARPA.

o Mission-driven programmes will encourage the collaboration of all relevant parties through common goals.

The application of new knowledge

2 How can we maximise the economic, environmental and societal impact of research through effective application of new knowledge?

Please comment here (500 words max):

- o Ensure the new knowledge is relevant to the needs of the UK.
- o Involve all the stakeholders in the setting of challenges, the defining of research priorities, and the selection of programmes and projects.
- o Reform the peer review process which perpetuates the traditional measurement of research value as papers published and cited, rather than real world impact.
- o Ensure proposals have a clear application and exploitation route, even for the most fundamental research.
- o Identify the "customer" for any research – government, industry, charity etc. – and ensure there is customer pull for the topic and their involvement in the delivery.
- o Make the outputs of publicly funded underpinning research (papers and data) "open access".
- o Improve government support for applied research, development and commercialisation, including demonstration projects that de-risk the introduction of innovation through new products and processes that exploit the UK's research output.

Driving up innovation

3 How can we encourage innovation and ensure it is used to greatest effect, not just in our cutting-edge industries, but right across the economy and throughout our public services?

Please comment here (500 words max):

- o The knowledge in our universities is a huge reservoir, but is only effectively exploited by some, cutting-edge UK industries. To the majority of industry, universities are "on a different wavelength", in terms of their objectives and priorities. There is a need to provide access to this reservoir of knowledge via organisations that understand industries' needs, and can translate the academic reservoir to meet those needs.
- o Organisations, such as those within the Innovation, Research and Technology (IRT) sector are the specialists in this activity. But their involvement in delivery of public sector policies to boost science, technology and innovation outcomes has progressively diminished over past decades since the 1970s.
- o More resources are needed to boost the role of these organisations in post-academic research translation, dissemination and exploitation. There is an extensive UK infrastructure of Public Sector Research Establishments (PSREs) and Research & Technology Organisations (RTOs), which has been augmented by the Catapult Centres.
- o Enhancing the resources and roles of all the organisations in the IRT sector will hugely increase the innovation in industry and public services. This may be by direct translation of academic research, or by the accumulated knowledge in the IRT sector from its own activities and from its partnership with academia.
- o It is important to recognise that exploitation of research by industry often involves small, incremental steps rather than large changes. The IRT sector has the expertise to define the appropriate innovative steps for individual companies.
- o The confidence of industry to make incremental innovations in partnership with the IRT sector, and to realise the benefit of these innovations, will result in an appetite and enthusiasm in time for innovation becoming an integral part of organisations' culture. This will lead to class leading productivity, products and services.

Inspiring and enabling talented people and teams

4 How can we attract, retain and develop talented and diverse people to R&D roles? How can we make R&D for everyone?

Please comment here (500 words max):

There is a need to develop the career path for R&D professionals, by working through the UK's education system. There is also a need to promote working in the UK to overseas professional. This should involve all the different specialisms needed for an effective, efficient UK R&D infrastructure, from academic researchers, through applied researchers, technicians and laboratory staff, to research managers and entrepreneurs.

Key actions for government are to:

- o Encourage creativity and innovation in school children that continues to undergraduate level – particularly in science, technology and engineering.
- o Promote R&D and innovation as a career and map out the various paths that lead to working in these fields.
- o Communicating to school children and teachers what a career in R&D and innovation what actually means/involves, covering all the aspects from fundamental research through to applied research and innovation management.
- o Build public understanding in the role and benefits of R&D and innovation – economic, environmental and societal benefits (using easy to understand examples).
- o Develop apprentice, graduate and post-graduate courses that are designed to develop R&D and innovation professional, including the relevant aspects of management and finance as well as technical subjects.
- o Promote the UK as the science and innovation superpower that welcomes capable researchers, technology specialists and 'STEM enabled' entrepreneurs from around the world, and ensure our immigration system is fit for purpose.

The IRT sector already plays a significant role in promoting careers in R&D and innovation, but can take a much more proactive role if government support is available.

Levelling up R&D across the UK

5 How should we ensure that R&D plays its fullest role in levelling up all over the UK?

Please comment here (500 words max):

- o Universities and IRT sector organisations have a good and improving record of employment regardless of gender and ethnicity. This is a continuing campaign for such organisations. Promoting R&D and innovation as a career (as discussed in question 4) will be a part of this, and will also address recruiting employees from economically disadvantaged backgrounds. This has to be matched by addressing the skills gap in economically disadvantaged regions to ensure the

relevant trained personnel are available.

o Levelling up the regional disparities in R&D and innovation activities will depend on a number of factors:

o Audits of local industry, skills and resources. Some of this has already been undertaken by the Science and Innovation Audits (SIAs)

o Local development plans

o Engaging the capabilities and specialisms of universities, FE colleges and RTOs

o Geographic advantages – such as the need for large scale R&D facilities that need deep water harbours for example.

o A combination of R&D funding and economic development funding (currently EU Structural Funds and in the future UK funds) should be used to develop facilities around the UK. It is vital that these are additional facilities that the UK needs, rather than unnecessarily replicating existing R&D and innovation infrastructure. This additionality can be based on the need for new, unique facilities, or where extra or local capacity is needed to meet demand.

o The UK's Shared Prosperity Fund can play a vital role in supporting the development of R&D and innovation activities throughout the UK. It is important that plans for this fund are made public.

o The IRT sector has facilities throughout the UK, and investment in these facilities will lead to the expansion of such organisations and their reach into local economies outside of the "golden triangle".

o However, for individual programmes and projects, decisions to fund on geographical location are not usually justified. Policy must be to ensure organisations throughout the UK are world-class competitive. Access to specialist expertise and facilities elsewhere in the UK, beyond the immediate locality, must also be enabled and encouraged.

o This will depend on cohesive working between central government, Devolved Authorities, LEPs and Combined Authorities. This should be an integral part of the planning discussed above.

Developing world-leading infrastructure and institutions

6 How should we strengthen our research infrastructure and institutions in support of our vision?

Please comment here (500 words max):

o The UK has a strong, world-class university infrastructure, and support for this must be continued, but with the caveats for research relevance discussed in earlier questions.

o Currently, the missing part of the UK's R&D and innovation infrastructure is the underfunding of the IRT sector. This sector is vital if the results of the UK academic research are to be exploited utilising their industry engagement and practical market awareness with the ensuing economic, environmental and societal benefits.

o The sector already supports industry, but does not have sufficient investment capacity and resources to meet the demand. This can involve work that provides generic support for an industry sector, or work for individual companies. Enhancing the IRT sector will increase industrial R&D spend, where companies expect the IRT organisation to have the core shared resources, skills and knowledge to address their problems and opportunities. Companies will then fund their specific projects and programmes.

o Balancing the support for the key players in R&D (universities, IRT sector and industry) will ensure the UK achieves its objective of being "a research and innovation superpower".

o The proposals for a UK ARPA will support this objective in providing a source of funding for ambitious, mission driven projects in terms of scale and objective, but it is key to recognise that every ambitious project also has numerous incremental developments and parts that have to be brought together to ensure a successful outcome, uptake and benefit beyond the core research.

o Funding of near market R&D and demonstration projects can sit uncomfortably in the current grant funding system. Increased use of customer/supplier contracts by government and government agencies can be more appropriate to these types of projects.

Being at the forefront of global collaboration

7 How should we most effectively and safely collaborate with partners and networks around the globe?

Please comment here (500 words max):

o The UK universities have a strong record of worldwide collaboration.

o The UK IRT sector also collaborates around the world, often bringing inward investment in R&D to the UK.

o Both universities and IRT sector organisations have been successfully involved in EU Framework Programmes since their inception. Future involvement in Framework Programmes must be a key priority for the UK, for the partnerships, networks and customer relationships it provides.

o This continuing involvement also applies to other EU and European research programmes where the UK has played a leading role, and the lack of future involvement will diminish the individual programmes, and research capability in both the UK and Europe.

o The use of Overseas Development Funds to promote collaborations is welcome, but care must be taken to ensure that such projects are of benefit to the UK and that key UK future commercial and security interests are not compromised in any agreements and contractual terms/conditions.

o Leaving collaboration to individual organisations (university, IRT sector organisations or industry) is valid, and can be encouraged by government support in promoting such collaborations and providing funding where there are bilateral national agreements.

o Major, strategic collaborations between the UK and third-party countries must be government-led and support national priorities. In this case clarity of the benefit to the UK and to the individual UK partners must be assured.

Harnessing excitement about our vision

8 How can we harness excitement about this vision, listen to a wider range of voices to ensure R&D is delivering for society, and inspire a whole new generation of scientists, researchers, technicians, engineers, and innovators?

Please comment here (500 words max):

A cohesive, professional, government-led promotional/marketing programme, involving all the relevant stakeholders from universities, schools and educational charities, through IRT organisations, to entrepreneurs and industry, is needed to promote the vision of the UK as a "science and innovation superpower". This should include the importance of this vision to UK future prosperity, the environment and societal benefits of R&D, and the promotion of careers in all aspects of

the infrastructure.

This programme should include:

- o A clear government lead, strategy and support for R&D.
- o Promotion of R&D in the UK, from government, but also from other players in the R&D infrastructure. This will require government coordination and support.
- o Emphasising the role R&D plays in national prosperity and every day life.
- o Emphasising the practical as well as the theoretical and blue skies aspects of R&D.
- o Have a clear "national" view of how innovation actually works in practice, and promote and disseminate it.
- o Plan the education system to deliver R&D workers as discussed above. Inspire young people with past, current, and especially future UK achievements as they occur.
- o Emphasise and laud the engineering used to apply the outcomes and knowledge originating from the fundamental and theoretical aspects of highly regarded research achievements.
- o Promote the UK's science and engineering professions and underline the esteem in which engineering leaders and achievers are or should be held, alongside 'the brightest and the best' scientists.
- o Make R&D understandable to and supported by the wide population through effective information and promotion.