

Submission to Consultation on 'Building our Industrial Strategy' - April 2017

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A: Summary:

- The United Kingdom should increase funding for artificial intelligence (AI) research to match or exceed that of countries such as Canada and France which are also competing to be world leaders in AI.
- AI research funding should not be earmarked for specific projects, but rather used to support the whole AI research ecosystem, from training to recruitment to encouraging institutional collaboration, as per the Canadian model.
- The UK should give appropriate attention to long-term issues of AI safety, by supporting research into AI safety and horizon scanning. Such research will increase public confidence in the opportunities offered by AI technologies, and reduce public concern about their deployment.
- Universities should be supported to
 - Ensure that computer science, mathematics, engineering and data science students and researchers are trained in the ethical implications of their work.
 - Provide training in creative and other skills that are less likely to be automated
- During Brexit negotiations and following Britain's exit from the European Union, the UK Government should ensure that a migration policy is in place that will still allow UK-based companies to attract the best and brightest AI talent from all over the world.
- The UK Government should support AI startups, scale-ups and SMEs, such that the pressure to be immediately commercially successful is relieved, and allowing increased innovation and commercial risk-taking.
- The UK Government should agree a 'New Deal on Data' between citizens, businesses, and government with policies on privacy, consent, transparency, and accountability.
- The UK Government should pursue an early Sector Deal for AI, on a par with the other early Sector Deals announced in the Green Paper such as those on Life Sciences and Industrial Digitalisation.
- We will be conducting research in order to:
 - Better understand the risks of job displacement (consequent to increased automation of roles and tasks) within specific sectors of industry and in different regions, and
 - Rigorously model the potential impacts of proposed solutions to the problem of job displacement, such as retraining.

We would welcome the opportunity to discuss these data with the Industrial Strategy Team at the Department for Business, Energy and Industrial Strategy, to help inform policy making.

B: Introduction:

Future Advocacy is a think tank focused on making sure the United Kingdom is best positioned to capitalize on the opportunities and mitigate the risks presented by artificial intelligence, big data, and similar technologies driving the Fourth Industrial Revolution. We are optimistic about these technologies and the tremendous opportunities they present, both in terms of economic growth and in improving social and personal well being. In tandem, we are aware of the inevitable socio-economic challenges these 'disruptive' technologies provide, and we advocate for policies that will minimise any negative impacts.

Over the last year, we've contributed to the House of Commons Science and Technology Committee's inquiry on Robotics and AI; participated in discussions at United Nations level; briefed Downing Street staff; and released a report called 'An Intelligent Future?' (available at futureadvocacy.com/s/An-intelligent-future-3.pdf), which makes 12 policy recommendations to the Government. Since then, we've established a global network of partners in industry and academia to begin to action these proposals.

We welcome the Government's Green Paper 'Building our Industrial Strategy', with its focus on innovative industries. In this document, we outline our position on the sections of the consultation which are relevant to our remit. **We are happy to be contacted** if you have any questions about our response (on the contact details below), and **we are happy for our response to be published in full**.

C: Responses to Consultation Questions:

5. What should be the priority areas for science, research and innovation investment?

We welcome the Government's commitment to cementing the UK's position as a world leader in the artificial intelligence sector. The review by Professor Dame Wendy Hall, Regius Professor of Computer Science at the University of Southampton, and Jerome Pesenti, Chief Executive of BenevolentTech, announced in the Digital Strategy (DS) released in March, will be instrumental in identifying the specific requirements needed for this sector to thrive. The £17.3 million in Engineering and Physical Sciences Research Council (EPSRC) grants to support the development of new Robotics and Artificial Intelligence (RAI) technologies in UK Universities also announced in the DS is welcome, but does not compare favourably when viewed in the context of other countries' spending on R&D in RAI technologies. For example, the Government of Canada announced in March that it is funding a Pan-Canadian Artificial Intelligence Strategy, earmarking \$125 million (~£100 million) to attract and retain top academic talent in Canada, increase the number of postgraduate trainees and researchers studying artificial intelligence,

and promote collaboration between Canada's main centres of expertise in Montreal, Toronto-Waterloo and Edmonton.¹ Similarly, as part of its #FranceAI strategy announced in January 2017, France has committed a total of €2 billion (~£1.7 billion) over the next 10 years to supporting AI research.² Moreover, the spending by large technology companies such as Google, Baidu, Facebook and Apple on R&D is of the order of billions of US\$, with a significant proportion of this being allocated to AI research.

Therefore, in order to retain its competitiveness on the world stage, the UK should **consider increasing funding for RAI research** to match or exceed that of other countries. Moreover, the Canadian approach of **investing in supporting the whole AI research ecosystem, from recruitment to training to encouraging collaboration between institutions**, is preferable to a funding strategy built on encouraging competition for funds to support single, specific projects. Such an approach increases the long-term sustainability of the AI sector, by creating and supporting training streams to provide the AI researches of the future, and embedding these streams within national collaborative research networks.

In tandem with a focus on RAI R&D, the UK Government must remain cognizant of long-term issues of AI safety - to do so would be in keeping with the wishes of a significant proportion of the electorate. In October 2016, we commissioned YouGov to conduct what is to our knowledge the only survey of the British public's perception of issues surrounding AI. A sample of 2070 adults aged over 18, weighted so as to be representative of the UK's adult population, responded to the survey. In response to the question "Which ONE, if either, of the following statements BEST describes your view towards Artificial Intelligence (AI)?", **30% responded that "AI is more of a risk to humanity than an opportunity"**.³

Therefore, to increase public confidence in the opportunities offered by AI technologies, and reduce public concern about their deployment, the UK Government should:

- **Support research into AI safety and horizon scanning**
- **Support the institutionalisation of safe AI research conduct in all sectors including the development of a code of ethics**
- **Develop standards and guidelines for whistleblowers**

¹ Canadian Institute for Advanced Research, available at <https://www.cifar.ca/assets/government-of-canada-renews-and-increases-support-for-cifar-and-invests-125-million-in-the-cifar-pan-canadian-ai-strategy/>

² Government of France, available at <http://www.gouvernement.fr/en/franceia-the-national-artificial-intelligence-strategy-is-underway>

³ Future Advocacy (2016) 'An Intelligent Future? Maximising the opportunities and minimising the risks of artificial intelligence in the UK', available at futureadvocacy.com/s/An-intelligent-future-3.pdf

6. *Which challenge areas should the Industrial Challenge Strategy Fund focus on to drive maximum economic impact?*

We welcome and strongly support the proposal that the Industrial Challenge Strategy Fund should **focus on supporting the whole AI and robotics research pathway, from early research to commercialisation**. We urge the Government to ringfence this spending and to quickly release further information on how much funding will be available specifically for this stream. Such an early commitment will reassure researchers in the field and make ‘spinning off’ of ideas originating in UK Universities more likely.

13. *What skills shortages do we have or expect to have, in particular sectors or local areas, and how can we link the skills needs of industry to skills provision by educational institutions in local areas?*

We welcome the various commitments made in the Green Paper around addressing shortages in the skills needed for the UK to be a global leader in the Fourth Industrial Revolution, such as:

- The creation of new Institutes of Technology to deliver higher technical education in STEM subjects and meet the skills needs of employers in local areas
- Professor Sir Adrian Smith’s independent review of post-16 mathematics to improve take up of mathematics and close large regional imbalances in take up of advanced mathematics.
- Replicating the specialist maths school models pioneered by Exeter and King’s College London to spread.
- Performing joined-up, authoritative research on the sector specific skills gaps that the UK faces now and in the future.

To these commitments, we would add that skills in AI ethics and good data governance should be a major focus going forward. Once again, this will ensure that the UK remains a world leader in the development of safe AI, and will increase public acceptance of the widespread deployment of these technologies. Therefore, we recommend that **UK Universities are supported in ensuring that computer science, mathematics, engineering and data science students and researchers are trained in the ethical implications of their work**, particularly with respect to handling and analysing vast quantities of personal data that drive AI applications, and the concepts of algorithmic transparency and accountability.

Many tasks and roles within industry are automatable, and with advances in RAI technologies, are increasingly likely to be so. Nevertheless, creative tasks, such as design, and tasks requiring communication and empathy, such as negotiation, are more difficult to automate. British industry will continue to require highly skilled employees who are trained and confident in performing such tasks. Therefore, **UK Universities should be supported in providing training in creative and other skills that are less likely to be automated**.

19. *What are the most important factors which constrain quoted companies and fund managers from making longer term investment decisions, and how can we best address these factors?* **AND**

22. *What are the barriers faced by those businesses that have the potential to scale-up and achieve greater growth, and how can we address these barriers? Where are the outstanding examples of business networks for fast growing firms which we could learn from or spread?*

As part of our research conducted since the launch of our report, we have spoken to various CEOs and CTOs from startups, scale-ups and SMEs working in the AI space to learn more about their vision for the future of AI development in the UK, as well as their concerns and perceived threats to this process. In all our conversations, concerns about the effects of Brexit on the ability to recruit and retain researchers and other experts in AI were mentioned. Therefore, during Brexit negotiations and following Britain's exit from the European Union, **the UK Government should ensure that a migration policy is in place that will still allow UK-based companies to attract the best and brightest AI talent from all over the world.**

Furthermore, another concern that was frequently raised was that the UK appears to have less of an 'appetite for commercial risk' when it comes to investment decisions, as compared to countries like the United States, for example. It is the experience of many startup founders that potential investors are looking for returns on investment that may be very difficult to guarantee or confidently predict with experimental technology such as AI and robotics. **The UK Government should dedicate some of the funds discussed earlier to supporting startups, scale-ups and SMEs, such that the pressure to be immediately commercially successful is relieved,** and allowing increased innovation and commercial risk-taking. In this regard, funding models such as the British Growth Fund and the London Co-Investment Fund have been very helpful to existing start-ups, and should be scaled up and replicated throughout the country.

Lastly, AI technologies depend on vast quantities of relevant data to train learning models. Access to high-quality, labelled and useful data has been frequently mentioned as an issue for SMEs. The efforts of institutions like the **Digital Catapult to ensure equitable data access to SMEs all over the country, not just large corporates based in the South East such as Google and Microsoft,** are commendable. However, it is important to ensure that the importance of data in driving machine learning algorithms is made clear to the general public, and the use of these data is done with their understanding and clear consent. We have called for a **'New Deal on Data', based on the idea of a more equitable data partnership between consumers,** who use AI technologies and provide the data that drive them, and companies, who develop the AI technologies and derive commercial benefit from them.

31. *How can the Government and industry help sectors come together to identify the opportunities for a 'sector deal' to address – especially where industries are fragmented or not well defined?*

There is a strong argument for a specific 'Sector Deal' on AI. The UK enjoys some of the best Universities performing research in the field (Cambridge, Oxford, University College London, Imperial College, Sheffield and others) and some of the most innovative companies worldwide. An early Sector Deal, on a par with the other early Sector Deals announced in the Green Paper such as those on Life Sciences and Industrial Digitalisation, would underline the Government's commitment to making AI and robotics technologies a central part of the UK's post-Brexit Industrial Strategy.

34. *Do you agree the principles set out above (section on 'Driving growth across the whole country') are the right ones? If not what is missing?*

The principles set out in this section, including the focus on ensuring nationwide growth, are broadly encouraging. What is missing is a specific understanding of the differential potential for job displacement as a result of automation in different regions across the UK. For example, preliminary research released in our report has identified call centre jobs as being ripe for automation, with the development of improved chatbots and similar technologies. Furthermore, call centre jobs are disproportionately distributed towards the North of the UK.⁴ Thus, such areas are likely to be hardest hit by automation unless specific measures are put in place to mitigate the impact of the implementation of these technologies, such as retraining schemes. Furthermore, unchecked job displacement without provision of alternative opportunities for employment and training may fuel resentment and disillusionment with the political system, in regions where such sentiment has been reported by various sources following the Brexit vote.

To date, little research exists on the likely impacts of job automation on specific industrial sectors and UK regions. Furthermore, almost no research exists on the potential outcomes of proposed solutions to job displacement, such as retraining schemes. **In collaboration with our network of partners, we will be conducting just such research and aim to have evidence to underpin policy suggestions later this year. We would welcome the opportunity to discuss these data with the Industrial Strategy Team at the Department for Business, Energy and Industrial Strategy** as it continues its work on developing the UK's Industrial Strategy.

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⁴ Future Advocacy (2016) 'An Intelligent Future? Maximising the opportunities and minimising the risks of artificial intelligence in the UK', available at futureadvocacy.com/s/An-intelligent-future-3.pdf