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& Industrial Strategy

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The Rt Hon the Lord McFall of Alcluith, Senior Deputy Speaker, Chair of the Liaison Committee

Dear Lord McFall,

Thank you for your letter of 30 January following up on progress made by this Government on the recommendations of the Select Committee on Artificial Intelligence. As you are well aware, these have been extraordinary times, and I thank you and the committee for your patience while we sought input from expert policy and delivery teams across Government.

As I hope this letter demonstrates, this Government is strongly committed to addressing the Grand Challenge on AI and Data set out in the Industrial Strategy. This began with the AI Sector Deal shortly after the Lords AI Committee published its report, and has continued with subsequent efforts. An independent AI Council was created with representatives across the Private Sector, Public Sector and Academia to help advise the government on responsible adoption of AI. The Office for AI was created to act at the AI Council secretariat and has worked to deliver the commitments in the AI Sector Deal, such as:

- improving the skills and diversity of the UK AI workforce, from AI Fellowships to attract international talent, to Masters-level AI conversion courses, backed with scholarships to encourage those from underrepresented backgrounds into the field;
- work to address the challenge of access to data and data sharing among organisations through data trusts and by other means;
- pushing AI adoption, from public sector best-practice sharing, to responsible public procurement of AI solutions, which will contribute to setting norms and standards.

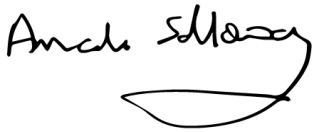
NHSx has been created to address the question of health data in our health services, and the Centre for Data Ethics and Innovation was created to put in place the capacity to think deeply and advise Government and regulators on uses of data and AI.

While we have achieved much in two short and eventful years, we recognise that there is still much to do to remain at the forefront of AI and Data by driving forward responsible AI in the UK and with our international partners. You will be aware of the further recent commitments this Government has made towards setting out a vision for the UK as a global leader in science, technology and and research,

including particular emphasis on AI and data – demonstrating the huge importance this Government places on this fast evolving field – and one which, through the help of the independent AI Council and Centre for Data Ethics and Innovation, we aim to deliver on the promises of to the public in a responsible way that works for everyone.

We hope you are reassured by this response.

Yours ever,



AMANDA SOLLOWAY MP
Minister for Science, Research and Innovation

Designing artificial intelligence

What progress has been made on the development of 'data trusts'? What will the governance of such trusts look like, and how will individuals and relevant organisations be consulted and represented?

Access to data, including exploring data sharing frameworks such as data trusts, remains an immensely important topic, and was identified as a priority by industry, academia and Government in the AI Sector Deal, drawing on it being the primary recommendation of the independent AI Review, 'Growing the artificial intelligence industry in the UK'. The Office for AI (OAI) and Innovate UK have worked with the Alan Turing Institute (ATI) and the Open Data Institute (ODI) to build consensus around what we mean by 'data trust', and in early 2019 funded three early-phase pilot data trusts, exploring the legal structures and governance needed to establish data trusts, co-designed with coalitions of partners working on common problems.

This work examined a data trust as a legal structure that provides independent stewardship of data. Organisations that collect and hold data permit an independent institution, the data trust, to make decisions about how that data is used and shared for an agreed purpose. The data trust becomes a steward of the data, taking responsibility to make decisions about the data and ensure they support the data trust's purpose. Data trusts are independent from the organisations that hold the data, and prospective data users. In order to achieve this independence, data holders and data users may be precluded from making decisions about data access, or may be included in decision making but prevented from dominating it. A data trust's trustees take on a legally binding responsibility to ensure that the data is shared and used to the benefit of a particular group of people and organisations, as well as other stakeholders affected by its use.

The legal part of the ODI work concluded that trust law is not an appropriate legal structure for data trusts. However, the fundamental underlying concept, that those who are stewards of data should be responsible for proper oversight of its sharing and use, is achievable through different legal structures. The legal team suggested that both an appropriate corporate structure and a contractual structure could be used to impose the required obligations on data stewards, though the more complex a data trust is (particularly if it will have a changing membership and evolving purpose) the more likely it is to need a corporate structure.

This work focussed on scoping and co-designing a data trust. Government has continued to fund work with the Open Data Institute on access to data and data trusts, and are encouraged to see private sector organisations contributing to supporting the Institute's continued thought leadership in this space as well.

As an example of wider interest in this topic, the Food Standards Agency is working with the University of Lincoln, via the Internet of Food Things Network Plus (www.foodchain.ac.uk) to develop a repeatable and scalable framework for managing data securely amongst business, regulators and other relevant parties across the food supply chain.

What progress has been made by departments in publishing open data, in particular since the Prime Minister's letter of December 2017? What steps have been taken across Government to improve both the quantity and quality of data available?

Since 2010 the UK has been at the forefront of opening up data to allow Parliament, the public and the press to hold public bodies to account. Transparency is crucial for accountability, delivering the best value for money and cutting waste and inefficiency.

In April 2018 the Cabinet Office established a central Transparency Data team to oversee the network of transparency data leads and publishers across government departments. The Transparency Data team supports departments as they improve the timeliness, quality and accessibility of Government's corporate transparency data publications. The team has a policy remit to consider how the range of transparency information published by Government can be expanded where appropriate and made as useful as possible to the public, business, the voluntary sector, Parliament and Government itself.

The Data Ethics and Transparency team (until recently at DCMS and now at GDS) have responsibility for delivery of Open Government Policy. The UK's third National Action Plan for Open Government (2016–2018) committed the Government to publish granular data on government grants expenditure at a scheme and award level. This was delivered in October 2017, Cabinet Office published £106 billion of grant data, with the Ministry of Justice and Department for Transport publishing data to the *360Giving scheme level standard*.[1]

The National Action Plan also made commitments to improving Contracts Finder, to ensure citizens can see a clear public record of how government money is spent on public contracts and with what results. This was delivered by the end of 2017. More data was made available to the public about various parts of contracting and on a timelier (in some cases daily) basis. Statistics on usage showed a continued increase in public interest and use of the data. There was also improved work on the format and completeness of data, as well as work merging it.

In May 2019 we launched the UK's fourth National Action Plan for Open Government. This Action Plan includes a number of open data commitments from across Government, including from the Cabinet Office Commercial Policy Transparency and Delivery team to improve the quality of open data published about government contracts, enabling tracking of cost from planning to final spend for contracts over £10,000 by Winter 2021. There is also a commitment from the Cabinet Office Grants Management Function to publish 2018/2019 financial year grants data in line with the 360Giving Standard, this is due for release in Q4 2019/2020.

The 2020 Spring Budget included funding for two important initiatives which will tackle long-standing problems with government's data infrastructure. Firstly, the Government Digital Service (GDS) has established a Data Standards Authority which is responsible for increasing the standardisation of government's data to improve its consistency, integrity and interoperability. Secondly, the Office for National Statistics (ONS) has established a Government Data Quality Hub to increase the quality of government's data through establishing best practice, tools and training. It is anticipated that these initiatives will work closely together and will help tackle some of the fundamental issues that result in data which is not fit for purpose.

What steps has the Government taken to ensure that those developing and deploying AI systems are aware of the risks? What role has the Alan Turing Institute (ATI) played in any such work?

Responsible AI must be the framework within which the AI ecosystem operates, both to mitigate risks and to realise the benefits available from the uptake of new technologies. The Government's approach to the responsible and risk-aware design, development and deployment of AI and machine learning (ML) systems is to ensure the UK remains a thought-leader and a pacesetter in the global AI/ML innovation ecosystem. A significant aspect of this has been the proactive and anticipatory manner in which it has handled preparing the developers and designers who are building these systems to consider their impacts and risks from the very beginning of project conceptualisation through to the deployment, monitoring, and re-assessment phases of the AI/ML lifecycle. The Government is working with a range of partners to ensure this is embedded in training and skills initiatives, such as the Industrial AI Masters programme with Institute of Coding, BCS (British Computer Society), and the Centre for Data Ethics and Innovation (CDEI), in research and innovation, with, UK Research and Innovation (UKRI), The ATI and many others, and in private and public sector adoption, such as via the AI Public Sector Review.

Last year, the OAI together with GDS, took the initiative of producing the world's first public sector guidance on the responsible design and use of AI/ML systems. As part of this project, The ATI authored Understanding Artificial Intelligence Ethics and Safety, which, after receiving Ministerial approval, became the Government's official public sector framework for producing and deploying responsible AI/ML technologies. This document stresses a risk-aware and impact-cognisant approach to the design process. It lays out (1) high-level values to facilitate reflection on risks and impacts of new AI/ML projects, (2) practical principles for the responsible design and implementation of these projects, and (3) a process-based governance framework to enable the operationalisation of such values and principles.

[1] Stipulates: 'open data-driven'; 'easy-to-use'; 'comprehensive' [view of grantmaking] https://www.threesixtygiving.org/support/standard/

This OAI/GDS/ATI guide has been permanently placed (as an open access publication) on the gov.uk website of the OAI and has been distributed by the Government to public data science agencies across the globe as the most comprehensive guidance on the applied ethics of AI/ML. It has also been directly linked to the innovation framework published online by the CDEI and directly cited by that agency as among “the best and most up-to-date thinking from the UK and beyond” upon which their work has drawn. The Committee on Standards in Public Life has additionally made the values and principles presented in the OAI/GDS/ATI guide a centrepiece of its recent review of AI standards and has suggested that the guide be ‘promoted extensively’.

Beyond championing a risk-and impact-aware approach to design and implementation of AI/ML systems in the public sector, the Government has also pursued a similar strategy in the area of AI explainability.

In December 2019, The Information Commissioner’s Office and The ATI published the consultation draft of Explaining AI Decisions, a three-part guide to designing and deploying AI/ML systems that are appropriately interpretable and explainable to users and affected individuals. This co-badged guidance is also a global first, and it stresses risk- and impact-aware methods to make AI/ML systems transparent both in their production processes and in the communication of their results. It builds on the values-based perspective of the OAI/GDS/ATI guide and frames the importance of explainable AI in terms of four principles: be transparent, be accountable, consider context, and reflect on impacts. This final principle forms the basis of the what is termed ‘impact explanation’—a protocol of clarification put in place to ensure risk-and impact-aware AI/ML design and use.

Finally, at a more organisation-based level, the Government has also acted constructively to develop regimes of responsible AI/ML innovation that are risk-and impact-aware. For example, the Ministry of Justice’s Data Science Hub and The ATI have been working together to develop an ethics platform for AI/ML design and use across the MoJ. This collaborative project, funded through UKRI, will apply the Government’s OAI/GDS/ATI guidance to the criminal justice context and customise the three tiers of the latter (ethical values, practical principles, process-based governance) to the domain specific needs of the MoJ’s wide range of data science and AI/ML applications.

What consideration has the Government given to introducing a specific challenge within the Industrial Strategy Challenge Fund to stimulate the creation of authoritative tools and systems for auditing and testing training datasets to ensure they are representative of diverse populations, and to ensure that when used to train AI systems they are unlikely to lead to prejudicial decisions?

AI and autonomous systems technologies collect, process and learn from data from various sources. These technologies are already being deployed across all sectors of society and have huge potential to promote both societal and economic benefits. However, if they are designed only for functionality, not recognising ethics and human values, they will not be trusted, accepted, deployed and used to their full potential, and their significant socioeconomic benefits will not be realised. To ensure that these technologies can be adopted by society, they need to behave as expected, operate in an understandable way and that can be investigated if things go wrong, be designed for use by all and be designed and implemented on the basis of societal understanding, human behaviours and values and to protect privacy.

Unlocking this potential requires substantial amounts of interdisciplinary research, integrating advances in both technical, and social sciences and humanities research. For example, research in logic, autonomy and intelligence and engineering (robotics and vehicles) is needed, but these technical developments must be carried out in the context of fundamental social sciences and humanities research across psychology, sociology, economics, ethics, philosophy, law, political science, international studies, innovation management and science and technology studies.

The UK research community has a strong track record of working at the boundary between disciplines to address complex questions in this space. There is already significant world-leading multidisciplinary research activity in the UK with a focus on making AI and autonomous systems technologies more responsible, ethical and trustworthy. UKRI and the predecessor Research Councils have funded various

activities at the interface between robotics, computer science and the humanities, with key investments made by the RCUK[2] Digital Economy Programme. For example, there was a recent call for proposals specifically aimed at funding projects investigating how to account for the effects of biases in training, data and the risks that this could be exploited or lead to unintended consequences. This call funded projects such as the Realising Accountable Intelligent Systems and People Powered Algorithms for Desirable Social Outcomes. Additional examples include the EPSRC funded fellowship *RoboTIPS* and the networks in Validation and Verification of Autonomous Systems and Robotics and Autonomous Systems.

In this context, UKRI is currently delivering the Trustworthy Autonomous Systems, a £33.7 million programme that will convene key stakeholder groups, including the public, to drive forward fundamental research into the design, development, curation, verification and validation of autonomous systems. The project is being delivered through two interconnected parts, a Hub and seven research nodes each focusing on a different research area needed to make autonomous systems trustworthy. The Hub was launched on 4 June 2020 and the nodes are scheduled to launch in October 2020, respectively.

In addition, in line with the findings on the UKRI AI Review, UKRI intends to set itself in a thought-leadership position by setting principles and expectations for the development of AI for all AI researchers and innovators undertaking UKRI-funded research and innovation. These principles and expectations will be built on the concept of RRI and will ask researchers and how they approach and carry out their AI research whilst anticipating, reflecting on, engaging with and acting on unanticipated uses and consequences. There is still need for further work to understand and implement the properties of Trustworthy AI across all applications of AI and this was a consistent cross-cutting message throughout the UKRI AI Review. Responsible trustworthy AI is also a consistent theme in the investigations and strategic approaches of key UK and international stakeholders. For example, the G20 AI Principles and OECD Recommendations on AI focus on Responsible AI as a key theme for international AI development going forward. Through the Royal Society's report 'Machine Learning: The Power and Promise of Computers that Learn by Example' the breadth of the responsibility challenge was illustrated, with clear current public concerns and barriers to adoption discussed as well as opportunities if fully responsible AI is adopted.

What progress has the Competition and Markets Authority made towards strengthening their ability to keep pace with development?

Since the Government responded to the recommendations of the report, the Competition and Markets Authority (CMA) has made substantial progress in strengthening its ability to keep pace in developments in AI. The Data, Technology and Analytics (DaTA) Unit, which sits under the Chief Data and Technology Insights Officer is now a year old and has grown throughout the year to a team of ~25 data scientists, data engineers, and data and technology insight advisors. The team has experience from within the commercial sector, as well as from wider government data science teams, and competition economics. The Data and Technology Insight team, within the DaTA unit, was specifically set up to keep pace with developments in AI alongside other new and emerging technologies, and where these might converge. As part of its remit, the team will explore current and future trends and the implications of data and technological innovation for consumers and competition.

In the last year, the DaTA Unit has focused on increasing CMA's internal effectiveness by building software tools to tackle repetitive or slow tasks, data gathering and manipulation, and analysis and insight using data science. An example of an AI-specific project is in using supervised machine learning to rank documents on their relevance in merger cases. These projects are enabling the DaTA team to build up its expertise on how AI techniques are implemented in real-world systems that can then be used to understand their use externally. The team has also had substantial input into a number of digital merger and consumer protection cases where their knowledge of technology and AI has been invaluable in understanding competition concerns and potential theories of harm.

[2] Research Councils UK – the former umbrella body for grant-awarding UK Research Councils prior to the creation of the new umbrella body, UK Research and Innovation (UKRI)

What is the long-term strategy for their new technology team, and the priorities on AI for the recently established position of Chief Data and Digital Insights Officer?

The long-term strategy of the DaTA Unit is to continue to grow our capabilities to help the CMA be more effective and efficient. We will grow our Data and Technology Insights team to engage with businesses and academia to understand trends and possible areas of concern that the CMA should be considering (e.g. by running external hackathons). We are also hiring a behavioural science team, which will strengthen our ability to tackle behavioural manipulation (e.g. how large technology platforms are combining their use of AI with 'dark patterns' and 'sludge' to influence online behaviours).

Of most relevance to AI, the DaTA team is starting a programme of work to increase our understanding of how firms are using AI and how the CMA can detect and remedy any issues. When considering cases, we are focusing on issues that cause the most harm to consumers where we believe we can substantially reduce that harm and build the DaTA unit capability to allow us to effectively deal with future harms.

Developing artificial intelligence

How many levy paying employers have transferred funds to other employers to support new apprenticeships? How many apprenticeships has this established? How are these new apprenticeships being monitored for success? How many SMEs and start-ups have benefitted from this process?

In response to feedback from employers, we introduced transfers in 2018 to support levy-paying employers to create apprenticeship starts in organisations who may have previously felt that employing an apprentice was beyond their reach.

Employers can transfer funds to other levy-payers, smaller businesses, charities, or Apprenticeship Training Agencies (ATAs), in order to support local skills needs and help sectors build sustainable capability for the future.

In response to feedback from employers, we increased the maximum amount that levy-paying employers can transfer to other employers from 10% to 25% of the annual value of funds entering their apprenticeship service accounts in April 2019.

In the 2018/2019 academic year, 910 apprenticeship starts were made as the result of a levy-paying employer transferring funds from their Apprenticeship Service Accounts (ASA). A further 480 starts were reported in the first quarter 2019/2020, showing that employer engagement with transfers is continuing to build. We know that, since the introduction of transfers in May 2018, 317 individual accounts have made transfers of funds.

Apprenticeships created as the result of transfers are subject to the same rigorous quality and assessment requirements as those funded by levy-payers in their own businesses: the receiving employer and the training provider they have chosen to use are responsible for meeting these requirements, not the transferring employer.

What are the overall conversion rates from undertaking an apprenticeship in a technology company to full-time employment? What steps, if any, are the Government taking to improve such rates and to ensure that apprentices find full-time employment in a field relevant to their training?

Apprenticeships are jobs with training, and there is an expectation that the majority of apprentices will continue with their employer at the end of their apprenticeship. The latest Outcome Based Success Measures report[3] released in October 2019 (with data on 2016/2017 achievers) provides details on all age apprenticeships and adult (19+) Further Education (FE) and Skills learners that achieved an eligible FE learning aim funded by the Education and Skills Funding Agency (ESFA).

[3] www.gov.uk/government/collections/statistics-outcome-based-success-measures

It shows that of the 277,000 learners achieving an apprenticeship as their highest aim in 2016/2017, 91% had a sustained positive destination rate (employment, education or further training). This has remained stable since 2015/2016. The sustained positive destination rate for learners who in 2016/2017 achieved Intermediate and advanced apprenticeships was 91%, and those achieving higher apprenticeships (Level 4 & 5) was 92%.

The Apprenticeships Evaluation Survey[4], released in 2017, is compiled from telephone interviews with 4,990 Level 2 and 3 apprentices and 835 Level 4+ apprentices ("higher apprentices"), undertaken from late February to mid-April 2017. at

Of the apprentices who had completed their apprenticeship at Level 2 and 3, 91% were in work at the point of survey. 60% of all Level 2 and 3 completers (apprentices) remained employed with the same employer at the time of the survey.

Of those who had completed their higher apprenticeship, 91% were in full-time work at the point of survey, and 6% were employed part time. The vast majority (89%) of all employed higher apprentices felt that it was likely that they would remain with the same employer for the next 2–3 years.

Our reforms to apprenticeships have put employers in control of designing the standards they need to meet their long-term skills needs. These new high-quality apprenticeship standards will help those achieving occupational competence at the end of their apprenticeship progress to fulfilling, successful careers.

New technologies and industries are reshaping the world at lightning speed. To meet the challenges this presents for individuals, business and the economy, we have kick-started an ambitious programme to transform technical and vocational education to match the best in the world. For too long doing and making things have taken second place to academic study – we want to change that. High-quality apprenticeships have been developed to ensure our workforce is fit for the future.

- Our apprenticeship programme is putting technical and vocational education on a par with academic study for the first time, in tandem with T Levels, a new high-quality technical alternative to A Levels.
- Apprenticeships are unique because the apprentice learns and earns at the same time. Whereas other forms of learning are primarily or solely classroom-based, apprentices spend most of their time gaining skills directly through working – while also spending a minimum of 20% of their time training away from the day job. Apprenticeships ensure everyone – whether they are a young person leaving school or someone who wants to re-train or change career – can gain the training and qualifications they need to enter the job market and that employers can access the skills they need to make the country economically strong and globally competitive.
- Apprenticeships are helping people from all walks of like to progress in their careers. After finishing an apprenticeship, 90% of apprentices go onto employment or further training, with 88% finding sustained employment.

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Has scoping work begun on the creation of a new industrial master's programme for AI? When is such a programme intended to be introduced? What will be its syllabus, and who is involved in its design and delivery?

In October 2019 the first students supported by companies who are part of the Industrial AI Masters Programme began their courses. the Institute of Coding and the OAI have helped to facilitate new partnerships between employers and universities, creating over 70 new places so far. Notably, these

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www.assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/659709/Apprenticeships_evaluation_2017-learners.pdf

include new courses, such as Cranfield Universities new MSc in Applied AI; new partnerships, such as between Queen Mary's University London and DeepMind with a scholarship for female students.[5]

Other companies include Accenture, Adarga.ai, Amplyfi, Bae Systems, Cambridge Consultants, Cisco UK, DeepMind, Cray, Infosys, Intel, QuantumBlack, who are all supporting the programme through direct sponsorship, and/or the provision of a very good paid placement to equip students of AI with an understanding of industry's needs and environments. The Institute of Coding is the delivery partner for the Industrial AI Masters programme in 2019 and will facilitate further new places, through new collaborations between industry and academia. These programmes have spearheaded a broader growth in the supply of Masters education in AI across universities and the Institute of Coding has a vital role to play in brokering new partnerships between these and industry employers.

Furthermore, 2020 will also see the start of the new AI Masters Conversion Degree Courses. This is a £13.5 million investment by the Government to address demand for professionals with AI and data science skills and the lack of diversity in the workforce. The Office for Students ran a competition over autumn/winter 2019 inviting innovative collaborations to design and provide the first set of new courses in Autumn 2020. The results of the first competition will be announced shortly.

What progress has the working group on skills within the AI Council made?

The skills and diversity working group of the AI Council has chosen to explore how to increase skills in AI, including the diversity of people studying and working in AI. At the meeting of 5 December 2019, which was informal due to the pre-election period, the skills and diversity working group identified potential avenues to take their work.

Soon after the subsequent meeting of 9 March 2020, the AI Council moved to support the Government in dealing with the direct impacts of COVID-19, and as a result the skills and diversity working group (along with the data working group and the narratives and perception working group) paused. Now that the immediate impacts of COVID-19 are less present, the AI Council are in the process of evaluating its revised areas of focus for 2020.

At the end of February 2019 UKRI announced £200 million to 'create a new generation of artificial intelligence leaders'. How is this money being spent, and what is it intended to achieve? How will such progress be reported to Parliament?
Information on the progress of this programme including number of applicants, success rates, funding allocated, and areas covered can be reported upon request. Updates on specific programmes in this way does not form part of UKRI's routine reporting. However, following the liaison committee's recommendations on the effectiveness of select committees, UKRI has been working with POST to build more effective relationships with committees. This could include updating relevant select committees on progress around any recommendations that have been agreed to.

Working with artificial intelligence

What steps have been taken to improve digital infrastructure in the UK since the publication of the Committee's report?

The Government has made good progress in improving digital infrastructure in the UK since the last report. The manifesto target of 95% superfast broadband coverage was met in December 2017, and current coverage stands at 96.5%. 5 million UK premises have been passed through the programme, of which c.400,000 premises have been covered with full fibre. These upgrades have resulted in increased productivity and connectivity to the benefits of communities, rural and urban, across the UK. The total turnover of businesses located in the upgraded postcodes expanded by almost £9 billion per annum. Furthermore, it is estimated that an additional 49,000 jobs were created in these postcodes following upgrades.

[5] https://www.qmul.ac.uk/media/news/2019/se/new-deepmind-scholarships-launch-at-queen-mary-to-encourage-more-women-in-ai.html

In particular, what role are the National Productivity Investment Fund and the Local Full Fibre Networks programme playing?

£740 million from the National Productivity Investment Fund has been reserved for digital infrastructure. Within this funding, c.£250 million has been allocated to the Local Full Fibre Networks (LFFN) programme. In the majority of LFFN projects, Local Authorities procure upgraded gigabit-capable services for their public sector buildings, for example, schools or council offices, triggering network build in the area. For the remaining projects, Local Authorities upgrade public assets and make them available for all commercial operators to access the upgraded infrastructure.

In addition to the LFFN programme, the Government launched the £200 million Rural Gigabit Connectivity (RGC) programme in May 2019. RGC is trialling models for local hubs in rural areas, starting with primary schools, where they will be upgraded to gigabit-capable connectivity. The aim of the programme is to stimulate commercial investment in the areas surrounding the hubs. Rural vouchers (up to £3,500 for SMEs and up to £1,500 for residents) are also offered to local SMEs and residents to encourage greater take-up of gigabit-capable services.

What assessment has been made of the impact of the Future Telecoms Infrastructure Review [FTIR]?

Since the publication of the FTIR in July 2018, full fibre coverage has more than doubled. 10% of the UK (c. 3 million premises – of which c400k were delivered via DCMS Programmes) can get full fibre broadband, an increase of 1.5 million from last year.

We welcome this significant improvement and further investment announcements from industry, and we still have more to do to achieve nationwide coverage. The Government will continue to build on the recommendations of the Future Telecoms Infrastructure Review, and will take action to remove barriers to network rollout and to ensure that those in the hardest to reach areas are not left behind.

We have already reintroduced the Telecommunications Infrastructure (Leasehold Property) Bill into Parliament, which will make it easier for network builders to access blocks of flats where there is an absent or unresponsive landlord. We will also be legislating shortly to mandate gigabit connectivity in new build homes.

The Government will also deliver on its promise to provide £5 billion of public money to make sure the hardest to reach areas aren't left behind. This funding will ensure that no part of the country will go without next generation broadband.

What assessment has been made of the success, or otherwise, of the challenges set by the GovTech Catalyst Fund for technology companies for the use of AI to address public sector challenges?

The majority of the 15 GovTech Catalyst challenges have now finished their first 3 months of early prototyping and are moving into the 12-month phase of the development of working prototypes, so they are still at a very early stage of development. From the assessment conducted after the initial 3-month phase we have concluded that there are some viable prototypes using AI and have allocated funding accordingly for further development of these solutions.

What other challenges are anticipated, when will they launch, and when will they conclude?

Govtech Catalyst is still learning the lessons from the first challenges and is building a business case for further funding building on the insights gained from the programme to date.

How are they being assessed for impact?

All GovTech Catalyst challenges are regularly reviewed against the programme's investment criteria and government digital standards. Impact analysis will be undertaken post-programme.

The Secretary of State for DCMS has signed an agreement with the chair of the World Economic Forum to send an official to the Centre for the 4th Industrial Revolution in San Francisco, to conduct research towards a framework for responsible public procurement of AI systems. What role will this research play in the guidance produced for civil servants in the UK?

During the Annual Meeting in Davos 2018, the DCMS Secretary of State signed an agreement to co-design innovative new tech policy approaches with the World Economic Forum's Centre of the Fourth Industrial Revolution in San Francisco.
The Office for AI seconded an official to the Centre and collaborated on co-designing *Guidelines for AI procurement* to unlock AI adoption in the public sector. The outputs of the project aim to support innovation in ethical AI development through government procurement. The *Guidelines* are designed to enable government departments to accelerate the adoption of ML tools and ensuring that the public is comfortable with the way AI-based systems make decisions. We drafted a Whitepaper with the World Economic Forum[6] and adapted the Guidelines for the UK, publishing the AI Procurement Guidelines[7] in June 2020.

Following a consultation phase and a pilot with the Department for Business, Industry and Innovation we are currently integrating the feedback into the *Guidelines.* We published an update of the *Guidelines* in June 2020. In order to procure AI more effectively and responsibly, in partnership with Crown Commercial Service, the Office for AI will launch an AI Marketplace in autumn 2020. Announced in December 2019, this electronic platform will provide categories such as consultancy services and OTC AI products and services. We suggest adhering to ethical standards is a criterion for participation. We are engaging the market to ensure the platform meets user needs.

The *Guidelines* support the Government's Technology Innovation Strategy that was published by the Government Digital Service in June 2019. The *Guidelines*, along with the 'Guide to Using AI in the Public Sector' describe the foundations that each government organisation will need to best use emerging technologies including AI. They support the aims and ambitions of the AI and Data Grand Challenge, and guide government departments as they prepare their plans for the Spending Review.

In October 2017 the Office for National Statistics published its assessment of the UK's current and future employment prospects, based on a range of indicators, and they continue to review the data to maintain, as far as is possible, an accurate assessment of the changing labour market. When is the next such assessment to be published? Has there been an update since October 2017? If not, why not?

The Office for National Statistics continues to produce a range of statistics and analysis on local labour markets. This has included publishing its first estimation of The Probability of Automation in England, which includes an assessment of the potential impact to local labour markets. This is expected to be updated in summer 2020. Further analysis on Job Quality Indicators in the UK brought together hours, earnings and contract information at a local authority level.[8]

Living with artificial intelligence

The Department for Education said they "would like to reassure the Committee that measures to improve the teaching of computer science in secondary schools are already underway". However, no specific details or commitments were provided on ensuring teachers will have time to train for the computing curriculum—can any further clarity be provided on how this will happen?

The National Centre for Computing Education (NCCE), launched November 2018 and backed by £84 million of government funding, is ensuring teachers have access to high quality training and resources to

[6] https://www.weforum.org/whitepapers/ai-government-procurement-guidelines
[7] https://www.gov.uk/government/publications/guidelines-for-ai-procurement

[8] The analysis mentioned in the Government response to this Committee's inquiry was produced by the Office for National Statistics in response to a Cabinet Office one-off request for data, and has not been repeated since. As such, the answer focuses on similar but different analysis on local labour markets that we have produced more recently.

improve the quality of computing education. A newly appointed network of 34 computing hubs across England is improving teachers' confidence in delivering the new computing curriculum across all key stages, by providing local level support to face-to-face and online CPD, and a repository of free, quality-assured online resources aligned to the national curriculum. This includes the accredited Computer Science Accelerator programme, which offers free training for up to 8,000 eligible secondary teachers by July 2022. To support and encourage teachers' participation in CPD, state-funded schools and colleges across England can access substantial bursaries. These can be used by schools to cover costs associated with CPD, such as travel costs and supply cover.

The Isaac Computer Science programme, which launched September 2019, has created affordable resources, provides CPD for A level teachers, and offers workshops for A level students in partnership with leading computer science departments in universities, to better prepare students for further study and employment in digital roles.

Is thought being given to ensuring that the reforms to the computer curriculum are not at the expense of arts and humanities subjects?

The reforms have shown that autonomy and freedom in the hands of outstanding leaders and teachers is key to deliver an excellent education. Computing is a compulsory subject in all state-maintained schools, and academies and free schools are able to use the national curriculum as a benchmark. As part of the new Ofsted inspection framework, published in September 2019, inspectors will consider the extent to which schools are providing a broad and balanced curriculum through the 'Quality of Education' judgement, which ensures pupils acquire knowledge and understanding in all aspects of their education.

We want all pupils to receive a high-quality arts education, which is why music, art and design, dance and drama are statutory subjects in the national curriculum for key stages 1–3. Between 2016 and 2020, the Government has spent nearly £500 million of funding for a diverse portfolio of music and arts education programmes designed to improve arts provision for all children. In early January, we announced funding of £85 million for music and arts in 2020–21; £80 million for music hubs coupled with further investment in film, dance, theatre, and design. It is crucial that young people learn creative skills and widen their horizons, so we will offer an 'arts premium' to secondary schools to fund enriching activities for all pupils.

At the end of September this year the Office for Students announced that they are making more funding available to develop new postgraduate conversion courses in data science and artificial intelligence. When will these courses be available? How many places will be open to students, and what qualifications will be required to undertake them?

The AI and Data Science Conversion Courses will start in September 2020. The original funding was made available for 2,500 places, 1,000 of which will be supported by £10 million of scholarship funding to encourage students from underrepresented backgrounds to apply for the places.

The aim of the scheme is to provide the opportunity for people from near-STEM and non-STEM backgrounds into AI and Data Science courses. We will shortly be announcing the providers who will develop and deliver these courses, after which more detail of the specific entry criteria will be available.

Until then, further detail, including the guidelines for applicants, is available on the Office for Students website www.officeforstudents.org.uk.

What discussions has the Government had with the Social Mobility Commission about the impact of AI on society? What steps are the Commission taking to consider the recommendations of the Committee's report?

The Social Mobility Commission has not initiated and discussions with Government about the impact of AI on society, but we are actively considering the recommendations of the Committee's report.

Healthcare and artificial intelligence

What progress has been made on the digitisation of NHS practices and records?

Work in the area of **Primary Care** aims to reduce administrative burden on GP practices, improve the effectiveness and safety of clinical processes and support patients in accessing health and care services digitally.

Key achievements include:

- GP practices are now computerised. Most of their processes are digitised and plans are in place to remove the historical Lloyd George records in all practices by 2022;
- GP practices now offer online services to patients (online booking of appointments, ordering of repeat prescriptions online, online access to their records) and increasingly offering online or video consultations and digital triage;
- The implementation of both online and video consultations has **accelerated rapidly** during the COVID-19 emergency. At the beginning of April 2020, we had 55% of GP practises enabled to do Video Consultations and 38% were able to provide Online Consultations. By the end of May we had increased these numbers to 86% of GP practises able to do Online Consultations and 92.4% of the population able to receive Video Consultations.
- The 'Securing Excellence in Primary Care (GP) Digital Services[9]' operating model was published in September 2019, through which £215m revenue funding was channelled to CCGs to fund infrastructure, support and clinical systems upgrades. In 2020/21, this amount has increased to £237m revenue and an additional £15.4m has been secured to fund improvements in infrastructure and resilience;
- The new GPIT Futures Framework, a modular and standards-based contract framework, replaced GP System of Choice in January 2020 as the mechanism for CCGs and GP practices to procure the systems they need;
- The GP Connect programme enables extended access services, NHS111 and COVID-19 Clinical Assessment Service to view patient records across and directly book patient appointments in 95% of GP practices; and
- A five-year contract framework has been agreed containing several digital commitments around patient access to their full records, targets for availability of appointments online, electronic prescriptions ordering and dispensing, removal of faxes, GP practice websites and digital services for students.

In response to the Covid-19 emergency, we have included Additional Information in Summary Care Records for patients by default, unless they have previously told the NHS that they did not want their information to be shared. At the same time, there has been a big push to increase the uptake off electronic prescription services, which has been very successful.

The **Digitising Providers** programme has increased the digital maturity of NHS Providers in **secondary care** settings so they can directly improve quality, safety and consistency of care, reduce unwarranted variation, address the funding and efficiency gap and improve the health and wellbeing outcomes for citizens.

The Global Digital Exemplars (an internationally recognised NHS provider delivering improvements in the quality of care through digital technologies and information) are sharing their learning and experiences through the creation of blueprints to enable other trusts to follow in their footsteps as quickly and effectively as possible. We are now building on this progress through the launch of the Digital Aspirants programme. 23 trusts were announced in the first wave, with subsequent waves to be confirmed between now and 2024.

Finally, the **Local Health and Care Record** is creating a person-centered shared digital record, integrating data from across the health and care system. The NHS Long Term Plan commits to national coverage of shared care records by 2024 and plans are well advanced for supporting the implementation for the rest of the country within these timescales.

How has the Digital Transformation Portfolio taken into account the need to digitise such records, and what plans does the programme have to maximise the benefits of AI for the NHS?

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[9] https://www.england.nhs.uk/publication/securing-excellence-in-primary-care-gp-digital-services-the-primary-care-gp-digital-services-operating-model-2019-21/

The Digital Transformation Portfolio continues to meet its commitment to digitising records. The below programmes of work are funded through the DTP to support meeting the technology commitments outlined in chapter 5.5 'Improving clinical efficiency and safety' in the NHS Long Term Plan:

- the National Record Locator Service allows clinicians to locate patient information held in non-clinical settings;
- Summary Care Records are an electronic record of important patient information, created from GP medical records. They can be seen and used by authorised staff in other areas of the health and care system involved in the patient's direct care;
- the National Message and Exchange Service (MESH) ensures large files of sensitive information can be securely transferred and used between care settings;
- Personal Health Records (PHRs) enable citizens to have access to, and contribute to, their medical record, book appointments, upload their own health information and provides a mechanism for easier, more efficient interaction with those that care for them.

Artificial Intelligence (AI) has the potential to make a significant difference to health and care. NHSX is focused on four key enablers for the development and deployment of AI Systems:

1. Creating the ecosystem for safe and ethical development of AI
2. Adapting the regulatory infrastructure and technical support
3. Enabling research and development
4. Spreading innovation

To improve understanding of the demand and supply landscape for AI in health and care, NHSX published the *Artificial intelligence: how to get it right report*[10]. The report – informed by research conducted by NHSX and partners – gives an overview of the current state of data-driven technologies within the health and care system and outlines where in the system AI technologies can be utilised safely and ethically.

The Digital Transformation Portfolio is responsible for delivering robust, secure and efficient data and technology systems, that are a fundamental prerequisite in enabling the **NHSX AI Lab** to develop and accelerate AI products. The AI Lab aims to bring together policies, partners and programmes to accelerate the development and deployment of safe, effective artificial intelligence applications. It will also make sure that the UK has the right regulatory frameworks in place, enabling research and giving patients confidence that their privacy is protected to the highest standards.

The AI Award will deploy £140m of award funding over three years to accelerate the testing and evaluation of the most promising AI technologies. The competition will help drive innovation and help develop the evidence base to take promising AI technologies to the point where they can eventually be commissioned across the NHS.

In addition, the NHSX AI Lab is publishing an AI Buyers Guide in early July, to help organisations think through procurement processes in the healthcare domain. This builds on previous work in the Office for AI and GDS AI Guide and the Office for AI/World Economic Forum AI procurement guide.

What safeguards are in place to protect the data rights of patients and to mitigate any risks of the use of AI?

The Government is committed to protecting the confidentiality of patient data. There are several key safeguards in place – encompassing legislation, security standards and toolkits, independent advisory bodies and a national data opt-out – which ensure that data is used across the system in a safe, secure and lawful way.

[10] https://www.nhsx.nhs.uk/assets/NHSX_AI_report.pdf

The strict rules about how data can – and cannot – be used are set out in GDPR and under the Common Law Duty of Confidentiality. Confidential patient information is looked after in accordance with good practice and the law. Every organisation that provides health and care services will take every step to:

- keep data secure
- use data that cannot identify patients whenever possible
- use data to benefit health and care
- not use data for marketing or insurance purposes (unless a patient requests this)
- make it clear why and how data is being used
- make it clear how data can be used, who can access it and when and how it must be destroyed

All NHS organisations must provide information on the type of data they collect and how it is used. For example, data release registers are published by NHS Digital and Public Health England, showing records of the data they have shared with other organisations.

The NHS adheres to the Caldicott Principles which organisations are expected to follow to protect any information that could identify a patient, such as their name and their records. These principles ensure information is only used and shared when it is appropriate to do so.

There is independent scrutiny of all applications to set aside the common law duty of confidence under s251 of the NHS Act 2006 to use Confidential Patient Information by the Confidential Advisory Group.

What consultation has taken place between NHS England and the Department for Health and Social Care and the general public and industry to explore how to maximise the benefits of health and care data for patients and taxpayers?

In July 2019, the Government published additional guiding principles to support NHS organisations allowing heavily controlled access to data by commercial partners. These state that there must be an explicit aim to benefit the NHS and patients (for example, to develop new and innovative treatments), and that the NHS must benefit fairly from all partnerships.

These principles align with the code of conduct for data-driven health and care technology, the Caldicott Principles and the data ethics framework. They address a number of emerging ethical challenges associated with the use of data in developing and testing data-driven innovations in the NHS.

What further consultation is anticipated, and what are the objectives of such work?

A policy framework is being developed to support the NHS in understanding what constitutes a fair partnership between the NHS and researchers, charities and industry on uses of NHS patients' data and NHS operational data. This has been tested through deliberative public engagement by NHS England and Understanding Patient Data (including citizen's juries).

Mitigating the risks of artificial intelligence

What discussions have the Government had with international partners about the definition of an autonomous weapons system, and what representations have they received about the issues presented with their current definition?

There is no international agreement on the definition or characteristics of autonomous weapons systems. Her Majesty's Government has received some representations on this subject from Parliamentarians and has discussed it during meetings of the UN Convention on Certain Conventional Weapons (CCW) Group of Governmental Experts (GGE) on Lethal Autonomous Weapons Systems (LAWS), an international forum which brings together expertise from states, industry, academia and civil society. The GGE is yet to achieve consensus on an internationally accepted definition and there is therefore no common standard against which to align. As such, the UK does not intend to change its definition.

Shaping artificial intelligence

Does the Government believe the UK is a world leader for the development of AI? If so, why? If not, what steps is it taking to ensure it becomes one?

The UK was recently placed within the global top 3 on Artificial Intelligence in the Global AI Index (Tortoise Media). It holds particular strengths in research, skills and talent, and venture capital investment – and is recognised as a global hub for applied AI in Fintech and healthcare.

The AI and Data Grand Challenge commits the Government to maintaining the UK at the forefront of the AI and Data revolution. To achieve this goal, the Government has been making sustained investments to build on the UK's strengths and foundations of the ecosystem, and fully realise the benefits from AI technologies.

What assessment has been made of the work of the AI Council? Is the Government happy with its work? Is there a plan to review the work of the Council at any stage? What feedback has industry given to the Government on the work of the Council? How is the Government measuring the impact of the Council?

The AI Council has met once formally, on 9 September 2019, and once informally, on 5 December 2019 during the pre-election period. During this time the Council agreed its main areas of focus for 2020, formed working groups around each, and invited the wider AI and tech ecosystem to join the work of the Council, which garnered around 500 responses. The Council are now engaging their respective participants and bringing them into the working groups.

At the end of 2020, the work of the working groups will have concluded and subsequent recommendations will be made to the Government, and this will be responded to. In addition, the OAI as secretariat to the Council is responsible for providing information to periodically inform their work, and the Chair of the Council is expected to meet with Secretaries of State at DCMS and BEIS annually to discuss the Council's work programme and progress.

The Government will also be considering how the AI Council, as a non-statutory expert committee of independent members set up to provide advice to Government and high-level leadership of the AI ecosystem, includes the wider ecosystem in their work as a measure of success. Industry has so far expressed broad support for the function of the working groups and are waiting to see how the ecosystem will be factored into each working group.

What assessment has been made of the work of the Centre for Data Ethics and Innovation [CDEI]?

It is too early to make an assessment of the work of the CDEI. They published their first formal report to the Government, on Online Targeting, on 4 February 2020, and their second formal report, on Algorithmic Bias, was published in early April. This, along with the publication of a number of other papers, will complete delivery of their first work programme.

What steps have been taken to improve coordination on the development of AI policy in the UK between different Government departments, as well as other bodies such as the AI Council, Centre for Data Ethics and Innovation and Alan Turing Institute?

Following from the AI Sector Deal, the OAI, the CDEI, and AI Council were created to coordinate and advise on AI Policy. The OAI's role is to coordinate AI policy thinking across Government, for example, by working in partnership with GDS on the AI Public Sector Review; with UKRI on AI skills and talent; and with the ATI on a range of work areas, for example, we facilitated three Memorandums of Understanding with Japanese counterparts - AIST, NII and RIKEN.

The ATI is focused on funding and delivering fundamental academic research in the field. In this sense the work ATI does is 'upstream' from CDEI's work to turn the latest academic thinking and best-practice into actionable policy recommendations for government departments and public bodies. DCMS has been working closely with the CDEI on the development of their 2020/2021 work programme, to ensure that they can provide useful advice to the government on key priority areas.

The CDEI and ATI have regular check-ins, from Chair level down to working level, and they have worked in partnership on some specific projects. In addition, Dr Adrian Weller, Programme Director for Artificial Intelligence, and Turing Fellow, is a CDEI Board member.

The AI Council was established as a non-statutory expert committee of independent members to provide advice to Government and high-level leadership of the AI ecosystem. Its role in this ecosystem is to support the growth of AI in the UK, promote its adoption and use in businesses and society, and encourage experts to focus on priority topics in AI.

Members of the AI Council include two CDEI Board members (Dame Paricia Hodgson and Kirit Sharma) and Professor Adrian Smith – Institute Director and Chief Executive of the ATI, to support coordination between all three bodies.

The AI Council has begun to engage and work with other teams in Government where their expertise is valued. For example, the data-sharing working group has been working with the National Data Strategy team in DCMS to advise and comment on their approach to their public consultation.

The working group model allows the AI Council to help other government departments deliver on their AI priorities, thereby allaying the need for each Department to create and set up its own AI advisory council. For example, the AI Council is due to advise NHSx on their AI Lab.

What is included in the ATI's international strategy for AI? What institutions are involved?

The ATI's international engagement approach is to pursue collaborative activities; for example, research exchanges, collaborative projects and networking events; that will support its goals of:

- advancing world-class research and applying it to real-world problems;
- training the leaders of the future; and
- leading the public conversation.

To this end, the Institute assesses potential collaborations in terms of whether it would help the UK achieve one or more of the following:

- research and/or innovation excellence;
- UKRI and broader UK strategic priorities;
- responsible use of data science and AI;
- development of an area of emerging strength; and
- 'global good' is compatible with our goals.

The Institute collaborates internationally in several ways, in addition to the international networks in which individual researchers participate. The Institute does so through projects developed with multinational organisations, such as the Toyota Mobility Foundation, Lloyd's Registry Foundation and Siemens, who typically provide funding for jointly developed projects that aim to develop solutions to hard methodological and real-world problems.

The Institute also has several research programmes aligned to challenge areas that also link with stakeholders, such as research organisations, government bodies and industry. For example, several research programmes have worked with other governments such as the US Department of Defence and Singapore's Ministry of Defence (DSO Labs) and the City of Amsterdam, on projects that mutually benefit the UK and the collaborating country. Additionally, the Institute's collaborative partners include independent or embedded data science and AI institutes which, like the Institute, can convene world-leading researchers

Below is a sample of institutions with whom the Institute is currently involved or are in dialogue about mutually beneficial collaborations:

- USA: MIT, Carnegie Mellon University, University of Texas Austin, Department of Defence;
- China: Beijing Academy of AI; Tsinghua University;
- Japan: NII, AIST, RIKEN (research institutes on robotics and AI); Toyota Mobility Foundation;

- Singapore: ASTAR (research Institute), SNU, DSO Singapore Ministry of Defence;
- India: Confederation of Indian Industry (CII);
- European networks: CLAIRE, ELLIS;
- France: Inria, Paris Artificial Intelligence Institute (PRAIRE);
- Germany: DFKI, Cyber Valley: Max Planck Institute for Intelligent Systems, Cluster of Excellence at University of Tubingen, University of Stuttgart; and
- Canada: Canadian Statistical Science Institute (CANSII); Canadian Institute for Advanced Research (CIFAR).

The Institute also works with the FCO's Science and Innovation Network to align with UK priorities regarding application of data science and AI in its collaboration with other countries. The Institute anticipates engaging with international bodies, such as the International Committee for the Red Cross or the UN, on cross-cutting projects for 'global good', often in areas such as support for people in unstable contexts, and environments that involve international cooperation or SDGs.

What funding is available to the Institute to pursue its AI work? How long will such funding last for?

Since the inception of the ATI in 2015, it has received approximately £5 million per annum from EPSRC to cover elements of core operational costs. This grant was recently extended for an additional two years until the end of March 2022. EPSRC also provided an initial £22 million grant for capital expenditure, which has been partly used to cover the cost of the Institute's office space within the British Library.

The remaining core operational costs and research activity is covered by multi-year grants from University Partners; Strategic Partners from industry, public sector and third sector organisations; and other research grants from UKRI and project partners on a project-by-project basis.

Does the Ministerial Working Group on Future Regulation, established to scan the horizon and identify the areas where regulation needs to adapt to support emerging technologies such as AI, supported by the Office for AI and the Centre for Data Ethics and Innovation, still exist? What has been its output? What areas has it identified, and what steps are being taken to address such needs?

The Ministerial Working Group on Future Regulation first met in October 2018 and met again in February 2019. It recommended the development of the White Paper on Regulation for the Fourth Industrial Revolution, which was published in June 2019. The paper committed to a number of measures which are being taken forward, including the following:

- a new Regulatory Horizon Council which will scan the horizon and identify the areas where regulation needs to adapt to support emerging technologies;
- building the evidence base for development of a Digital Regulation Navigator to help small and innovative businesses and those with business ideas find out what regulation would apply to them and their ideas;
- a review of the case for extending the Regulators' Pioneer Fund, which has funded a number of innovation-enabling projects, led by regulators, to support the entry of new technologies and innovations in markets; and
- a partnership with the World Economic Forum to shape global approach to regulating innovative products and services.

Does the Government have any plans to host a global summit in London with all interested nations and governments, industry (large and small), academia, and civil society to develop a common framework for the ethical development and deployment of artificial intelligence systems? Do the Government intend to sign up to an international (e.g. OECD or EU or G20) set of principles?

The Government is working with the tech community on London Tech Week, an annual event during spring (delayed to September in 2020 due to Covid-19). London Tech Week is open to all countries, organisations and societies, with a range of events, activities and conferences.

The UK is a signatory of the OECD Recommendation on AI, the G20 non-binding principles on AI, and is an active member in multilateral fora including UNESCO, the Council of Europe and the International Telecommunications Union.

This forms the end of our response.