Government response to House of Lords Artificial Intelligence Select Committee's Report on AI in the UK: Ready, Willing and Able?

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Presented to Parliament by the Secretary of State for Business, Innovation & Skills by Command of Her Majesty

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House of Lords Select Committee on Artificial Intelligence

AI in the UK: ready, willing and able?

Government Response

Introduction

1. The Department for Business, Energy & Industrial Strategy (BEIS), the Department for Digital, Culture, Media and Sport, and the Office for Artificial Intelligence welcome the House of Lords Select Committee on Artificial Intelligence's report, *AI in the UK: ready, willing and able?*

2. The Government recognises the importance of artificial intelligence to the UK's economy, its businesses, public services, its workers and consumers. As an enabling and exponential group of technologies, AI can drive efficiencies, boost productivity and accelerate innovation. It is key to realising the ambitions of the Industrial Strategy and ensuring the UK is at the forefront of existing and future industries.

3. As set out in the Industrial Strategy, published in November 2017, Artificial Intelligence and the Data Economy are regarded as one of four Grand Challenges, or areas that reflect 'seismic global change' to which the UK needs to respond and lead. Government, in coordination with industry and academia, is delivering on this through an Artificial Intelligence Sector Deal as well as through missions, or ambitious goals that seek to address the Grand Challenges. The Sector Deal's key policies aim to spur funding and investment; support necessary skills; establish essential infrastructure; and support businesses and places across the UK to develop and adopt AI and data technologies. Missions will drive forward innovation across sectors and will target key opportunities with both domestic and global impact.

4. The first mission, announced by the Prime Minister on 21 May 2018, seeks to make the UK a world leader in the use of data, AI and innovation to transform the prevention, early diagnosis and treatment of chronic diseases by 2030. Succeeding in this mission will deliver on one of a number of steps necessary towards saving lives and increasing NHS efficiency, reducing the need for costly late stage treatment.

5. Applications of artificial intelligence are broad, allowing small and large companies alike to develop innovative solutions that can meet needs and create new opportunities. Fundamental to the successful development and application of artificial intelligence is the availability of data, which the Government recognises as essential infrastructure. However, the risks and challenges posed by data aggregation and sharing are also recognised. To address these, the Office for Artificial Intelligence, the future Centre for Data Ethics and Innovation and the AI Council will work together to create Data Trusts. Data Trusts will ensure that the infrastructure is in place, that data governance is implemented ethically, and in such a way that prioritises the safety and security of data and the public.

General understanding, engagement and public narratives
Recommendation 1

    i. **The media provides extensive and important coverage of artificial intelligence, which occasionally can be sensationalist. It is not for the Government or other public organisations to intervene directly in how AI is reported on, nor to attempt to promote an entirely positive view among the general public of its possible implications or impact. Instead, the Government must understand the need to build public trust and confidence in how to use artificial intelligence, as well as explain the risks. (Paragraph 50)**

    6. The Government understands that to successfully address the Grand Challenge on AI and Data outlined in the Industrial Strategy white paper, it is critical that trust is engendered through the actions Government takes and the institutions it creates. Working towards a more constructive narrative around AI will harness and build on work already underway through the Government's Digital Charter. Through the Charter, we aim to ensure new technologies such as AI work for the benefit of everyone – all citizens and all businesses – in the UK. The Government is developing policies and actions that make the UK the safest and fairest place to be online, driving innovation and growth across the economy – helping to shift the debate in a healthier and more productive direction.

    7. The Government is also working to:
- Ensure debate and policy-making are sufficiently evidence-based and informed by convening experts across sectors;
- Build public confidence and trust in AI and data technologies by laying strong foundations through the AI institutions Government is setting up – e.g. the Office for AI, the AI Council, and the Centre for Data Ethics and Innovation
- Equip individuals and businesses with the tools and skills to engage in and benefit from AI, and act as more informed decision-makers;
- Be transparent and accessible to industry and public scrutiny.

    8. The Centre for Data Ethics and Innovation will deliver its work through extensive engagement with civil society and the public, as well as industry and regulators (particularly the Information Commissioner's Office and consumer protection and competition bodies). It will seek to ensure that governance measures are aligned with and respond to public concerns around data driven technologies, and address businesses' needs for greater clarity and certainty around data use. It will do so while ensuring the UK continues to meet the EU data protection 'adequacy' standard that enables the free flow of personal data between the two jurisdictions. It will draw on and commission research and analysis to fully understand the nature and impacts of data and AI.

Everyday engagement with AI
Recommendations 2-3

    ii. **Artificial intelligence is a growing part of many people's lives and businesses. It is important that members of the public are aware of how and when artificial intelligence is being used to make decisions about**

them, and what implications this will have for them personally. This clarity, and greater digital understanding, will help the public experience the advantages of AI, as well as to opt out of using such products should they have concerns. (Paragraph 58)

iii. **Industry should take the lead in establishing voluntary mechanisms for informing the public when artificial intelligence is being used for significant or sensitive decisions in relation to consumers. This industry-led approach should learn lessons from the largely ineffective AdChoices scheme. The soon-to-be established AI Council, the proposed industry body for AI, should consider how best to develop and introduce these mechanisms. (Paragraph 59)**

9. The Government fully supports innovative uses of data where it is used safely and responsibly. The General Data Protection Regulation (GDPR), which is being brought into UK law through the Data Protection Act 2018, will support automated processing including the use of personal data in artificial intelligence and machine learning.

10. The Data Protection Act 2018 reflects the need to ensure there are stringent provisions in place to appropriately regulate automated processing. The Act includes the necessary safeguards such as the right to be informed of automated processing as soon as possible and also the right to challenge an automated decision made by a data controller or processor.

11. Individuals should not be subject to a decision based solely on automated processing if that decision significantly and adversely impacts them, either legally or otherwise, unless required by law.

12. If a decision based solely on automated processing is required by law, the Act specifies safeguards that controllers should apply to ensure the impact on the individual is minimised. This includes informing the data subject that a decision has been taken and provides them with 21 days to ask the controller to reconsider the decision or retake the decision with human intervention.

13. Informing the public of how and when AI is being used to make decisions about them, and what implications this will have for them personally will be raised with the new Artificial Intelligence Council. At present, this decision will be left to individual businesses to decide on whether and in what way to inform consumers of AI's deployment. Should a regulatory requirement be introduced, it will be done so in consultation with relevant industry bodies, businesses, regulators, and Government departments.

14. The terms and proposed members of the AI Council are currently being considered by Government. Issues regarding 'opt-outs' will be flagged with the Council upon its establishment.

Designing artificial intelligence
Access to, and control of, data
Recommendations 4-10

iv. The Government plans to adopt the Hall-Pesenti Review recommendation that 'Data Trusts' be established to facilitate the ethical sharing of data between organisations. However, under the current proposals, individuals who have their personal data contained within these trusts would have no means by which they could make their views heard, or shape the decisions of these trusts. We therefore recommend that as Data Trusts are developed under the guidance of the Centre for Data Ethics and Innovation, provision should be made for the representation of people whose data is stored, whether this be via processes of regular consultation, personal data representatives, or other means. (Paragraph 82)

15. Government is currently exploring data sharing frameworks such as Data Trusts – mechanisms where parties have defined rights and responsibilities with respect to shared data – in order to protect sensitive data, facilitate access to data, and ensure accountability. During this process we will consider how best to develop governance structures that would include representation of those individuals and organisations concerned.

v. Access to data is essential to the present surge in AI technology, and there are many arguments to be made for opening up data sources, especially in the public sector, in a fair and ethical way. Although a 'one-size-fits-all' approach to the handling of public sector data is not appropriate, many SMEs in particular are struggling to gain access to large, high-quality datasets, making it extremely difficult for them to compete with the large, mostly US owned technology companies, who can purchase data more easily and are also large enough to generate their own. In many cases, public datasets, such as those held by the NHS, are more likely to contain data on more diverse populations than their private sector equivalents, and more control can be exercised before they are released. (Paragraph 83)

16. The Government wants to ensure that digital markets work for everyone – for citizens, businesses and society as a whole. It is important to ensure innovative start-ups and SMEs are not held back by not being able to access data (including non-personal data and, where consent is explicitly given, personal data) to build AI systems because they do not have the negotiating power or capacity of larger organisations. It may be important to take measures to make access to public data more equitable, provided appropriate safeguards are put in place. For example, Data Trusts could help SMEs pool resources to rationalise access to data and work together to preprocess data – allowing them to compete with more established firms. In so doing, a healthier AI and data business ecosystem could be fostered.

17. The Government is also considering mechanisms and terms for data sharing. For example, Government is exploring how sharing data will allow access to a wider pool of data and recognises that requirements and arrangements for doing so will vary.

vi. We recommend that wherever possible and appropriate, and with regard to its potential commercial value, publicly-held data be made available to AI researchers and developers. In many cases, this will require Government departments and public organisations making a concerted effort to digitise their records in unified and compatible formats. When releasing this data, subject to appropriate anonymisation measures where necessary, Data Trusts will play an important role. (Paragraph 84)

18. Government departments already publish open data – including many thousands of datasets on departmental spend, environmental and agricultural data, and transport, to name but a few categories. Such datasets are used to build services and applications; some businesses build their services entirely on open Government data.

19. However, the Government recognises that there is work to be done in order to ensure the quality of published data is of the highest calibre – including that it is in a commonly accessible and machine readable format, and conforms to metadata standards – both of which reduce friction in access and use, including by the AI community. In December 2017 the Prime Minister sent a letter to Departments asking them to improve the quantity and quality of data that they make open. We recognise that continued engagement of Departments on this agenda is crucial. There are examples of innovative organisational models providing access to restricted data, such as around geospatial data or education data, through data labs. Government departments should continue to engage with such models, and with best practice on publishing high-quality open data, in order to provide access to more, better quality, timely, and machine readable open data when the data is non-personal. When data includes personal data, it may be necessary to use mechanisms such as secondment of appropriately vetted staff into data holding Departments.

vii. We support the approach taken by Transport for London, who have released their data through a single point of access, where the data is available subject to appropriate terms and conditions and with controls on privacy. The Centre for Data Ethics and Innovation should produce guidance on similar approaches. The Government Office for AI and GovTech Catalyst should work together to ensure that the data for which there is demand is made available in a responsible manner. (Paragraph 85)

20. Government is supportive of an approach that makes key datasets available for businesses and other organisations to innovate with. This could be achieved by a number of means, including through portals and, increasingly preferred, via APIs. The Office for Artificial Intelligence is working with the GovTech Catalyst on driving adoption across sectors and will be made available for data innovation as appropriate.

viii. We acknowledge that open data cannot be the last word in making data more widely available and usable, and can often be too blunt an instrument for facilitating the sharing of more sensitive or valuable data. Legal and technical mechanisms for strengthening personal control

over data, and preserving privacy, will become increasingly important as AI becomes more widespread through society. Mechanisms for enabling individual data portability, such as the Open Banking initiative, and data sharing concepts such as Data Trusts, will spur the creation of other innovative and context-appropriate tools, eventually forming a broad spectrum of options between total data openness and total data privacy. (Paragraph 86)

ix. We recommend that the Centre for Data Ethics and Innovation investigate the Open Banking model, and other data portability initiatives, as a matter of urgency, with a view to establishing similar standardised frameworks for the secure sharing of personal data beyond finance. They should also work to create, and incentivise the creation of, alternative tools and frameworks for data sharing, control and privacy for use in a wide variety of situations and contexts. (Paragraph 87)

21. The Government's recent green paper *Modernising Consumer Markets* set out our ambition to support the implementation of data portability in regulated markets to strengthen competition and help consumers find the best deal for them.[1] The paper announced that the Government will launch a "Smart Data Review" to identify the lessons learned from existing data portability initiatives, and consider how the approach of Open Banking can be implemented in other regulated markets.

x. Increasingly, public sector data has value. It is important that public organisations are aware of the commercial potential of such data. We recommend that the Information Commissioner's Office work closely with the Centre for Data Ethics and Innovation in the establishment of Data Trusts, and help to prepare advice and guidance for data controllers in the public sector to enable them to estimate the value of the data they hold, in order to make best use of it and negotiate fair and evidence-based agreements with private-sector partners. The values contained in this guidance could be based on precedents where public data has been made available and subsequently generated commercial value for public good. The Information Commissioner's Office should have powers to review the terms of significant data supply agreements being contemplated by public bodies. (Paragraph 88)

22. The Government recognises that data is the infrastructure for artificial intelligence – providing a fundamental framework for AI systems to function. The Committee is right to identify the potential commercial value of public sector data as well as its role in supporting the development of artificial intelligence products. Government recognises that innovative and valuable services can be built with public sector data – from public transport applications, to having a clearer picture of flood risk for emergency services, insurers and citizens. We are committed to supporting and growing digital businesses, and understand that open data offers a powerful way to speed up the development of ecosystems around specific technologies and sectors.

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[1] https://www.gov.uk/government/consultations/consumer-green-paper-modernising-consumer-markets

23. Where personal data is concerned, understanding potential commercial value of services built on top of the data could inform negotiating strategies, if balanced alongside ethical considerations such as proportionality, privacy and public benefit. It will be critical for public trust in data sharing that we ensure equitable and proportionate access to data generated by the public sector. Further research is required to understand what model(s) are appropriate in different contexts. It may be important to impose conditions towards fostering a more equitable market for innovation to avoid the development of 'data monopolies'. Government is exploring whether the process of data use – not the data itself, which may be personal – should be made transparent as a condition of access to data. We would want to test whether this promotes public trust and innovation, or impedes reuse of valuable public data.

24. The Office for Artificial Intelligence, and the Centre for Data Ethics and Innovation and the AI Council in consultation with relevant Government departments will explore ways in which public data can be utilised by diverse businesses, including SMEs in a fair way. Government believes that the equitable access to public data should be prioritised so as not to privilege any single business or group of businesses. Data should be viewed as an enabler to businesses.

Intelligible AI
Recommendations 11-13

> **xi. Based on the evidence we have received, we believe that achieving full technical transparency is difficult, and possibly even impossible, for certain kinds of AI systems in use today, and would in any case not be appropriate or helpful in many cases. However, there will be particular safety-critical scenarios where technical transparency is imperative, and regulators in those domains must have the power to mandate the use of more transparent forms of AI, even at the potential expense of power and accuracy. (Paragraph 99)**

> **xii. We believe that the development of intelligible AI systems is a fundamental necessity if AI is to become an integral and trusted tool in our society. Whether this takes the form of technical transparency, explainability, or indeed both, will depend on the context and the stakes involved, but in most cases we believe explainability will be a more useful approach for the citizen and the consumer. This approach is also reflected in new EU and UK legislation. We believe it is not acceptable to deploy any artificial intelligence system which could have a substantial impact on an individual's life, unless it can generate a full and satisfactory explanation for the decisions it will take. In cases such as deep neural networks, where it is not yet possible to generate thorough explanations for the decisions that are made, this may mean delaying their deployment for particular uses until alternative solutions are found. (Paragraph 105)**

> **xiii. The Centre for Data Ethics and Innovation, in consultation with the Alan Turing Institute, the Institute of Electrical and Electronics Engineers, the British Standards Institute and other expert bodies, should produce guidance on the requirement for AI systems to be intelligible. The AI development sector should seek to adopt such**

guidance and to agree upon standards relevant to the sectors within which they work, under the auspices of the AI Council. (Paragraph 106)

25.   Government believes that transparency of algorithms is important, but for development of AI an overemphasis on transparency may be both a deterrent and is some cases such as deep learning prohibitively difficult. Such considerations need to be balanced against positive impacts use of AI brings.

26.   With respect to AI and data technologies' application to health, Government believes that given the likely benefits that would accrue to patients and providers from this technology, we must carefully weigh this against the requirement for transparency. Over-emphasis on transparency could deter the use of AI, and in doing so, could deny patients access to an important component of their care. Anything we do in this area will link strongly to, and depend on, effective communication with patients and health and care professionals.

27.   DHSC in particular has some concerns with the broad scope of this recommendation. Many of the most important applications of AI in health and care, including diagnostics, will rely on deep learning techniques, and acceptance of this recommendation risks cutting across ongoing programmes of work.

28.   DHSC's recommended approach is to focus on techniques that can mitigate or bypass the black box problem, including the use of counterfactuals and explanation of the weighting of the different inputs considered by an algorithm. This will depend on effective communication with patients and health and care professionals, and ensuring that patients continue to be able to give informed consent for any treatment provided. Use of AI technologies should augment human expertise in the diagnosis and treatment of disease, and in other sectors where the AI could have an impact on human life.

Addressing prejudice
Recommendations 14 - 16

xiv. We are concerned that many of the datasets currently being used to train AI systems are poorly representative of the wider population, and AI systems which learn from this data may well make unfair decisions which reflect the wider prejudices of societies past and present. While many researchers, organisations and companies developing AI are aware of these issues, and are starting to take measures to address them, more needs to be done to ensure that data is truly representative of diverse populations, and does not further perpetuate societal inequalities. (Paragraph 119)

xv. Researchers and developers need a more developed understanding of these issues. In particular, they need to ensure that data is pre-processed to ensure it is balanced and representative wherever possible, that their teams are diverse and representative of wider society, and that the production of data engages all parts of society. Alongside questions of data bias, researchers and developers need to consider biases embedded in the algorithms themselves --human

developers set the parameters for machine learning algorithms, and the choices they make will intrinsically reflect the developers' beliefs, assumptions and prejudices. The main ways to address these kinds of biases are to ensure that developers are drawn from diverse gender, ethnic and socio-economic backgrounds, and are aware of, and adhere to, ethical codes of conduct. (Paragraph 120)

xvi. We recommend that a specific challenge be established 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. This challenge should be established immediately, and encourage applications by spring 2019. Industry must then be encouraged to deploy the tools which are developed and could, in time, be regulated to do so. (Paragraph 121)

29. Government recognises that one of the risks of automated decision-making is that the datasets which the algorithms learn from may reflect the structural inequalities of the society from which data are collected and that this can lead to the encoding of unintentional bias. We will work to ensure that those developing and deploying AI systems are aware of these risks, and the trade-offs and options for mitigation are understood. It is important that multiple perspectives and insights are represented during the development, deployment and operation of algorithms. To this end, we will work the Alan Turing Institute, which has been working to address these issues.

30. We will also work to augment the AI workforce to ensure diversity by training, attracting and retaining a diverse talent pool in terms of gender, ethnic and socio-economic backgrounds, and will work to mitigate and counter the effects of unconscious bias through these endeavours.

Data monopolies
Recommendation 17

xvii. While we welcome the investments made by large overseas technology companies in the UK economy, and the benefits they bring, the increasing consolidation of power and influence by a select few risks damaging the continuation, and development, of the UK's thriving home-grown AI start-up sector. The monopolisation of data demonstrates the need for strong ethical, data protection and competition frameworks in the UK, and for continued vigilance from the regulators. We urge the Government, and the Competition and Markets Authority, to review proactively the use and potential monopolisation of data by the big technology companies operating in the UK. (Paragraph 129)

31. The CMA understands both the importance of data, and risks outlined by the committee. It has identified online markets and the digital economy as a priority area in their 2018/19 Annual Plan. The Government's recently published *Modernising Consumer Markets* Green Paper also contains a strong focus on digital markets including online platforms. It identifies a number of potential competition issues and seeks views on the use and

effectiveness of the UK's competition legislative powers in the context of digital markets. The CMA will actively engage in this review.

32. More broadly, the CMA is aware of the debate around access to data being important to innovation in AI and in digital markets generally, and the Committee's report makes a useful contribution to this debate. The CMA is actively exploring where it can be of most value in this space and therefore welcomes the Committee's report

33. The powers that the CMA has are that it is able to stop anti-competitive agreements or abuses of a dominant position within a market. The CMA is able to prohibit mergers which meet certain jurisdictional tests. It can protect the welfare of consumers by enforcing consumer protection regulations. Finally, they can take a broad examination of entire markets through their market study and market investigation powers and have strong remedial powers.

34. The CMA is building a new technology team to strengthen its ability to keep pace with the use of algorithms, artificial intelligence and big data in business. The team will be made up of data scientists, computer experts and economists. A new position of Chief Data and Digital Insights Officer has been created and the appointment just made to lead the team to develop and deliver an effective data and digital insight strategy in order to allow the CMA to better understand the impact that data, machine learning and other algorithms have on markets and people.

35. The CMA is working closely with colleagues across Government and in the European Commission on various regulatory initiatives and on considering how user data can be harnessed to improve outcomes for consumers. The CMA is also in close contact with its international colleagues regarding their work on digital markets and big data.

Developing artificial intelligence
Investment in AI development
Recommendations 18 - 21

> **xviii. The UK AI development sector has flourished largely without attempts by the Government to determine its shape or direction. This has resulted in a flexible and innovative grassroots start-up culture, which is well positioned to take advantage of the unpredictable opportunities that could be afforded by AI. The investment environment for AI businesses must be able to cope with this uncertainty, and be willing to take the risks required to seize the chances AI offers. (Paragraph 135)**

> **xix. We welcome the changes announced in the Autumn Budget 2017 to the Enterprise Investment and Venture Capital Trust schemes which encourage innovative growth, and we believe they should help to boost investment in UK-based AI companies. The challenge for start-ups in the UK is the lack of investment available with which to scale up their businesses. (Paragraph 150)**

xx. To ensure that AI start-ups in the United Kingdom have the opportunity to scale up, without having to look for off-shore investment, we recommend that a proportion of the £2.5 billion investment fund at the British Business Bank, announced in the Autumn Budget 2017, be reserved as an AI growth fund for SMEs with a substantive AI component, and be specifically targeted at enabling such companies to scale up. Further, the Government should consult on the need to improve access to funding within the UK for SMEs with a substantive AI component looking to scale their businesses. (Paragraph 151).

xxi. To guarantee that companies developing AI can continue to thrive in the UK, we recommend that the Government review the existing incentives for businesses operating in the UK who are working on artificial intelligence products, and ensure that they are adequate, properly promoted companies, and designed to assist SMEs wherever possible. (Paragraph 152)

36. Government's Autumn Budget 2017 and the Industrial Strategy published in November 2017 both highlight the importance of investment in the technologies of the future and to ensure every part of the UK can share in the rewards. This includes artificial intelligence, amongst other technologies. A key Government commitment to this end is increasing R&D investment by a further £2.3bn in 2021-22 from the NPIF, and increasing the R&D expenditure credit to 1.2%, demonstrating clear progress towards the Government's ambition to raise the level of investment in R&D in the economy to 2.4% of GDP.

37. Further policies aligned with increasing investment in innovative and knowledge-intensive businesses, including artificial intelligence, include:
- establishing a new £2.5bn Investment fund. By co-investing with the private sector, a total of £7.5bn of investment will be unlocked;
- doubling the annual allowance for people investing in knowledge-intensive companies through the Enterprise Investment Scheme (EIS) and the annual investment those companies can receive through EIS and the Venture Capital Trust scheme, together unlocking over £7bn of growth investment;
- investing in a series of private sector fund of funds of scale, supporting a total of up to £4bn of investment;
- backing new and emerging fund managers, unlocking at least £1.5bn of new investment;
- backing overseas investment in UK VC through the Department of International Trade, expected to unlock £1bn of investment;
- working with the Pensions Regulator to clarify investment guidance for trustees to give pension funds confidence to invest in assets supporting innovative firms as part of a diverse portfolio; and
- changing the qualifying rules of Entrepreneurs' Relief.

38. Additionally, Government's Industrial Strategy Challenge Fund Wave 2 has secured funding allocations. This includes the Quantum Pioneer programme, comprised of a £20m Collaborative Research and Development competition aimed at delivering working prototype devices with project sizes expected to be approximately £3m-10m.

39. Government agrees that EIS, VCT, and the £2.5bn Investment Fund will support businesses working on artificial intelligence technologies. Both sets of policies, however, are sector agnostic. With respect to the Investment Fund, this means that the new £2.5bn patient capital investment fund is sector agnostic and demand-led and so it cannot be reserved or apportioned to particular business sectors or technologies. The British Business Bank will issue a "Request for Proposals" and it is for venture and investment funds to prepare proposals in response and approach British Patient Capital within the Bank for support for their proposed fund. As such investment arising through both EIS, VCT, and the Investment Fund neither prioritises nor disfavours any particular sector.

Turning academic research into commercial potential
Recommendations 22-23

xxii. The UK has an excellent track record of academic research in the field of artificial intelligence, but there is a long-standing issue with converting such research into commercially viable products (Paragraph 159)

xxxiii. To address this we welcome, and strongly endorse, the recommendation of the Hall-Pesenti Review, which stated "universities should use clear, accessible and where possible common policies and practices for licensing IP and forming spin-out companies". We recommend that the Alan Turing Institute, as the National Centre for AI Research, should develop this concept into concrete policy advice for universities in the UK, looking to examples from other fields and from other nations, to help start to address this long-standing problem. (Paragraph 160)

40. Government agrees that it is important that the UK should capture the economic benefits of the public investment in academic research in all areas, including those associated with the field of artificial intelligence.

41. Latest evidence from "Research into issues around the commercialisation of university intellectual property (IP)" published in April 2018 recognised the diversity of opportunities and issues that could not be accommodated within a "one size fits all" approach (a conclusion which also emerged from an earlier review of University Tech Transfer published in 2016).[2] It concluded that "*approaches taken to knowledge exchange and the commercialisation of university intellectual property are working reasonably well",* although there are *"a number of specific constraints, barriers and pinch-points",* and that *"there is potentially scope to do more".*

42. The research highlights a potential need for further training, guidance on practices that help reduce complexity for all involved in the commercialisation process, and a need for greater transparency on university policies, in broad terms, to streamline the negotiation process and help manage expectations among partners.

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[2] https://www.gov.uk/government/publications/commercialisation-of-university-intellectual-property

43. The Government agrees that universities should set out clearly their principles and approach to handling IP, including licensing IP and for supporting IP-based spin-out and other start-up companies. The Government also recognises that AI is not a homogenous activity but one with great diversity in:

- the application (*from being a component of a product or service through to a "pure AI" activity*);
- the particular discipline (*which ranges from STEM to arts, humanities and social sciences*);
- the channel or approach for commercialisation (*from an IP-based academic spin out to alumni start-up either soon or a long time after graduation*); and
- the origin of the opportunity (*which may arise through a lone inventor, a post-doc or researcher benefiting from the ideas and experience of a research group, through to the culmination of long sustained investment in an active research group*).

44. The Government has appointed the Alan Turing Institute as the national institute for data science and artificial intelligence – bringing together the capabilities of leading universities across the UK. We would encourage the Turing Institute to use its expertise in the application of data science and AI, along with its existing and future collaborations to work with and support its founding and partner universities to identify and progress the range of opportunities for commercialisation emerging from their work.

45. As well as increased support for the application and commercialisation of research through the c. £1.7bn Industrial Strategy Challenge Fund, the Government is improving the incentives, support, processes and skills that enable the flow of knowledge and ideas around society, and increase opportunities for research commercialisation, including:

- Research England is developing a new Knowledge Exchange Framework - to benchmark how well universities in England are doing at fostering knowledge sharing and research commercialisation, including through licensing intellectual property and creating IP based spin-outs;

- The Knowledge Exchange Champion (Trevor McMillan, VC of Keele University) is developing a "Knowledge Exchange Concordat", which will encourage leaders of universities to commit to a set of principles and a process of continuous improvement to increase the effectiveness of their knowledge exchange activities; and

- Higher Education Innovation Funding will increase to £250m pa by 2021 to support universities to work with businesses and others to innovate and commercialise research, and the £100m Connecting Capability Fund is supporting universities in England to collaborate together, to pool capability and to share good practices in IP commercialisation and in working with business.[3]

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[3] https://www.gov.uk/Government/publications/commercialisation-of-university-intellectual-property

Improving access to skilled AI developers
Recommendations 24 – 30

xxiv. We welcome the expanded public funding for PhD places in AI and machine learning, as well as the announcement that an industry-funded master's degree programme is to be developed. We do believe that more needs to be done to ensure that the UK has the pipeline of skills it requires to maintain its position as one of the best countries in the world for AI research. (Paragraph 168)

xxv. We recommend that the funding for PhD places in AI and machine learning be further expanded, with the financial burden shared equally between the public and private sector through a PhD matching scheme. We believe that the Doctoral Training Partnership scheme and other schemes where costs are shared between the private sector, universities and research councils should be examined, and the number of industry-sponsored PhDs increased. (Paragraph 169)

xxvi. We further recommend that short (3–6 months) post-graduate conversion courses be developed by the Alan Turing Institute, in conjunction with the AI Council, to reflect the needs of the AI development sector. Such courses should be suitable for individuals in other academic disciplines looking to transfer into AI development and design or to have a grounding in the application of AI in their discipline. These should be designed so as to enable anyone to retrain at any stage of their working lives. (Paragraph 170)

xxvii. We recommend that the Government ensures that publicly-funded PhDs in AI and machine learning are made available to a diverse population, more representative of wider society. To achieve this, we call for the Alan Turing Institute and Government Office for AI to devise mechanisms to attract more female and ethnic minority students from academic disciplines which require similar skillsets, but have more representative student populations, to participate in the Government-backed PhD programme. (Paragraph 174)

xxviii. We acknowledge the considerable scepticism of at least some technology companies who believe that the apprenticeship levy is of little use to them, despite the success that others in the sector have had with apprenticeships. The Government should produce clear guidance on how the apprenticeship levy can be best deployed for use in the technology sector, in particular in SMEs and start-ups. (Paragraph 175)

xxix. The Government's announcement that it will increase the annual number of Tier 1 (exceptional talent) visas from 1,000 to 2,000 per year is welcome. While top-tier PhD researchers and designers are required, a thriving AI development sector is also dependent on access to those able to implement artificial intelligence research, whose occupations may fall short of the exceptional talent requirements. (Paragraph 181)

xxx. We are concerned that the number of workers provided for under the Tier 1 (exceptional talent) visa scheme will be insufficient and the

requirements too high level for the needs of UK companies and start-ups. We recommend that the number of visas available for AI researchers and developers be increased by, for example, adding machine learning and associated skills to the Tier 2 Shortage Occupations List. (Paragraph 182)

46. Increasingly, employers in the technology sector understand the benefits of apprenticeships to build the skills of their workforce, including at higher levels. In terms of apprenticeship funding, levy paying employers can now transfer up to 10% of their funds to other employers to support new apprenticeships. SMEs and start-ups in the technology sector could benefit from receiving transferred funds from levy paying employers to fund new apprenticeships in their businesses.

47. The Education and Skills Funding Agency (ESFA) has responsibility for proactively engaging with and supporting over 17,000 levy paying employers and 1.49m non-levy paying employers. Government will work with ESFA to ensure guidance is accessible and clear.

48. The Government has a long-term commitment to enhance support for postgraduate study. This will make the UK more globally competitive by increasing the supply of individuals with high-level skills and knowledge. From summer 2016, we introduced postgraduate master's degree loans for both taught and research-based. We intend to expand this further by introducing new loans for doctoral study from academic year 2018/19. In 2016/17, around 63,600 students on master's courses were paid £502 million in postgraduate loans. HESA's official student enrolment data for 2016/17 show that there was a 15% increase in full-time postgraduate entrants in taught masters in England – the first year that the master's loan was made available.

49. We have announced an increase in number of available Tier 1 (Exceptional Talent) visas as one of the available visa routes for non-EEA migrants wishing to come to the UK to work from 1000 to 2000 per year. This presents great opportunities for ensuring the UK attracts the best and brightest talent in AI. We will work with Tech Nation to explore how to promote this and other visa routes to AI specialists, and will continue to review how we promote these routes to maximise the growth of AI in the UK.

50. As part of the recent successful AI and Data Sector Deal, we committed to develop a new industrial master's programme for AI. We are kicking off work with the help of the British Computer Society, supported by the Alan Turing Institute, and in partnership with universities and major businesses such as Ocado, Amazon, Rolls Royce, McKinsey's Quantum Black, and others.

51. Scoping work commences in early July to develop the programme and gather further commitments and support across universities and industry.

52. Government is also creating a specific working group on Skills within the AI Council, which will seek to address issues and skills, including assessing impacts and ensuring provision of skills is appropriate.

Maintaining innovation
Recommendations 31-32

> **xxxi. We believe that the Government must commit to underwriting, and where necessary replacing, funding for European research and innovation programmes, after we have left the European Union. (Paragraph 188)**

> **xxxii. The state has an important role in supporting AI research through the research councils and other mechanisms, and should be mindful to ensure that the UK's advantages in AI R&D are maintained. There is a risk that the current focus on deep learning is distracting attention away from other aspects of AI research, which could contribute to the next big advances in the field. The Government and universities have an important role to play in supporting diverse sub-fields of AI research, beyond the now well-funded area of deep learning, in order to ensure that the UK remains at the cutting edge of AI developments. (Paragraph 191)**

53. The artificial intelligence Sector Deal is the first commitment from Government and industry to realise this technology's potential, outlining a package of up to £0.95bn of support for the sector, which includes Government, industry and academic contributions up to £525m in new commitments, and up to £421m from allocating UKRI AI specific funding from within existing budgets, alongside £250m for Connected and Autonomous Vehicles. This support complements and leverages some of the £1.7bn that has been announced under the cross-sectoral Industrial Strategy Challenge Fund so far. Five challenges have AI components across the spectrum of technologies encompassed by AI, which AI businesses will be able to bid in to through future competitions.

Working with artificial intelligence
Productivity
Recommendations 33-34

> **xxxiii. We support the Government's belief that artificial intelligence offers an opportunity to improve productivity. However, to meet this potential for the UK as a whole, the AI Council must take a role in enabling AI to benefit all companies (big and small) and ensuring they are able to take advantage of existing technology, in order for them to take advantage of future technology. It will be important that the Council identifies accelerators and obstacles to the use of AI to improve productivity, and advises the Government on the appropriate course of action to take. (Paragraph 199)**

> **xxxiv. We welcome the Government's intentions to upgrade the nation's digital infrastructure, as far as they go. However, we are concerned that it does not have enough impetus behind it to ensure that the digital foundations of the country are in place in time to take advantage of the potential artificial intelligence offers. We urge the Government to consider further substantial public investment to ensure that everywhere in the UK is included within the rollout of 5G and ultrafast broadband, as this should be seen as a necessity. (Paragraph 203)**

54. The Government is strongly committed to improving the nation's digital infrastructure. A total of £740m from the National Productivity Investment Fund has been allocated to the Local Full Fibre Networks programme and the 5G Testbeds and Trials programmes over the next four years to support this aim.

55. Of this £740m, £280m is allocated to the Local Full Fibre Networks programme, the strategic objective of which is to stimulate commercial investment in full fibre networks and accelerate the rollout of full fibre across the country. The programme is currently running a £190m Challenge Fund which is designed to leverage local and commercial investment in full fibre networks in both rural and urban locations across the whole of the UK. Local bodies have been invited to submit formal bids, and funding will be allocated in waves. 13 successful bidders for the first wave of funding were announced in the Chancellor's Spring Statement in March 2018, totalling an investment of up to £95.5m from the fund. We expect the next wave of the Challenge Fund to open in summer 2018.

56. The Local Full Fibre Networks programme also launched a £67m Gigabit Broadband Voucher Scheme in March 2018. Small to medium sized businesses can claim a voucher worth up to £3,000 and the residents in the local communities around them can claim a voucher worth up to £500 as part of a group project. Gigabit broadband vouchers can be used to contribute to the installation cost of faster connections over gigabit-capable infrastructure. Businesses and local community groups interested in requesting a voucher can find details of suppliers in their local area on our website at https://gigabitvoucher.culture.gov.uk/.

57. £400 million of public funding has also been made available for fibre connectivity through the Digital Infrastructure Investment Fund. This is intended to unlock approximately £1bn of private investment.

58. The Department for Environment, Food and Rural Affairs (Defra) has also allocated £30m of grant funding from the Rural Development Programme for England, targeted at helping to connect businesses with broadband in hard to reach rural areas.

59. Beyond this, the Future Telecoms Infrastructure Review will assess what further changes could be made to create the competitive conditions to encourage the long-term investment needed to deliver the next generation of digital infrastructure in different areas of the UK, including hard-to-reach rural areas.

Government adoption, and procurement, of artificial intelligence
Recommendations 35 - 38

> **xxxv. The Government's leadership in the development and deployment of artificial intelligence must be accompanied by action. We welcome the announcement of the GovTech Catalyst and hope that it can open the doors of Whitehall to the burgeoning AI development sector in the**

UK. We also endorse the recommendation of the Hall-Pesenti Review aimed at encouraging greater use of AI in the public sector. (Paragraph 215)

60. The GovTech Catalyst Fund will provide £20m for technology companies to use AI and other emerging technologies to help solve public sector challenges. The first five public sector challenges to be funded were announced on 10 May. The first of these challenges, from the Home Office – to identify Daesh still images online – opened as a competition to tech companies on 14 May. The other four challenges announced will be opened formally as competitions in the following four months. A second call for challenges to public sector bodies opened on 21 May. We expect to fund at least 15 competitions through the GovTech Fund, which will provide opportunities for up to 75 tech companies to undertake initial feasibility work and propose solutions and up to 30 tech companies with R&D funding to build proof of concepts.

xxxvi. To ensure greater uptake of AI in the public sector, and to lever the Government's position as a customer in the UK, we recommend that public procurement regulations are reviewed and amended to ensure that UK-based companies offering AI solutions are invited to tender and given the greatest opportunity to participate. The Crown Commercial Service, in conjunction with the Government Digital Office, should review the Government Service Design Manual and the Technology Code of Practice to ensure that the procurement of AI-powered systems designed by UK companies is encouraged and incentivised, and done in an ethical manner. (Paragraph 216)

xxxvii. We also encourage the Government to be bold in its approach to the procurement of artificial intelligence systems, and to encourage the development of possible solutions to public policy challenges through limited speculative investment and support to businesses which helps them convert ideas to prototypes, in order to determine whether their solutions are viable. The value of AI systems which are deployed to the taxpayer will compensate for any money lost in supporting the development of other tools. (Paragraph 217)

61. The Technology Code of Practice and associated guidance are agnostic of any specific technology. For example, as stated in the 'Choosing technology: an introduction' guidance, the most important thing is to make choices that allow technology buyers to change their minds at a later stage, and adapt technology as their understanding of how to meet user needs changes.[4]

62. Where users' needs are potentially best met by commercially available AI (or other new and emerging) technologies or services, then existing Crown Commercial Service (CCS) procurement channels such as the G-Cloud and Digital Outcomes and Specialists frameworks, which are available to the whole UK public sector through the Digital Marketplace[5], should be used and in accordance with UK public procurement policy and regulations.

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[4] https://www.gov.uk/service-manual/technology/choosing-technology-an-introduction
[5] https://www.digitalmarketplace.service.gov.uk/

63. Where users' needs are potentially best met by the application of AI (or other new and emerging) technologies or services that do not yet exist commercially, the Small Business Research Initiative (SBRI) process that's used by the Government Digital Service (GDS) GovTech Catalyst and Fund, provides a research and development funding route for innovative tech companies to develop such solutions. Once these are commercialised, their offerings should be diffused for wider adoption by the UK public via the Digital Marketplace (as outlined above).

64. At Davos 2018, the Secretary of State for Digital, Culture, Media and Sport signed an agreement with the Chair of the World Economic Forum to second an official to the San Francisco *Center for the 4th Industrial Revolution*, to conduct research towards a framework for responsible public procurement AI. Outputs will be considered by the Centre for Data Ethics and Innovation, and may feed into future iterations of the Data Ethics Framework and Digital Marketplace, to equip public sector procurers with the tools they need to consider AI solutions when sourcing digital solutions.

> **xxxviii. Finally, with respect to public procurement, we recommend the establishment of an online bulletin board for the advertisement of challenges which the Government Office for AI and the GovTech Catalyst have identified from across Government and the wider public sector where there could be the**
> **potential for innovative tech- and AI-based solutions. (Paragraph 218)**

65. Information and guidance on the GovTech Catalyst Fund and a list of all of the challenges submitted to date is available on GOV.UK.[6] Information for tech companies on each of the competitions launched is available on the Innovate UK website.[7]

Impact on the labour market
Recommendation 39

> **xxxix. The labour market is changing, and further significant disruption to that market is expected as AI is adopted throughout the economy. As we move into this unknown territory, forecasts of AI's growing impact— jobs lost, jobs enhanced and new jobs created—are inevitably speculative. There is an urgent need to analyse or assess, on an ongoing basis, the evolution of AI in the UK, and develop policy responses. (Paragraph 231)**

66. The UK labour market is one of the most flexible in the world which is a result of our regulatory approach and low-cost burdens. As a global leader, the UK needs a large workforce with deep AI expertise; a more diverse AI research base and workforce; and better digital skills in the wider workforce to use AI.

67. We recognise the need to develop accurate forecasts on the likely impacts of AI and automation on jobs and their skill-content, as well as monitoring the

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[6] https://www.gov.uk/government/publications/govtech-catalyst-round-1-submitted-challenges
[7] https://www.gov.uk/government/organisations/innovate-uk

pace and scope of changes. The Government is working on how we best understand the sequence of which sectors are likely to experience disruption and when. While not a guarantee, history shows that new technologies create new jobs. Therefore, the key for the success of our economy and for individuals to prosper is to make sure that appropriate skills provision is in place throughout peoples' working lives, such as through the National Retraining Scheme.

68. In October 2017 the Office for National Statistics (ONS) published its assessment of the UK's current and future employment prospects at local authority level, based on a range of indicators.[8] In conjunction with their data science campus they also produced a map-viewer tool for this data.[9] They continue to review the data to maintain, as far as is possible, an accurate assessment of the changing labour market.

69. Government believes that digitisation of industry, including the adoption of artificial intelligence and data technologies, has the potential to achieve great benefits for the labour market, which can offset the impact of job displacement. Extensive research conducted for the Made Smarter Review found that industrial digitisation can result in a net gain of 175,000 jobs. However, Government recognises that there will be challenges of job displacement in the short term and is preparing to mitigate this by providing digital skills training and lifelong learning opportunities, and by introducing new degrees such as Industrial Masters courses and more PhDs.

70. There are a number of areas where Governments may act to ensure a positive AI future:
- improving the diversity of the AI workforce, to avoid encoding bias;
- improving the way skills training systems respond to changing skills needs;
- improving technology for training and education;
- conversion courses and PhDs;
- helping people and cities and regions adapt to changes in work and in economies; and
- promoting uptake of AI across industry, so companies can stay competitive with public sector use of AI.

71. The Artificial Intelligence Sector Deal addresses these specific areas by:
- working with the AI Council to promote diversity in the AI workforce;
- announcing a major reform of technical education with the launch of T levels and investment in STEM subjects;
- £84m of new funding to deliver a comprehensive four-year programme to improve computing education and drive up participation in computer science, including upskilling up to 8,000 computer science teachers;
- supporting the creation of Ada, the National College of Digital Skills, which will train up to 5,000 students over the next seven years for a wide range of digital careers;

8
https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/adhocs/007606employmentcharacteristics oflocalauthoritiesgreatbritain2015

9 https://datasciencecampus.shinyapps.io/employmentProspects/

- working with industry, which will be investing to fund a Master's degree programme with an integrated internship targeting an initial cohort of 200 students per year; and
- funding 450 new PhD places and establish the prestigious Turing Fellowship to support an initial cohort of 10 AI fellows in order to keep the best and brightest AI researchers in the UK.

National Retraining Scheme
Recommendation 40

xlv. The UK must be ready for the disruption that AI will have on the way in which we work. We support the Government's interest in developing adult retraining schemes, as we believe AI will disrupt a wide range of jobs over the coming decades, and both blue- and white-collar jobs which exist today will be put at risk. It will therefore be important to encourage and support workers as they move into the new jobs and professions we believe will be created as a result of new technologies, including AI. The National Retraining Scheme could play an important role here, and must ensure that the recipients of retraining schemes are representative of the wider population. Industry should assist in the financing of the National Retraining Scheme by matching Government funding. This partnership would help improve the number of people who can access the scheme and better identify the skills required. Such an approach must reflect the lessons learned from the execution of the Apprenticeship Levy. (Paragraph 236)

72. The Government is currently developing its plans for the National Retraining Scheme, which was announced at Autumn Budget 2017. This will be an ambitious, far-reaching programme that helps adults to retrain as our economy evolves due to technological change, including further developments in Artificial Intelligence.

73. It will offer vital support to individuals who will increasingly need to learn new skills throughout their working lives, allowing them to progress and redirect their careers to secure the jobs of the future. The Government has been clear that the Scheme will need to work for adults whose jobs are likely to be disproportionately affected by technological change.

74. The Government is working closely with industry and employees to develop the Scheme, including through an historic National Retraining Partnership between Government, the Confederation of British Industry and the Trades Union Congress, ensuring that wider stakeholder views continue to feed into the ongoing development of the Scheme. This in turn will help identify priority areas based on evidence and national training needs. Establishing the most appropriate funding mechanisms will be an important consideration as we develop the Scheme, along with learning lessons from past interventions and reforms.

Living with artificial intelligence
Education and artificial intelligence
Recommendations 41-46

xlvi. It is clear to us that there is a need to improve digital understanding and data literacy across society, as these are the foundations upon which knowledge about AI is built. This effort must be undertaken collaboratively by public sector organisations, civil society organisations (such as the Royal Society) and the private sector. (Paragraph 249)

xlvii. The evidence suggests that recent reforms to the computing curriculum are a significant improvement on the ICT curriculum, although it is still too early to say what the final results of this will be. The Government must be careful not to expand computing education at the expense of arts and humanities subjects, which hone the creative, contextual and analytical skills which will likely become more, not less, important in a world shaped by AI. (Paragraph 250)

xlviii. We are, however, concerned to learn of the absence of wider social and ethical implications from the computing curriculum, as originally proposed. We recommend that throughout the curriculum the wider social and ethical aspects of computer science and artificial intelligence need to be restored to the form originally proposed. (Paragraph 251)

xlviv. While we welcome the measures announced in the Autumn Budget 2017 to increase the number of computer science teachers in secondary schools, a greater sense of urgency and commitment is needed from the Government if the UK is to meet the challenges presented by AI. (Paragraph 257)

xlv. The Government must ensure that the National Centre for Computing is rapidly created and adequately resourced, and that there is support for the retraining of teachers with associated skills and subjects such as mathematics. In particular, Ofsted should ensure that schools are making additional time available to teachers to enable them to train in new technology-focused aspects of the curriculum. We also urge the Government to make maximum use across the country of existing lifelong learning facilities for the training and regular retraining of teachers and other AI experts. (Paragraph 258)

xlvi. Supplementary to the Hall-Pesenti Review, the Government should explore ways in which the education sector, at every level, can play a role in translating the benefits of AI into a more productive and equitable economy. (Paragraph 259)

75. We welcome the Committee's recognition that the computing curriculum has improved. The new computing curriculum was introduced in 2014 in recognition that the demand for high-level skills in computing will grow in the years ahead. We recognise the importance of the arts and humanities in the national curriculum and as part of a broad and balanced curriculum. Arts and humanities subjects are mandatory until the end of key stage 3 for pupils in

maintained schools, which must also offer at least one subject from each of arts; design & technology; humanities; modern foreign languages to key stage 4 pupils.

76. To respond to the Committee's concerns about the absence of social and ethical implications of computer science, the content of the computing curriculum ensures all pupils will become digitally literate at a level suitable for the future workplace and as active participants in a digital world. The curriculum aims for all pupils to be 'responsible, competent, confident and creative users of information and communication technology'. Moreover, ethical and social aspects of computing are addressed in the computer science GCSE, which requires knowledge and understanding of 'the ethical, legal and environmental impacts of digital technology on wider society, including issues of privacy and cyber security'.

77. The Children and Social Work Act 2017 places a duty on the Secretary of State for Education to make Relationships Education at primary and Relationships and Sex Education at secondary mandatory through regulations. We expect that these subjects will cover the risks of the internet, including cyberbullying and online grooming.

78. It is important to allow a period of stability for these changes to embed and the Secretary of State for Education has committed to no further changes to the national curriculum for the rest of this parliament, beyond those already announced.

79. In response to the Committee's concerns about the National Centre for Computing and the broader measures announced in the Autumn Budget 2017, the Department for Education would like to reassure the Committee that measures to improve the teaching of computer science in secondary schools are already underway. Government went to tender in May 2018 for the wider computing programme, which includes establishing a National Centre of Computing Education and at least 40 hubs, an intensive Continuing Professional Development (CPD) programme of at least 40 hours to upskill up to 8,000 existing teachers – to ensure they have the knowledge needed to teach the new GSCE computer science. This will be designed for computing teachers without a post-A level qualification in computer science and aims to reach up to 8,000 secondary teachers – enough for there to be one in every secondary school. The investment also includes an A-level support programme. We have committed to programmes beginning in autumn 2018 and the first cohort of teachers should start the CPD programme in the 18/19 academic year. The pace of this timetable recognises the urgency of these issues. Alongside the measures planned for the schools workforce, the Government has plans to upskill the further education workforce in preparation of the launch of T-Levels. Further details on this will be forthcoming shortly.

Impact on social and political cohesion
Recommendations 47-48

> **xlvii. There are many social and political impacts which AI may have, quite aside from people's lives as workers and consumers. AI makes the processing and manipulating of all forms of digital data substantially easier, and given that digital data permeates so many aspects of modern life, this presents both opportunities and unprecedented challenges. As discussed earlier in our report, there is a rapidly growing need for public understanding of, and engagement with, AI to develop alongside the technology itself. The manipulation of data in particular will be a key area for public understanding and discussion in the coming months and years. (Paragraph 265)**

> **xlviii. We recommend that the Government and Ofcom commission research into the possible impact of AI on conventional and social media outlets, and investigate measures which might counteract the use of AI to mislead or distort public opinion as a matter of urgency. (Paragraph 266)**

80. The Government published the Digital Charter earlier this year which set out our ambition to make the UK the safest place to be online. The Government takes the issue of manipulation online very seriously, particularly where this may influence political debate, and tackling disinformation is a key pillar of the Digital Charter. The Government is undertaking additional research to better understand the problem of disinformation, including the scale, scope and impact in the UK. This includes an assessment of the impact of AI and other technologies, which will support the development of policies to tackle disinformation online. Going forward, we will continue to work with industry, civil society and international partners to conduct further research and public awareness programmes to tackle this problem.

Inequality
Recommendations 49-50

> **xlix. The risk of greater societal and regional inequalities emerging as a consequence of the adoption of AI and advances in automation is very real, and while the Government's proposed policies on regional development are to be welcomed, we believe more needs to be done in this area. We are not yet convinced that basic income schemes will prove to be the answer, but we watch Scotland's experiments with interest. (Paragraph 275)**

> **l. Everyone must have access to the opportunities provided by AI. The Government must outline its plans to tackle any potential societal or regional inequality caused by AI, and this must be explicitly addressed as part of the implementation of the Industrial Strategy. The Social Mobility Commission's annual State of the Nation report should include the potential impact of AI and automation on inequality. (Paragraph 276)**

81. We know that better skills and training widen access to opportunities. Further to the digital skills initiatives we have described, the Social Mobility

Commission has a broad remit to advise on a range of issues, including how the labour market impacts social mobility. We are currently recruiting a new Chair for the Commission, and the Commission's future research programme will be agreed with the new Chair once they are appointed.

Healthcare and artificial intelligence
Recommendations 51 - 54

li. Maintaining public trust over the safe and secure use of their data is paramount to the successful widespread deployment of AI and there is no better exemplar of this than personal health data. There must be no repeat of the controversy which arose between the Royal Free London NHS Foundation Trust and DeepMind. If there is, the benefits of deploying AI in the NHS will not be adopted or its benefits realised, and innovation could be stifled. (Paragraph 300)

82. NHS patients rightly expect to receive the best possible care, and technologies like the Streams app, developed by Royal Free and Deepmind, have the potential to revolutionise the way treatment is delivered. However, they must be used in a way that keeps patient data safe and secure.

83. As a point of clarity it is worth noting that whilst it has been widely reported that Deepmind's Streams app uses an AI algorithm – it does not, but we acknowledge that lessons from Royal Free/Deepmind are applicable to AI (and to other, data-driven technologies).

84. We respect the judgement of the Information Commissioner and the National Data Guardian on this matter. We are working to ensure that we have a regulatory framework for technology which protects patients, and is flexible enough to take into account the innovative nature of the products that it will regulate.

lii. The data held by the NHS could be considered a unique source of value for the nation. It should not be shared lightly, but when it is, it should be done in a manner which allows for that value to be recouped. We are concerned that the current piecemeal approach taken by NHS Trusts, whereby local deals are struck between AI developers and hospitals, risks the inadvertent underappreciation of the data. It also risks NHS Trusts exposing themselves to inadequate data sharing arrangements. (Paragraph 301)

85. DHSC has begun work to develop clear policy propositions on how the UK can accrue value from granting access to patient data for research and innovation purposes and patient and public benefit.

liii. We recommend that a framework for the sharing of NHS data should be prepared and published by the end of 2018 by NHS England (specifically NHS Digital) and the National Data Guardian for Health and Care. This should be prepared with the support of the ICO and the clinicians and NHS Trusts which already have experience of such arrangements (such as the Royal Free London and Moorfields Eye Hospital NHS Foundation Trusts), as well as the Caldicott Guardians.

This framework should set out clearly the considerations needed when sharing patient data in an appropriately anonymised form, the precautions needed when doing so, and an awareness of the value of that data and how it is used. It must also take account of the need to ensure SME access to NHS data, and ensure that patients are made aware of the use of their data and given the option to opt out. (Paragraph 302)

86. Work led by NHS England and NHS Digital to develop frameworks and mechanisms to make NHS data available as a research resource is ongoing.

87. Funding initiatives deriving from the Industrial Strategy and the Life Sciences Sector Deal are designed to encourage the development and growth of British SMEs.

88. We will continue to work with ICO, NDG, regulatory bodies, the wider NHS and partners to ensure that appropriate regulatory frameworks, codes of conduct and guidance are available.

liv. Many organisations in the United Kingdom are not taking advantage of existing technology, let alone ready to take advantage of new technology such as artificial intelligence. The NHS is, perhaps, the most pressing example of this. The development, and eventual deployment, of AI systems in healthcare in the UK should be seen as a collaborative effort with both the NHS and the AI developer being able to benefit. To release the value of the data held, we urge the NHS to digitise its current practices and records, in consistent formats, by 2022 to ensure that the data it holds does not remain inaccessible and the possible benefits to society unrealised. (Paragraph 303)

89. Provider digitisation is the main component of the over £4bn Digital Transformation Portfolio. This is currently undergoing re-prioritisation to ensure that it delivers the ICT infrastructure the NHS will need to take advantage of emerging technologies including AI.

90. The Digital Transformation Portfolio and associated programmes are addressing this through a system-wide move towards interoperability led by NHS England and NHS Digital. This includes ensuring that data is interoperable between providers and across care settings.

91. We are addressing other aspects of interoperability through, for example, the adoption of the SNOMED standard for clinical terminology, to ensure consistency between different providers in different areas.

92. All patient data held by the NHS is handled within the legal framework, and meets the strict parameters for sharing information and the security standards set out by the National Data Guardian. This means that patient information will never be sold for marketing or insurance purposes.

93. We are committed to continuing to support researchers to access patient information to carry out research which aims to improve human health and care. Again, this will only happen within the legal framework, with anonymised

information wherever possible and within the standards set out by the National Data Guardian. When information is accessed in this way, researchers will often be charged for the administrative costs of providing information.

94. NHS England and the Department of Health and Social Care are committed to working with representatives of the public and industry to explore how to maximise the benefits of health and care data for patients and taxpayers.

Mitigating the risks of artificial intelligence
Legal liability
Recommendations 55-56

lv. In our opinion, it is possible to foresee a scenario where AI systems may malfunction, underperform or otherwise make erroneous decisions which cause harm. In particular, this might happen when an algorithm learns and evolves of its own accord. It was not clear to us, nor to our witnesses, whether new mechanisms for legal liability and redress in such situations are required, or whether existing mechanisms are sufficient. (Paragraph 317)

lvi. Clarity is required. We recommend that the Law Commission consider the adequacy of existing legislation to address the legal liability issues of AI and, where appropriate, recommend to Government appropriate remedies to ensure that the law is clear in this area. At the very least, this work should establish clear principles for accountability and intelligibility. This work should be completed as soon as possible. (Paragraph 318)

95. Government welcomes the above recommendation and the acknowledgement of potential errors produced through artificial intelligence technologies and their potential implications. We believe that artificial intelligence technologies should serve people, businesses, and sectors beneficially and, where any outcomes resulting from errors are detrimental to these groups, remedial action should be undertaken. The Office for Artificial Intelligence, Centre for Data Ethics and Innovation, and the AI Council will take these concerns into consideration and, as appropriate, engage the Law Commission on best course of action.

Criminal misuse of artificial intelligence and data
Recommendations 57 - 59

lvii. The potential for well-meaning AI research to be used by others to cause harm is significant. AI researchers and developers must be alive to the potential ethical implications of their work. The Centre for Data Ethics and Innovation and the Alan Turing Institute are well placed to advise researchers on the potential implications of their work, and the steps they can take to ensure that such work is not misused. However, we believe additional measures are required. (Paragraph 328)

96. A response to recommendation 57 can be found in the final section of this document.

lviii. We recommend that universities and research councils providing grants and funding to AI researchers must insist that applications for such money demonstrate an awareness of the implications of the research and how it might be misused, and include details of the steps that will be taken to prevent such misuse, before any funding is provided. (Paragraph 329)

97. UKRI agrees with the recommendation and recognises the potential for misuse of emerging research and technologies around AI. UKRI already assesses ethical issues within research as part of the peer review process and takes action to utilise a more specific Responsible Research and Innovation framework where appropriate. Assessment of concerns surrounding AI will be taken into account by these existing processes.

lix. We recommend that the Cabinet Office's final Cyber Security Science & Technology Strategy take into account the risks as well as the opportunities of using AI in cybersecurity applications, and applications more broadly. In particular, further research should be conducted into methods for protecting public and private datasets against any attempts at data sabotage, and the results of this research should be turned into relevant guidance. (Paragraph 333)

98. Government welcomes the recommendation that the Cyber Security Science & Technology Strategy takes into account the risks as well as opportunities of using AI in cybersecurity, and other applications. The Department for Digital, Culture, Media and Sport will consider this in developing the strategy, recognising the potential for AI and machine learning to have a transformative impact on the cyber security threats, and solutions, of the future.

Autonomous weapons
Recommendations 60-61

lx. Without agreed definitions we could easily find ourselves stumbling through a semantic haze into dangerous territory. The Government's definition of an autonomous system used by the military as one where it "is capable of understanding higher-level intent and direction" is clearly out of step with the definitions used by most other Governments. This position limits both the extent to which the UK can meaningfully participate in international debates on autonomous weapons and its ability to take an active role as a moral and ethical leader on the global stage in this area. Fundamentally, it also hamstrings attempts to arrive at an internationally agreed definition. (Paragraph 345)

lxi. We recommend that the UK's definition of autonomous weapons should be realigned to be the same, or similar, as that used by the rest of the world. To produce this definition the Government should convene a panel of military and AI experts to agree a revised form of words. This should be done within eight months of the publication of this report. (Paragraph 346)

99. The Ministry of Defence has no plans to change the definition of an autonomous system. The UN Convention on Certain Conventional Weapons Group of Government Experts (GGE) on Lethal Autonomous Weapon Systems (LAWS) continues to look at the issue but has yet to agree on the definition and characteristics of possible LAWS. The UK will continue to actively participate in future GGE meetings, trying to reach agreement at the earliest possible stage.

Shaping artificial intelligence
Leading at home
Recommendations 62-67

lxii. Artificial intelligence's potential is an opportunity the Government is embracing. The Government's recent enthusiasm and responsiveness to artificial intelligence in the UK is to be welcomed. We have proposed a number of recommendations for strengthening recent policy announcements, based on the extensive evidence we have received as a Committee. We encourage the Government to continue to be proactive in developing policies to harness the potential of AI and mitigate the risks. We do, however, urge the Government to ensure that its approach is focused and that it provides strategic leadership—there must be a clear roadmap for success. Policies must be produced in concert with one another, and with existing policy. Industry and the public must be better informed about the announcements, and sufficient detail provided from the outset. (Paragraph 366)

lxiii. The pace at which this technology will grow is unpredictable, and the policy initiatives have been many. To avoid policy being too reactive, and to prevent the new institutions from overlapping and conflicting with one another, we recommend that the Government Office for AI develop a national policy framework for AI, to be in lockstep with the Industrial Strategy, and to be overseen by the AI Council. Such a framework should include policies related to the recommendations of this report, and be accompanied, where appropriate, by a long-term commitment to such policies in order to realise the benefits. It must also be clear within Government who is responsible around the Cabinet table for the direction and ownership of this framework and the AI-related policies which fall within it. (Paragraph 367)

lxiv. The roles and remits of the new institutions must be clear, if they are to be a success. The public and the technology sector in the UK must know who to turn to for authoritative advice when it comes to the development and use of artificial intelligence. To ensure public confidence, it must also be clear who to turn to if there are any complaints about how AI has been used, above and beyond the matters relating to data use (which falls within the Information Commissioner's remit). (Paragraph 368)

lxv. We recommend that the Government Office for AI should act as the coordinator of the work between the Centre for Data Ethics and Innovation, the GovTech Catalyst team and the national research centre for Artificial Intelligence Research (the Alan Turing Institute), as well as the AI Council it is being established to support. It must also take heed of the work of the more established bodies which have done work in

this area, such as the Information Commissioner's Office and the Competition and Markets Authority. The work programmes of all the new AI-specific institutions should be subject to agreement with one another, on a quarterly basis, and should take into account the work taking place across Government in this area, as well as the recommendations from Parliament, regulators, and the work of the devolved assemblies and Governments. The UK has a thriving AI ecosystem, and the Government Office for AI should seek to inform its work programme through wide public consultation as it develops Government policy with regard to artificial intelligence. The programme should be publicly available for scrutiny. (Paragraph 369)

lxvi. We welcome the new focus for the Alan Turing Institute as the national research centre for artificial intelligence. We want it to be able to fulfil this role, and believe it has the potential to do so. As such, the new focus must not simply be a matter of rebranding. The successful institutes in Canada and Germany, such as the Vector Institute and the German Research Center for Artificial Intelligence, offer valuable lessons as to how a national research centre should be operated. (Paragraph 370)

lxvii. The Government must ensure that the Alan Turing Institute's funding and structure is sufficient for it to meet its new expanded remit as the UK's national research centre for AI. In particular, the Institute's current secondment-based staffing model should be assessed to ensure its suitability, and steps taken to staff the Institute appropriately to meet the demands now placed upon it. (Paragraph 371)

100. Government supports the Alan Turing Institute, which agrees that coordination between institutions operating in this space is vital. One of the Institute's key strengths lies in their ability to convene groups around policy issues, and they welcome the opportunity to support the Office for Artificial Intelligence in its function providing strategic leadership in this field, and in its coordination efforts across the many players involved. The Institute will utilise their reputation for shaping the public conversation in data science, which includes participation in the Ada Lovelace Institute where they will contribute their research leadership.

101. Building the breadth of their remit to include artificial intelligence, the Institute recognises that there are considerable areas of overlap between AI and data science, both in their potential to bring game-changing impact to our society and economy, and in the core scientific competencies which underpin them. The Institute is currently developing their international strategy to include collaborations with similar research institutions in Germany, France, and Canada, among others.

102. The Alan Turing Institute has achieved a significant amount in the short time it has been operational. The Government and UKRI are currently exploring future funding options to enable the Institute to integrate AI with the existing Data Science remit. Regarding the secondment model and staffing, they are evolving their Fellowship model to be project-driven, reflecting the maturation of their research programmes since they first launched in 2015. The Institute

has invested in and grown their in-house team of research engineers and data scientists.

Regulation and Regulators
Recommendations 68-69

> **lxviii. Blanket AI-specific regulation, at this stage, would be inappropriate. We believe that existing sector-specific regulators are best placed to consider the impact on their sectors of any subsequent regulation which may be needed. We welcome that the Data Protection Bill and GDPR appear to address many of the concerns of our witnesses regarding the handling of personal data, which is key to the development of AI. The Government Office for AI, with the Centre for Data Ethics and Innovation, needs to identify the gaps, if any, where existing regulation may not be adequate. The Government Office for AI must also ensure that the existing regulators' expertise is utilised in informing any potential regulation that may be required in the future and we welcome the introduction of the Regulator's Pioneer Fund. (Paragraph 386)**

103. The Government agrees with the recommendation. In its Industrial Strategy, the Government committed to work with businesses to develop an agile approach to regulation that promotes innovation and the growth of new sectors, while protecting citizens and the environment. To this end, the Government is establishing a Ministerial Working Group on Future Regulation 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. The Government will also establish a £10m Regulators' Pioneer Fund to support regulators to develop new approaches which enable emerging technologies such as AI.

104. Government would offer a range of support such as helping align policies around a sector, addressing a regulatory issue or deregulating, ensuring existing sources of funding are used most effectively, and supporting the creation of new institutions to support the sector.

105. Industry cannot create laws but can collaborate on processes to make it easier to comply with the law, including by identifying challenges and how to address them safely. Data Trusts will not necessarily be a legal entity, although that is one form they could take. Whatever the formulation of the model, it needs to be a repeatable framework that businesses can use. Data Trusts will operate using existing legal frameworks and regulations covering data. In future, the Centre for Data Ethics and Innovation will advise Government and regulators on ethics of data and its use, including for AI -- where a core function will be to partner with the Office for AI in the design of data sharing frameworks including Data Trusts.

> **lxiv. The additional burden this could place on existing regulators may be substantial. We recommend that the National Audit Office's advice is sought to ensure that existing regulators, in particular the Information Commissioner's Office, are adequately and sustainably resourced. (Paragraph 387)**

106. The Government recognises the challenge, and opportunity, in securing a regulatory approach that both commands public trust and enables world-leading innovation in emerging technologies. Achieving both is central to creating a market that can lead on global adoption of AI technologies.

107. The UK already has a strong track record in meeting this challenge as demonstrated by the Regulatory Sandbox approach - a world-first regulatory mechanism that has enabled innovation. We are investing in securing this outcome for Artificial Intelligence with a £10m investment on the Regulators Pioneer Fund and the new £9m Centre for Data Ethics and Innovation.

108. The Centre will help strengthen the existing governance landscape. It will supply government with independent, expert advice on measures to enable and support safe, ethical and ground-breaking innovation in AI technologies.

109. The Regulatory Pioneers' Fund is accepting applications over 2018-2020 to support regulators to develop new approaches for innovative, emerging technologies.

110. Both of these initiatives will complement the efforts of regulators - ensuring that they have access to both the resource and advice to adapt as required to market evolutions driven by AI.

Assessing policy outcomes
Recommendation 70

> **lxx. It is essential that policies towards artificial intelligence are suitable for the rapidly changing environment which they are meant to support. For the UK to be able to realise the benefits of AI, the Government's policies, underpinned by a co-ordinated approach, must be closely monitored and react to feedback from academia and industry where appropriate. Policies should be benchmarked and tracked against appropriate international comparators. The Government Office for AI has a clear role to play here, and we recommend that progress against the recommendations of this report, the Government's AI-specific policies within the Industrial Strategy and other related policies, be reported on an annual basis to Parliament. (Paragraph 391)**

111. Governance of and reporting for the AI and Data Grand Challenge is based on the standard Industrial Strategy governance structures. As the Centre for Data Ethics and Innovation and the AI Council, composed of leaders from industry, academia, and the public sector, are stood up over the coming months, there may be a need to update these structures. Any such decision will be made through the existing Industrial Strategy decision framework. As the AI Council's secretariat, the Office for AI's responsibilities with respect to reporting will depend on the outcomes of these decisions.

> **lxxi. The transformative potential for artificial intelligence on society at home, and abroad, requires active engagement by one and all. The Government has an opportunity at this point in history to shape the development and deployment of artificial intelligence to the benefit of everyone. The UK's strengths in law, research, financial services and civic institutions, mean it is well placed to help shape the ethical development of artificial intelligence and to do so on the global stage. To be able to demonstrate such influence internationally, the Government must ensure that it is doing everything it can for the UK to maximise the potential of AI for everyone in the country. (Paragraph 402)**
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> **lxxii. We recommend that the Government convene a global summit in London by the end of 2019, in close conjunction with all interested nations and Governments, industry (large and small), academia, and civil society, on as equal a footing as possible. The purpose of the global summit should be to develop a common framework for the ethical development and deployment of artificial intelligence systems. Such a framework should be aligned with existing international governance structures. (Paragraph 403)**

112. Government recognises the transformative potential for artificial intelligence on society and the economy, both domestically and internationally. And we are taking steps to ensure the UK is a global leader on artificial intelligence. Since the publication of this Government's Industrial Strategy, we have taken steps to ensure the appropriate Government entities exist to address the social and economic possibilities AI can offer. The Centre for Data Ethics and Innovation, the Office for Artificial Intelligence, and the AI Council will collectively ensure Government addresses the Grand Challenge on AI and Data and shows global leadership on AI.

113. Government launched the Artificial Intelligence Sector Deal in April 2018 which sets out actions to promote the adoption and use of AI in the UK and delivers on the recommendation of the independent AI review, *Growing the AI industry in the UK,* which focused on ways to boost the UK's emerging AI sector at home and across the world.[10] The Sector Deal is the first commitment from Government and industry to realise AI's potential, outlining a package of up to £0.95bn of support for the sector, which includes Government, industry and academic contributions. Up to £603m is newly allocated funding, and up to £342m from within existing budgets, alongside £250m for Connected and Autonomous Vehicles. This support complements and leverages some of the £1.7bn that has been announced under the cross-sectoral Industrial Strategy Challenge Fund so far, with five challenge having AI components that AI businesses will be able to bid into through future competitions.

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[10] https://www.gov.uk/government/publications/growing-the-artificial-intelligence-industry-in-the-uk

lxviii. Many organisations are preparing their own ethical codes of conduct for the use of AI. This work is to be commended, but it is clear that there is a lack of wider awareness and co-ordination, where the Government could help. Consistent and widely-recognised ethical guidance, which companies and organisations deploying AI could sign up to, would be a welcome development. (Paragraph 419)

lxxiv. We recommend that a cross-sector ethical code of conduct, or 'AI code', suitable for implementation across public and private sector organisations which are developing or adopting AI, be drawn up and promoted by the Centre for Data Ethics and Innovation, with input from the AI Council and the Alan Turing Institute, with a degree of urgency. In some cases, sector-specific variations will need to be created, using similar language and branding. Such a code should include the need to have considered the establishment of ethical advisory boards in companies or organisations which are developing, or using, AI in their work. In time, the AI code could provide the basis for statutory regulation, if and when this is determined to be necessary. (Paragraph 420)

114. There are a number of high level themes emerging around the ethical and innovative uses of data and AI, some of which are highlighted within the Committee's report. Many of these are not inherently new or unique, but are being amplified through the use of data-driven and AI-based technologies.

115. The Centre will identify the measures needed to strengthen and improve the way data and AI is used. It will operate by drawing on evidence and insights from across regulators, academia, the public and business and translate these into actions that deliver direct, real world impact on the way that data and AI is used. Following the public consultation in the summer, the Centre, in dialogue with the Government will carefully prioritise and scope the specific projects within its work programme.

Regarding all recommendations concerning the Centre for Data Ethics and Innovation
Recommendations: 4, 7, 9, 10, 13, 57, 65, 68, 74

iv. The Government plans to adopt the Hall-Pesenti Review recommendation that 'Data Trusts' be established to facilitate the ethical sharing of data between organisations. However, under the current proposals, individuals who have their personal data contained within these trusts would have no means by which they could make their views heard, or shape the decisions of these trusts. We therefore recommend that as Data Trusts are developed under the guidance of the Centre for Data Ethics and Innovation, provision should be made for the representation of people whose data is stored, whether this be via processes of regular consultation, personal data representatives, or other means. (Paragraph 82)

vii. We support the approach taken by Transport for London, who have released their data through a single point of access, where the data is

available subject to appropriate terms and conditions and with controls on privacy. The Centre for Data Ethics and Innovation should produce guidance on similar approaches. The Government Office for AI and GovTech Catalyst should work together to ensure that the data for which there is demand is made available in a responsible manner. (Paragraph 85)

ix. We recommend that the Centre for Data Ethics and Innovation investigate the Open Banking model, and other data portability initiatives, as a matter of urgency, with a view to establishing similar standardised frameworks for the secure sharing of personal data beyond finance. They should also work to create, and incentivise the creation of, alternative tools and frameworks for data sharing, control and privacy for use in a wide variety of situations and contexts. (Paragraph 87)

x. Increasingly, public sector data has value. It is important that public organisations are aware of the commercial potential of such data. We recommend that the Information Commissioner's Office work closely with the Centre for Data Ethics and Innovation in the establishment of Data Trusts, and help to prepare advice and guidance for data controllers in the public sector to enable them to estimate the value of the data they hold, in order to make best use of it and negotiate fair and evidence-based agreements with private-sector partners. The values contained in this guidance could be based on precedents where public data has been made available and subsequently generated commercial value for public good. The Information Commissioner's Office should have powers to review the terms of significant data supply agreements being contemplated by public bodies. (Paragraph 88)

xiii. The Centre for Data Ethics and Innovation, in consultation with the Alan Turing Institute, the Institute of Electrical and Electronics Engineers, the British Standards Institute and other expert bodies, should produce guidance on the requirement for AI systems to be intelligible. The AI development sector should seek to adopt such guidance and to agree upon standards relevant to the sectors within which they work, under the auspices of the AI Council. (Paragraph 106)

lvii. The potential for well-meaning AI research to be used by others to cause harm is significant. AI researchers and developers must be alive to the potential ethical implications of their work. The Centre for Data Ethics and Innovation and the Alan Turing Institute are well placed to advise researchers on the potential implications of their work, and the steps they can take to ensure that such work is not misused. However, we believe additional measures are required. (Paragraph 328)

lxv. We recommend that the Government Office for AI should act as the coordinator of the work between the Centre for Data Ethics and Innovation, the GovTech Catalyst team and the national research centre for Artificial Intelligence Research (the Alan Turing Institute), as well as the AI Council it is being established to support. It must also take heed of the work of the more established bodies which have done work in this area, such as the Information Commissioner's Office and the Competition and Markets Authority. The work programmes of all the new AI-specific institutions should be subject to agreement with one

another, on a quarterly basis, and should take into account the work taking place across Government in this area, as well as the recommendations from Parliament, regulators, and the work of the devolved assemblies and Governments. The UK has a thriving AI ecosystem, and the Government Office for AI should seek to inform its work programme through wide public consultation as it develops Government policy with regard to artificial intelligence. The programme should be publicly available for scrutiny. (Paragraph 369)

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116. Throughout Government's response, recommendations that concern the Centre for Data Ethics and Innovation have either been answered in part or omitted. The explanation for this follows.

117. The Government welcomes the recommendations made on the Centre for Data Ethics and Innovation and its work. The Government is in the process of setting up the Centre and will be launching a consultation soon on its role, objectives and activities. The Select Committee's Report and its recommendations on the Centre will make an invaluable contribution to both the development of the Centre and its initial work programme.

118. There are a number of high level themes emerging around the ethical and innovative uses of data and AI, some of which are highlighted within the Committee's report. Many of these are not inherently new or unique, but are being amplified through the use of data-driven and AI-based technologies.

119. The Centre will identify the measures needed to strengthen and improve the way data and AI is used. It will operate by drawing on evidence and insights from across regulators, academia, the public and business and translate these into actions that deliver direct, real world impact on the way that data and AI is used. Following the public consultation in the summer, the Centre, in dialogue with the Government will carefully prioritise and scope the specific projects within its work programme.