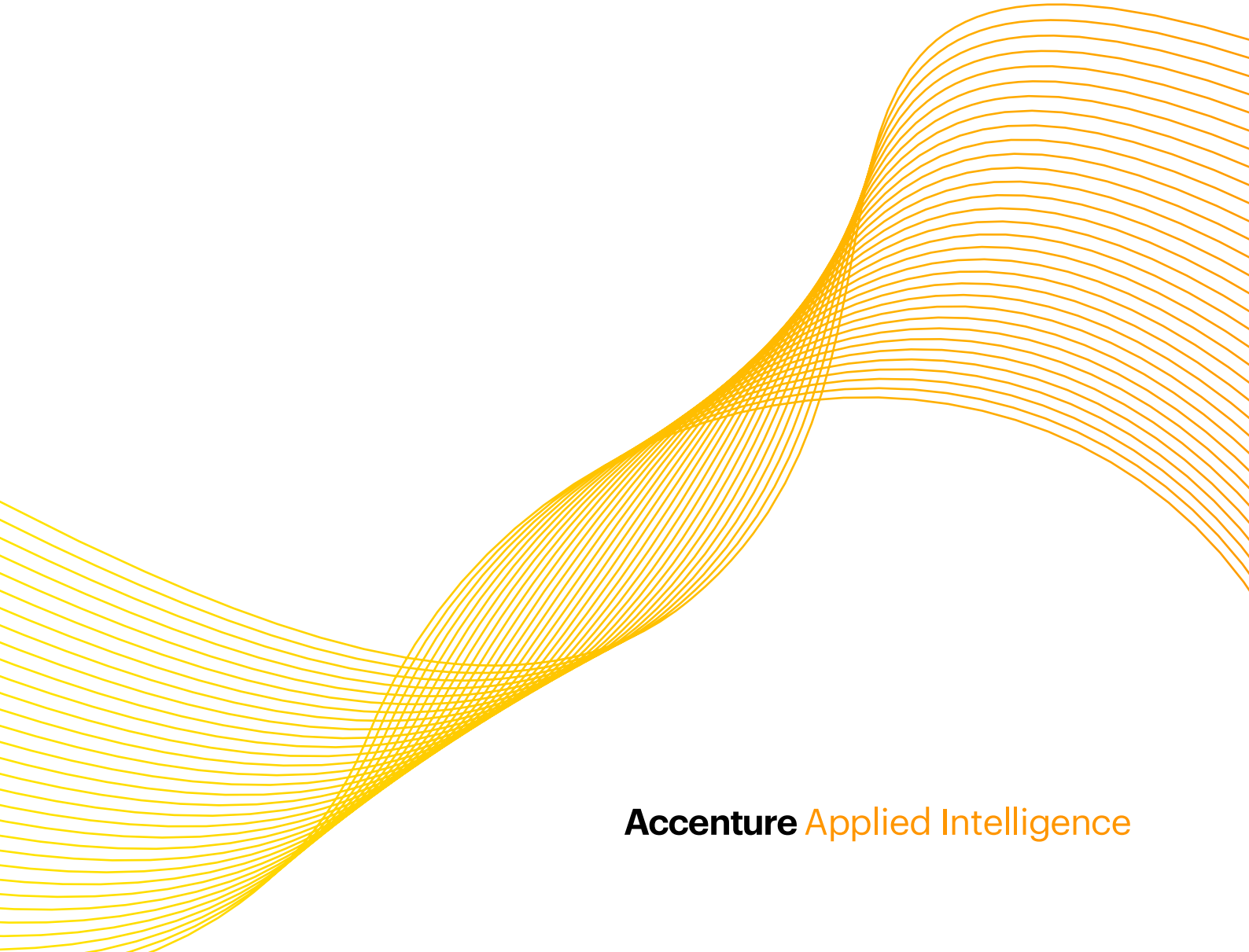
REALISING THE ECONOMIC AND SOCIETAL POTENTIAL OF RESPONSIBLE ARTIFICIAL INTELLIGENCE IN THE UK



Accenture Applied Intelligence

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THE FOURTH INDUSTRIAL REVOLUTION

Artificial Intelligence (AI), combined with the internet of things, big data analytics, nanotechnology and blockchain, is underpinning the fourth industrial revolution[1] and together, these technologies are impacting how we live and work in a significant way. Whether this impact will be negative or positive is at the heart of the debate that surrounds this topic. Perhaps the biggest challenge, and key to realising the positive benefits coming out of these technologies, is our ability to navigate uncertainty in an ethical, responsible and sustainable way.

Change, by its very nature, creates challenges; and there has been much media focus on the potentially negative impact AI might have, particularly on the workforce. AI and other technologies can be a force for positive change provided a human-centric approach is taken in the development, application and governance of the technology. In that sense, it is critical that people are empowered and enabled by AI and that everybody remains steadfast in this principle. This is not for the principle's sake itself, but so that we realise the economic and societal potential of AI fully. Only by ensuring that government, business, academia and broader societal groups work together to manage the challenges associated with AI, or the 'transition' through this revolution, will the benefits and potential be assured.

The purpose of this paper is to contribute to the current discussion about how to accelerate investment in AI while managing its growth in a responsible and sustainable manner. As part of this task, we have sought to move the debate from the theoretical to the practical, by looking at how AI is being applied today, and how it will be applied in the short- to medium-term. Given the rapid pace of the development of technology, it is difficult to anticipate the associated challenges and opportunities we will face in the next decade, never mind many decades from now. The risk of forecasting too far into the future is that we will either underestimate the benefits or overestimate the challenges. Our focus, therefore, has been to develop insights on how a partnership between government, business, academia and societal groups, can pave the way for future opportunities for the economy and society.

KEY RECOMMENDATIONS

For the UK to realise the economic and societal potential of AI and provide clarity to innovators, confidence to investors, and build public trust, we recommend that:

1. **An AI Strategy** - is developed to enable the UK's AI ecosystem to align to a shared and ambitious vision, with specific and stretching targets, clear milestones, timeframes and regular review points to ensure progress is made.

2. **Clear leadership** - is established with the newly created trio of AI bodies – The Office for AI, the AI Council and the Centre for Data Ethics – setting out clear remits while engaging with already established and new players alike.

3. **A global AI ethical framework** - is developed with the UK in the lead to coordinate collective action to shape global governance in ethics for the responsible and sustainable development and deployment of AI.

4. **A smart regulatory framework** - is created, focused on the use and application of technologies rather than the technology per se, with issues addressed, in an agile manner, as they arise through global, industry-driven guidelines, standards, best practice and codes.

5. **A data intelligence framework** - is established, focused on building confidence in three key data-centred tenets: provenance, content and integrity, drawing from existing data science and cybersecurity capabilities, to ensure that data underpinning AI is accurate, reliable and secure.

6. **Sandboxing schemes** - are implemented focused on AI regulation enabling innovative businesses to test and pilot AI responsibly; and access to data, enabling business and research institutions to develop, test and agree terms and conditions for access and use of data.

7. **The impact of AI is mapped** - at a granular level by region and sector enabling the transition of 'at-risk' workforce into sustainable employment and ensuring potential regional disparities are managed.

8. **Skills demands are forecast** - to enable the education system to adapt accordingly. In the first instance this will require a shift from STEM (science, technology, engineering and mathematics) to STEAM (science, technology, engineering, arts and mathematics) learning to reflect the multidisciplinary skills that AI demands.

9. **Invest in reskilling and retraining** - enabling employees to embrace lifelong learning and to address the challenges of displacement and the skills mismatch between supply and demand.

ARTIFICIAL INTELLIGENCE TODAY

AI is a constellation of technologies that allow smart machines to support human capabilities and intelligence by sensing, comprehending, acting and learning; thereby allowing people to achieve much more than can be achieved without AI.

These technologies include machine learning, natural language processing, virtual assistants, cognitive robotic process automation, unique identity, video analytics and many more.

AI is not a new technology, having first been named in the 1950s. Since then, big strides have been made, but these have been in the field of Artificial Narrow Intelligence – algorithms that can process documents, drive vehicles or beat champion chess players. However, the weight of expert opinion is that we are a long way from the emergence of Artificial General Intelligence, which sees the development and production of machines that can think like humans, show common sense and empathy and distinguish right from wrong.[2]

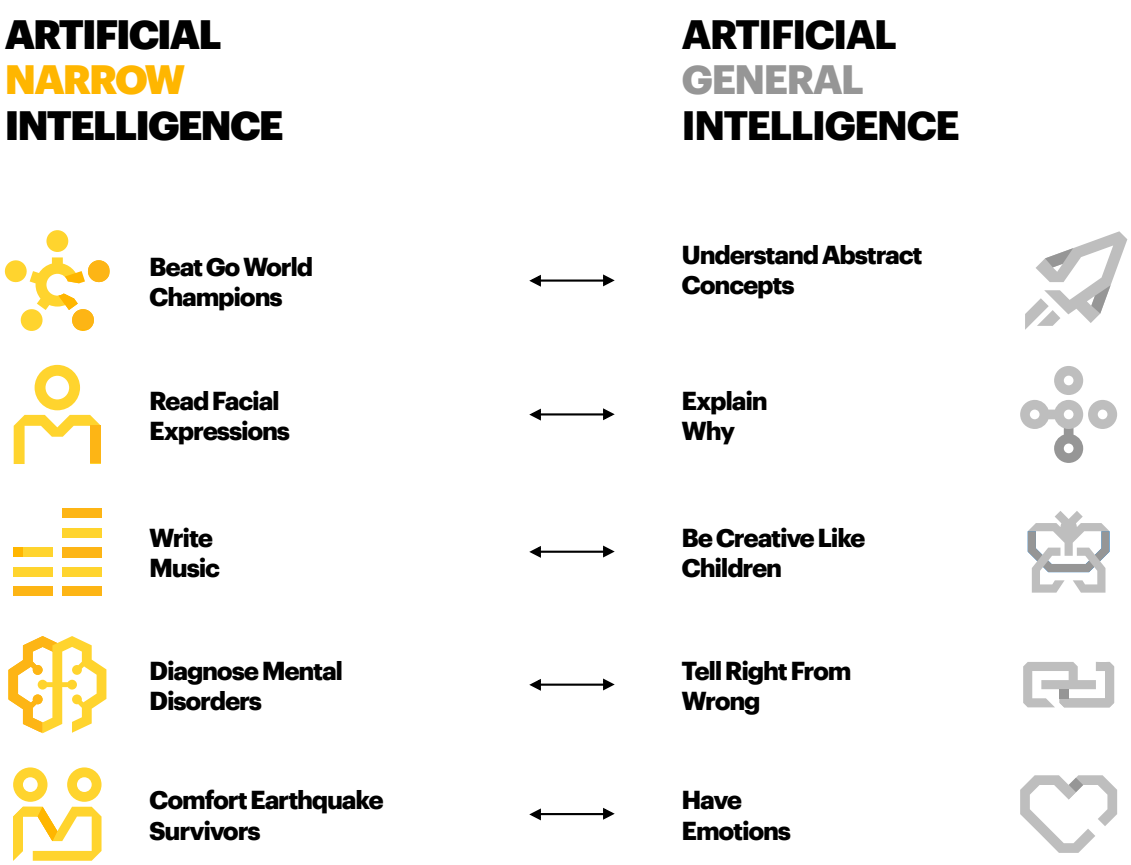


Figure 1: Artificial Narrow Intelligence vs Artificial General Intelligence
Source: Presentation by Mark Purdy of Accenture Research at the LSE Economics Symposium 2018

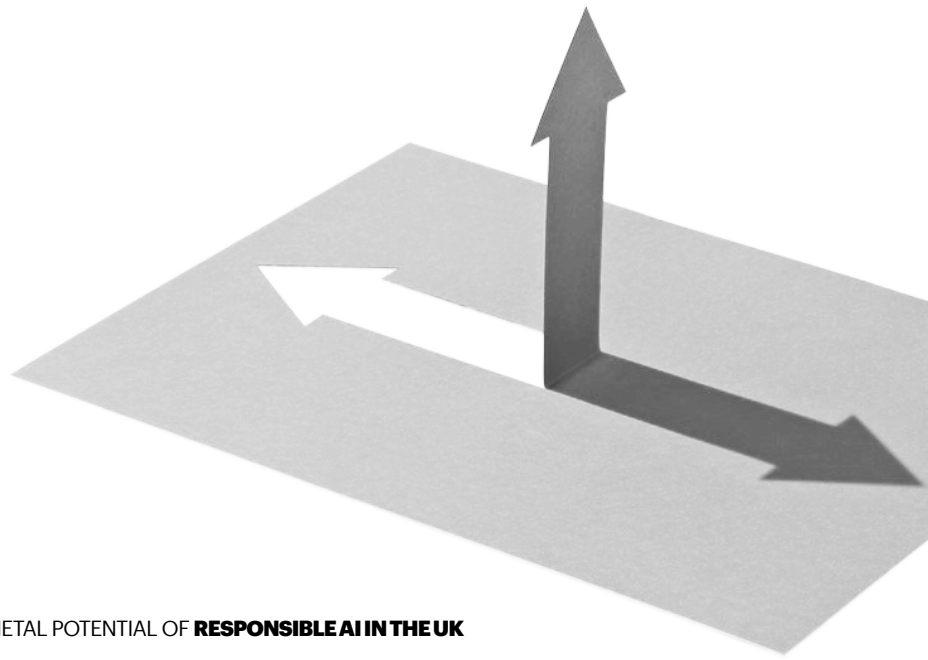
WHY THE HYPE?

We have recently moved beyond research and development to the real-world application of AI. This shift has been driven by the combination of greater and more affordable computing power and storage, the growth in data volumes, and the rise of open source frameworks. We have now reached critical mass for mainstream adoption and consequently investment in AI has risen steeply[3] as demonstrated by CB Insights, which estimated there was a 141% increase in AI start-ups in 2017 on 2016 figures.[4]

In addition, while we might not have previously put an 'AI' label on it, AI applications are an increasingly normal part of everyday life with tools such as Apple's Siri and Google Now on our mobile devices, Amazon's Alexa in our home, and chatbots online now part of our everyday customer experience. We have, however, become much more aware of 'AI' in the past year, thanks, in no small part, to the significant increase in media attention.

More importantly, and why the hype is justified, is that AI is a transformational technology, which, like electricity or the steam engine, not only impacts society directly but also has an enabling effect on the broader economy.[5] It opens-up vast new possibilities and has the potential to positively transform how we live and work as well as create new economic growth, estimated to be worth an additional £630 billion to the UK economy by 2035, thereby increasing the annual growth rate of Gross Value Added (GVA) from 2.5% to 3.9%.[6]

It opens-up vast new possibilities and has the potential to positively transform how we live and work, as well as create new economic growth.



THE ECONOMIC AND SOCIETAL POTENTIAL OF AI

AI technologies can be leveraged for the betterment of society and to address some of the challenges people face today. These include supporting inclusion, diagnosing diseases, protecting the environment and helping the communities in which we live through better public services.

A FLOURISHING SOCIETY

SUPPORTING SOCIAL INCLUSION

Social isolation and loneliness are an increasing feature of today's society and certain demographics suffer more than others. Elderly people, for example, are considered the most isolated demographic in the world today with 200,000 older people in the UK going a month or longer without having a conversation with friends or family.[7] Accenture London Liquid Studios, together with Age UK, ran a pilot of HomeCare, a companion for the elderly to assist with everyday tasks, and living independently. Together, we applied AI to create a human-centred platform to provide support and assistance in areas such as health appointments, medicine reminders, grocery shopping, exercise and staying connected with the most important people.[8]

INCLUSION OF PEOPLE WITH DISABILITIES

AI is opening ways for people with disabilities to accomplish tasks with less effort and participate where they could not before. In one example, Accenture Labs ran a pilot with the National Association for the Blind in India to create DRISHTI—a mobile application that uses natural language processing, optical character recognition, and the latest AI technologies to provide audio descriptions of a visually challenged person's immediate surroundings. It even integrates with smart glasses for a seamless hands-free experience. It is a solution that empowers the visually impaired and improves their everyday lives.[9]

MORE EFFECTIVELY DIAGNOSING DISEASE

AI technologies can enable early detection and targeted treatments. In one application, a Harvard-based team of pathologists created an AI-based technique to identify breast cancer cells with greater precision than doctors unaided by AI. When the doctors and technology worked autonomously, pathologists beat the machines with 96% accuracy versus 92%. The biggest surprise came when humans and AI combined forces. Together, they accurately identified 99.5% of cancerous biopsies. With nearly 1.7 million new cases of breast cancer diagnosed globally each year, this translates to 68,000 to 130,000 more women receiving accurate diagnoses than if we relied on humans or machines alone.[10]

HELPING PROTECT THE ENVIRONMENT

EMAGIN Clean Technologies Inc. has a new system that uses AI for environmental protection to help municipal utilities proactively improve their water and wastewater operations. EMAGIN uses operational AI software to analyse and 'learn' from data that is already collected by water utilities via sensors. Based on what happened in the past, the system can predict what will happen in the future and make recommendations to maximise efficiency. If they accurately know what water demand will be at a given time, for instance, utilities can prepare by pumping when electricity rates are at their lowest, generating savings in the process.[11]

IMPROVING PRODUCTIVITY AND JOB CREATION

IntelliSense is using AI combined with the Internet of Things (IoT) and analytics to identify energy savings and deliver resource productivity gains for its customers worldwide, while creating new jobs and companies in the UK. [12]

SUPPORTING BETTER PUBLIC SERVICES

Accenture worked with the emergency services in Saga Prefecture, Japan, to analyse 150,000 cases of transport data collected from iPads installed in emergency vehicles. The objective was to analyse how patients were being transported and how transportation times could be shortened. Using a machine learning algorithm and data mining, it was possible to reduce the transport time by 40%, with an average time reduction of 1.3 minutes.[13]

A STRONGER ECONOMY

With the recent convergence of a transformative set of technologies, the UK economy is entering a new era in which AI has the potential to overcome the physical limitations of capital and labour and open new sources of value and growth and indeed opportunities to improve the way we work. Accenture research found that AI has the potential to boost UK labour productivity by up to 25% by 2035 and enable people to make more efficient use of their time.[14]

AI can therefore be considered as a new factor of production, alongside the traditional factors of capital and labour, and can drive growth and improve the way we work in three ways:

THROUGH AUGMENTATION

- Enhancing human capabilities and improving work through virtual assistants can relieve individuals of time-consuming tasks like record-keeping.
- As outlined previously, pathologists leveraged machines to diagnose faster and increase the accuracy of diagnosis on cancerous biopsies, enabling clinicians to spend more time with patients.

THROUGH INTELLIGENT AUTOMATION

- Physical work tasks can be automated using intelligent machines. For example, Fetch Robotics has created robots that use lasers and 3D depth sensors to safely work alongside warehouse workers.
- Decision-making and assessment can be supported, particularly in remote locations. For example, IPsoft's Amelia, an AI platform with natural language processing capabilities, can diagnose a problem and suggest a solution, self-learn through repetition at scale and recognise gaps in its knowledge and take steps to close them. If presented with a question that it cannot answer, it escalates to a human colleague, then observes how the person solves the problem.[15]

THROUGH INNOVATION DIFFUSION

- Stimulating additional innovation and cross-industry spill-over effects. Autonomous cars, for instance, can lead to innovations beyond the automotive industry such as mobile services, advertising, insurance, environmental and even social benefits.
- AI is also leading to the creation of new industries such as ride-sharing and new jobs such as professional data cleaners.

An Accenture report, conducted with Frontier Economics, found that the productivity enhancing impact of AI has the capability to add £650 billion GVA to the UK economy through a combination of intelligent automation, augmentation of labour and capital investments. The resulting diffusion of innovation across the economy would result in a productivity level 25% higher than would otherwise be the case. [16]

The growth boost to the UK economy will flow from approximately equal parts augmentation and intelligent automation channels. While the UK's dominant service sector can adopt AI to fuel the productivity of knowledge workers, its strong pharmaceutical and aerospace industry could also capitalise on intelligent systems to optimise production.

The UK has a comparative advantage in developing AI technologies with the strongest AI and machine learning market in Europe, comprising over 200 start-ups in the field - compared to just 81 in Germany and 50 in both the Nordics and France - as well as a thriving ecosystem of researchers, developers and investors.[17] Furthermore, a CBI survey in May 2017 revealed that AI tops the list of technologies that UK organisations plan to invest in over the next five years.[18]

AI has the capability to add £650 billion GVA to the UK economy...

ENABLING THE AI POTENTIAL IN THE UK

We have outlined elements of the economic and societal potential of AI for the UK, we must now consider how to enable that potential by providing clarity to innovators, confidence to investors, and building public trust. This includes acknowledging challenges and considering how to address them in the confidence that the UK has a strong AI foundation. According to Oxford Insight's Government AI Readiness Index, the UK is ranked first in its ability to absorb - and exploit - the innovative potential of AI.[19]

WHAT IS HAPPENING IN THE UK?

THE UK AI ECOSYSTEM

GOVERNMENT

The UK Government has made strides to articulate the importance of AI for the UK's economy and society, as well as setting out its commitment to and investment in making the UK a leading power in AI. It has done so through:

- The commission of the independent AI review, '**Growing the AI Industry in the UK**', which sets out how the government and business can work together on skills, infrastructure and to implement a strategy for AI in the UK;
- The publication of the **Industrial Strategy white paper**, which identified AI and data as one of four Grand Challenges and includes ambitious missions to address key opportunities, such as putting the UK at the forefront of the use of AI and data in early diagnosis, innovation, prevention and treatment of illnesses;
- The House of Lords select committee on AI report, '**AI in the UK: ready, willing and able?**', which made over 70 recommendations on the deployment of AI; and
- The launch of the UK's **AI Sector Deal** which seeks to respond to the AI review by establishing the beginning of a partnership between government, business and academia, and build on the commitments made in the Industrial Strategy, which aims to place the UK at the forefront of the development of AI and the data economy to improve productivity.

The AI Sector Deal marks the first phase of a significant innovation-focused investment drive in AI by the Government, business and academia, and is intended to help cement the country's reputation as a global AI hub. The £1 billion deal comprises a total of £300 million of private financing and £300 million of new Government spending in addition to £400 million the Government has previously announced. The funds will be focused on developing AI skills, supporting the UK research base and developing regional technology hubs. The deal sits alongside the £250 million already set aside for Connected and Autonomous Vehicles, and the £1.7 billion announced under the cross-sectoral Industrial Strategy Challenge Fund.[20]

This is a strong start, but the UK's ambition must not stop here. As the Government itself acknowledges, the country must continue to be proactive, provide strategic leadership and focus on delivery. This is especially so given the competition the country faces. For example, France has its own version of the AI Sector Deal, which includes investment of £1.1 billion on scientific laboratories, research projects and funding for AI start-ups.[21] The European Commission, meanwhile, has pledged to invest £18 billion into AI by the end of 2020 in a bid to catch up with China, which expects to dominate by 2030.[22]

BUSINESS

AI is clearly part of the Government's ambitions to make the UK the best place in the world to start and grow a digital business. Success will depend on businesses – small or large, national or international - being engaged in the process. Here the UK is well placed. The country's vibrant start-up scene has converged with its academic excellence in machine learning and artificial intelligence. The result has been some early successes across the AI domain, including acquisitions of British AI leaders: DeepMind by Google, Magic Pony by Twitter and SwiftKey by Microsoft.

These successes have given rise to a range of new businesses tackling the full AI stack. These companies include Graphcore, which builds AI chips; Five.AI, which builds autonomous driving platforms; Diffbot, which is using AI to support software development; and many others. Significantly, the UK is one of the leading three countries with expertise across many different domains of AI, including strengths in chip design for AI, such as ARM and Graphcore; core AI platforms, such as DeepMind, Prowler, and Improbable; and a plethora of industry applications, such as Tractable, Behavox, Labgenius and many others. However, if the UK is to realise the full potential of AI, then all businesses across all sectors will have to engage by adopting AI or working with others that do.

ACADEMIA

The academic and research community also plays a vital role in harnessing the potential of AI. The UK boasts many strong organisations in this respect, such as the Alan Turing Institute, the UK's national research centre for AI, which was established in 2015 by five founding universities (Cambridge, Edinburgh, Oxford, UCL and Warwick) – at total of 13 now - and the UK Engineering and Physical Sciences Research Council. The Institute's researchers work across disciplines and look at the theoretical development of AI as well as its application to real world problems.[23] The Institute joins the likes of the German Research Center for AI (DFKI) and the Canadian Vector Institute, alongside several international businesses who have announced the establishment of major research centers in France, including Samsung, Fujitsu and Google.

UK universities provide a strong foundation for innovation. The universities of Cambridge and Oxford, for example, are already considered world-leading centres of AI innovation, having stimulated three start-ups that made major AI breakthroughs and went on to become prime acquisition targets. This includes VocalIQ which was purchased by Apple in 2015.[24] The success of UK universities is supported by funding from organisations like the Leverhulme Trust, which provides annual funding of £80 million for research.[25]

Another example of academic excellence is the University of Cambridge's partnership with the Engineering and Physical Sciences Research Council (EPSRC) and the Science and Technology Facilities Council (STFC). The three organisations are launching a £10 million AI supercomputer, which will be made available to businesses. This development is to be welcomed, as the historic lack of supercomputers to support AI has been seen as a major barrier to the success of UK-based AI innovators.[26]

SOCIETY

To ensure sustainable growth that benefits both the economy and society, the public needs to be engaged. Accenture research shows that workers of all generations and skill levels appear ready to embrace the new reality of digital in the workforce, with 84% being excited about the changes it will bring and 87% are optimistic, projecting that it will improve their work experience in the next five years.[27] Furthermore, groups that we may not immediately consider to be obvious proponents of AI appear willing to utilise the technology. For example, and as discussed previously, our AI elderly HomeCare platform has been particularly well received - one user noted they "would be lost without the platform", while for another "it reinforced (their) autonomy".[28]

Public debate and engagement on the use of AI is required and must develop alongside the technology itself. Moves by the Royal Society's Action and Research Centre, which has established the Forum for Ethical AI, are important, but far more is required in this space to ensure the public are better informed and part of the conversation.[29]

Taken together, these measures send a positive message that the UK is investing in and focused on creating an environment that allows AI to flourish. Our view, nevertheless, is that to realise the full economic and societal potential of AI, the UK should develop a joined-up, overarching AI strategy to enable its AI ecosystem to align to a shared and ambitious vision, with specific and stretching targets, clear milestones, timeframes and regular review points to give clarity to innovators, confidence to investors, and to build public trust.

To achieve these goals, the newly created Government Office for AI, and the AI Council,[30] should work together with relevant consumer groups on the development, delivery and refresh of the strategy to ensure it keeps pace with technological advances. An example of such a strategy is China's published guidelines on AI development which include a clear governance structure, with the allocation of responsibility and plans for research, industry and legislative action for each of 2020, 2025 and 2030.[31]

GOVERNANCE

LEADERSHIP

Leadership is key to ensuring that the economic and societal benefits of AI are realised in a coordinated, equitable and sustainable way. The UK Government's announcement of three bodies, tasked with coordinating the development of AI: The Office for AI, The AI Council and The Centre for Data Ethics and Innovation, is a move in the right direction.[32] This trio provides a good balance between the need to ensure both economic growth and societal growth and to provide engagement with and support to business, academia and wider society. It is essential that each body has a clear remit to ensure overlap and/or conflict is avoided and, once again, to give clarity to innovators, confidence to investors, and to build public trust.

Finally, the UK has a thriving AI ecosystem and the new institutions must ensure that they take full advantage of this through sustained engagement with new and more established players, such as the Alan Turing Institute, the Leverhulme Centre for the Future of Intelligence, the Royal Society of Arts, the British Academy, and the Royal Society and the Nuffield Trust with its forthcoming Ada Lovelace Institute.[33]

SMART REGULATION

A thriving AI sector requires a regulatory environment that enables sustainable innovation. The UK starts from a position of strength, as the Government has a strong record of supporting pioneering innovation. The Government has also signalled its commitment to innovation through the creation of a £10 million Regulatory Pioneers Fund[34] which aims to help create a better environment for demonstrating and scaling new technologies, including AI.

Of course, ethical concerns around the evolution of AI have led to calls for its regulation. It is an important discussion to have but is also a complex one. First, AI is not just a single technology deployed in a single 'use case' and, second, the speed of technological development means it is difficult for traditional regulation to keep pace. Moreover, the discussion often focuses on the risks associated with potential future uses of AI – the Artificial General Intelligence uses described earlier – that cannot be fully understood today.

These caveats aside, it is important that adequate focus on the short- to medium-term issues is maintained. These are the need to establish and maintain trust to accelerate the uptake of AI, as well as looking at whether existing regulation supports those objectives.

What is required, therefore, is a smart approach to the regulation of AI; one which clears barriers to innovation, provides a predictable and sustainable environment for business, protects public safety and builds public trust in the technology. An example of such an approach is the UK Financial Conduct Authority's regulatory sandbox model,[35] which has proved so successful that it has now been adopted in other countries, including Australia.

Aligned to the Regulatory Pioneers Fund, the UK should, therefore, look to implement an AI focused regulatory sandboxing scheme, based on the FCA sandboxing model, that will enable innovative businesses to test and pilot AI responsibly, in a safe environment, and within a safe framework.

Government needs to assess whether regulations already in place are sufficient to respond to the potential challenges posed by AI. This means, for example, testing existing competition law, understanding whether current liability rules can respond to new use cases and if areas such as Copyright and IP need to be updated to enable increased AI innovation.[36]

Where gaps or barriers are identified, government should update existing regulatory frameworks, including through the creation and recognition of standards, which can adapt to the speed of AI development, while ensuring there is an appropriate level of cyber-security, safety and accountability.

If new regulation is required, then a collaborative effort between government and business should seek to create adaptive, agile and self-improving regulation and standards to keep pace with technological change.

Government should work with business and others to develop a smart regulatory framework that focuses on the use and application of technologies (rather than on the technology itself). Issues should be addressed as they arise, in an agile manner, through global, industry-driven guidelines, standards, best practice and codes. This agility is critical given that grey areas in the regulatory space will prevail longer than the innovation cycle.

Such multi-stakeholder initiatives have the strongest influence on creating industry cross-fertilisation and equal access to resources for entrepreneurs and big players alike. They also help to identify gaps in existing standards and certifications, which ecosystem players can then act upon.

This framework would help create and safeguard trust at the heart of AI and related business models and permit the flexibility for innovation.

ETHICAL AI FRAMEWORK

AI is evolving rapidly and will continue to have a significant impact on the UK's economy and society. To ensure the impact is a positive one, government, business, academia and wider society must work together to ensure AI is designed, developed and deployed in an ethical and responsible way. This will bake trust into the system at every level – an essential ingredient of its licence to operate – and ensure that the full benefits of AI can be realised in a sustainable way.

Accenture, for example, is developing a framework called Launchpad; an innovation-friendly, agile approach to ethical development. It helps organisations understand risk stemming from AI initiatives and what governance, methodologies and technical solutions can be deployed in mitigation.[37]

The UK has an opportunity to lead the charge around AI ethics and develop a globally relevant framework that incorporates 'trust by design'.[38] This will enable the UK to realise the economic and societal potential of AI responsibly and ensure sustainable and equitable growth.

We, therefore, welcome the UK Government establishing what it describes as the world's first national advisory body for data and AI: The Centre for Data Ethics and Innovation. The Centre will seek to ensure that ethics and innovation are mutually reinforcing – not mutually exclusive – by unlocking the usefulness of data, protecting its value for organisations and, most importantly, keeping people's data secure.[39]

However, there is strong competition internationally to be seen as leading in the field of AI ethics. The German Federal Government, for example, has said it will appoint a Data Ethics Committee[40] to develop a framework for data policy that sets out the responsible use of algorithms, artificial intelligence and digital innovations. France, meanwhile, is establishing an independent council on Ethical AI to engage government and citizens into defining their ethical approach.[41] The UK must, therefore, be proactive and work at pace to continue in its current position as an international convener in the ethics space.

This is an important point, given that the UK Government's Industrial Strategy aims to put the UK at the forefront of the artificial intelligence and data revolution,[42] as it may not be plausible for the UK to compete with the likes of the US and China in terms of funding or scale. Just as the AI Sector Deal recognises that the UK must be strategic and focused on areas where it can compete globally,[43] ethics is an area where the UK is making great strides, including the work of the Alan Turing Institute, the Leverhulme Centre for the Future of Intelligence and the newly established Ada Lovelace Institute.

However, the AI ethics debate is not for government to solve alone. It is important for the whole of the UK – government, business, academia and society – to collaborate and build on its existing position of strength so that we can engage AI further to differentiate and boost sustainable and equitable growth. These opportunities include fostering a public discussion to build a set of fundamental ethical principles for AI development. Flexibility is necessary to allow for the development of specific codes in certain sectors, building on these fundamental principles.

For AI to deliver fully on its promise, a supportive tripartite framework – regulatory, legal and ethical – is required. Trust is key to the development and uptake of AI and for trust to flourish. We therefore need a smart regulatory environment: a supportive legal system underpinned by an ethical framework which enables principled decisions to be made on issues too complex or fast-changing to be adequately addressed by regulation or legislation alone.

AN AI-ENABLED WORKFORCE

EDUCATION

AI is already transforming the nature of work, and the skills required for the modern workplace. The UK will, therefore, need to ensure its education system is working at pace, and flexibly, to develop an AI-enabled workforce of the future. While education is a long-term investment, action needs to take place in the short-term and on an ongoing basis to remain relevant.

Positive steps are being taken by the Government through the AI Sector Deal, which sets out the UK's ambition to be home to the world's best and brightest minds in AI. The Deal has committed to investing £406 million in skills, with a focus on maths, digital, and technical education; including funding to upskill up to 8,000 computer science teachers, creating 1,000 government-backed AI PhDs by 2025, and developing an internationally competitive Turing Fellowship programme in AI.[43] This initiative compares to the likes of the Canadian Institute for Advanced Research (CIFAR) Global Scholars Programme.[44]

Nevertheless, efforts are still needed to shift from STEM to STEAM skills, which reflect the multidisciplinary skills AI demands. For AI to flourish alongside people, creativity, arts, critical problem-solving, interpersonal skills and an open mindset to lifelong learning will be equally important. The education system needs to remain relevant and able to anticipate and adapt to skills demands and encompass informal learning. Meanwhile, students need to understand how and why these skills should be blended.

The UK curriculum will also need to be adapted to develop the multidisciplinary skills mentioned above. This change will require a degree of flexibility in the education system, including working with businesses more closely to forecast skills requirements and adapt accordingly. Vocational training and apprenticeship programmes – such as the Government's T-Levels[45] and digital apprenticeships[46] - will continue to play a key role in preparing students for future working environments and help them refine the skills they need. All this should go hand-in-hand with the idea that people will need to embrace lifelong learning, and government and business will need to focus more on helping achieve this goal.

RE-SKILLING AND RETRAINING

In fact, given that AI is already transforming the nature of work, and the skills required in the workplace, the notion of lifelong learning needs to be embraced today.

The £30 million being invested by the Government to increase adult learning and retraining via a scheme to test the use of AI and innovative education technology (EdTech) in online digital skills courses[47] is, therefore, welcome. Already today, the biggest challenge is how to support workers that are forced by AI to find new careers. The second most immediate challenge, particularly for businesses, is ensuring access to the skills they require given the current mismatch between supply and demand.

This mismatch is widely understood, with almost half of business leaders in an Accenture survey identifying it as a key challenge.[48] The traditional source of skilled workers has been the education system. However, given the pace of technology and the evolving nature of work, education and training bodies cannot keep up with the skills demand. As discussed above, while investment in primary, secondary and higher education is very much welcomed to meet future skills needs, it is not going to meet short- to medium-term demand: it is a longer-term project.

Already in the short term, AI is expected to create 2.3 million jobs by 2020, while eliminating 1.8 million, making 2020 a pivotal year in AI-related employment dynamics[49]. This is supported by the findings of our Tech Vision 2018 survey which found that 81% of executives believe that within the next two years, AI will work next to humans as a co-worker, collaborator and trusted advisor.[50]

THE EVOLUTION OF WORK AND THE ELEVATION OF WORKERS.

A drilling technician drills multiple test holes, manually preparing the drill, calculating and entering correct pressure and speed for the drill.	AI tells the drilling technician which oil deposits to target and intelligent drills calculate speed, pressure and depth.
A pharmacovigilance scientist combs through vast volumes of documents in order to assess safety issues related to drugs.	AI, using Natural Language Processing and Machine Learning, helps free scientists to work on higher risk cases and cater to growth in adverse event cases.
A software developer spends time each week identifying new spam flags and manually writing rules for spam detection.	Machine intelligence identifies new spam keywords and updates detection rules, freeing the employee from work unrelated to new software development.
An aerospace engineer designs a new plane component making manual calculations to produce strong and light designs.	Generative Design mimics natures evolutionary approach to consider millions of possible designs and tests for strength and lightness.
A long-haul driver controls the vehicle on the road, in charge of the speed, braking and steering.	The driver becomes an "in-cab systems manager," performing high-level technical work, such as monitoring diagnostics systems and optimising routing tasks as automation controls braking and speed.

Source: Accenture Future Workforce Ethnographic Study 2017

To compound this shift, according to the World Economic Forum (WEF), the impact of AI is likely to be highly specific to the industry, region and occupation in question, and the ability of various stakeholders to successfully manage change.[51] All stakeholders need to come together not only to realise the opportunities of an AI-enabled workforce but also to address the challenges of displacement and the skills mismatch between supply and demand.

This requires working together to identify, through economic forecasting, groups that are most at risk of job displacement, or societal marginalisation, through AI and automation. AI stakeholders should jointly develop strategies to support the development of viable alternative economic activity and relevant reskilling programmes, including better matching skills demand and supply.

The imperative is on businesses to invest in retraining and reskilling programmes to develop their AI-enabled workforce. Not only is this the responsible thing to do, it makes good business sense too. First, based on our analysis, the top performing companies – approximately 20% of all publicly listed companies globally – are investing in AI. Simultaneously, they are investing in training and reskilling their workforce around human-machine collaboration.[52] Second, there is little alternative to meet short-term skills demands. However, only 3% of all companies we surveyed plan to significantly increase investment in training and re-skilling programmes in the next three years.[53]

The challenge is how to change mindsets from focusing only on the efficiency AI can enable to building human capabilities and investing in continuous learning to prepare for new human/machine collaboration. Part of this shift will include creating an understanding of how AI can augment human capabilities and the types of roles that will be created by AI.

Businesses will need to establish insight-driven training programmes, which map their required skills against the current skills of their workforce. The programmes should be continually updated as technology develops and implemented across the company. Much of these insight-driven programmes will be enabled by technology.

At Accenture, for example, we have retrained over 160,000 employees with new IT skills and provided more than 100,000 employees with the skills they need to be job-ready in less than two years. This success was based on our 'New Skilling' framework, which guides talent based on a progression of skills from awareness to expert and a range of digital learning channels. The approach decreased the cost of training hours by more than 25%, while increasing the total number of training hours by 40%.[54]

We put 60% of the money we save from investments in AI into our training programmes. Over a two-year period, we retrained tens of thousands of people whose roles had been automated. These employees are now taking on higher value work, in some cases using AI and other technologies to provide more informed services to clients.[55]

The short-term challenge will be to manage the transition of the immediate 'at-risk' workforce into sustainable employment. This will require the government, business, academia and wider society to work together to map the impact by region and sector, create awareness of existing support, and develop relevant reskilling and retraining programmes.

An example of existing support is the East London Business Alliance (ELBA), a member-led regeneration charity focused on the pillars of Employment, Education and Community. Since 2011, ELBA has been Accenture's non-profit innovation partner in the UK, convening cross-sector stakeholders and subject matter experts to help create technology solutions such as the Skills to Succeed Academy and Accenture Digital Skills, with the aim of achieving social impact at scale, reaching over 130,000 beneficiaries nationally since 2013. As the lead UK charity partner on Project Orion, Accenture Corporate Citizenship's re-skilling pilot in the UK and US, ELBA aims support other UK-based non-profits as they adopt our solution and adapt their programmes to address the pressing need to re-skill workers whose jobs are at risk of automation.[56]

DATA VERACITY AND ACCESS TO DATA

DATA VERACITY

Data veracity is fundamental to realising the positive benefits of AI in an ethical, responsible and sustainable way. AI systems are only as good as the data they use.

Our Tech Vision 2018 survey reported that 82% of organisations that responded are increasingly using data to drive critical decision-making, and at an unprecedented scale. Yet 79% of these organisations agree that they have not yet invested in the capabilities to verify the truth of this data.[57]

Inaccurate and manipulated information threatens to compromise the insights that government needs to deliver essential public services, that businesses rely on to plan, operate, and grow, and that the public require to have trust in the public services they rely on and the businesses with which they interact.

Ensuring the integrity and veracity of data is, therefore, of paramount importance to the UK's economy and society. As the AI Sector Deal rightly asserts: without access to good quality data from a range of sources (whether privately or publicly held), AI technologies cannot deliver on their promise of better, more efficient and seamless services.[58]

Data integrity and veracity can be addressed by building confidence in three key data-focussed tenets:

1. Provenance or verifying the history of data from its origin through its life cycle
2. Context or considering the circumstances around its use
3. Integrity through securing and maintaining data. We therefore recommend that the government, business, academia and wider society work together to develop a data intelligence framework, drawing from existing data science and cybersecurity capabilities that ensure that these tenets are appropriately addressed.[59]

ACCESS TO DATA

Just as data veracity is key to the development of sound AI, so is the availability of data at scale. As the independent AI review puts it: more open data in more sectors mean more data to use with AI to address challenges in those sectors, increasing the scope for innovation.[60]

The UK is well positioned in this space. The Government is already leading the way in making public datasets open and available and is ranked first in the world on government performance its use of open data by the World Wide Web Foundations.[61] From a private sector perspective, the Open Data Institute has also worked with many businesses in the banking, agriculture and sports sectors to publish open data.[62] Furthermore, and from a legislative perspective, the Digital Economy Act 2017 included new provisions on using data for the public good.[63] Moreover, the General Data Protection Regulation (GDPR), specifically the UK's Data Protection Bill, which implements the EU data laws in the UK, addresses the handling and sharing of personal data – something that is key to the development of AI.[64]

Nevertheless, the UK cannot afford to rest on its laurels given other countries are also taking measures to open and share more of their data. This includes France, which has called for a more proactive approach to sharing the public-sector data of French citizens with businesses to improve services.[65]

The open data question is acknowledged in the AI Sector Deal, which contends that significant challenges to sharing datasets remain, including legitimate concerns around security and competitive advantage, which need to be tackled. The Government's commitment to exploring data sharing frameworks such as Data Trusts is, therefore, welcome.[66]

The Government's vision for Data Trusts is that they will allow two or more parties in any sector to partner in data sharing agreements, shape the agreements according to their needs, ensuring that exchanges are secure and mutually beneficial and enabling multiple organisations to work together to solve a common problem.[67]

For the impact of this approach to be maximised, Data Trusts should – according to the independent AI review – include standardised, repeatable terms; helping the UK create a competitive and innovative market that serves the interests of holders of large datasets, and of businesses who could develop AI services by leveraging that data.[68]

We agree that the UK Government and business should in partnership develop a Data Trust framework and suggest that the Government and regulators should test the approach by extending the concept of sandboxing to data sharing to create a safe environment for industry and research institutes to develop, test and agree terms and conditions for access and use of data, including allocation of derived IP and value.

GLOBALLY LOCAL POTENTIAL

REGIONAL FOCUS

We welcome the Government's Industrial Strategy's plans to develop local industrial strategies to complement the national one.[69] The AI Sector Deal which forms part of the Government's strategy to invest in AI around the UK, also makes a commitment to establish clusters and regional tech hubs to improve the environment for start-ups. This includes a £21 million investment in Tech City UK, so it can expand into Tech Nation, with the aim of transforming the UK from a series of standalone tech hubs into a network; working with Digital Catapult centres across London North East & Tees Valley, Northern Ireland, Brighton and Yorkshire to help implement digital policies and identify policy needs in emerging technologies.[70]

Furthermore, the creation of the National Innovation Centre for Data[71] in 2017 and the Scottish Data Lab with hubs in Aberdeen, Edinburgh and Glasgow,[72] which seek to enable industry, public sector and world-class university researchers to innovate and develop new data science capabilities to solve real world problems, also demonstrates that the UK is on the right track in ensuring that the benefits of AI will be felt right across the UK.

A similar approach is taken in the United States, where digital hubs exist in Silicon Valley, Seattle, Boston and New York; and bring together talent and research capabilities from leading universities, private investment and collaboration. This network has arguably played an important role in developing the US's AI capabilities.[73]

What is still required in the UK – and building on our recommendation for government, business, and academia to work together to map the impact of AI by region and sector – is the publication of plans to ensure that any potential regional disparities are managed and progress on implementation is monitored transparently. Doing so will help give the required clarity to innovators and confidence to investors while helping build public trust.

With only six of the UK's 63 towns and cities having higher productivity than the European average, and more than half of UK cities (38) among the 25% of cities with the lowest productivity,[74] there is a significant opportunity for AI to increase the contribution of the regions to UK productivity and it is one that should be seized.

GLOBAL CONTEXT

To ensure that the benefits of AI are felt by all, the UK must – as set out above – be nationally and, importantly, regionally focused. It must also be globally relevant. Competition for talent and investment is after all global and it is therefore imperative that the UK's activity is undertaken in a global context.

As the House of Lord's explained, "we believe it is very much in the UK's interest to take a lead in steering the development and application of AI in a more co-operative direction, and away from this riskier and ultimately less beneficial vision of a global 'arms race'... whatever the UK decides for itself will ultimately be for naught if the rest of the world moves in a different direction."[75]

As discussed in an earlier section, the UK is well positioned to lead and coordinate collective action to shape global governance in ethics by developing an internationally agreed ethical framework for the development and deployment of AI. The coordination point is of particular importance given the work already happening in this space, including by The Institute of Electrical and Electronics Engineers (IEEE) and the British Standards Institution, to name just two.

Furthermore, for the UK to ensure that AI growth is sustainable it must ensure that it is globally competitive and relevant not just ethically but also from a regulatory and legal perspective. So, wherever possible, the UK Government, business and academia should work with global counterparts to create a common understanding of existing standards, certifications and methodologies that enable the development of AI to be of the widest benefit to economies and societies alike. Where gaps exist, the UK should take a leadership role in the creation of required frameworks, including internationally recognised safety and security frameworks. An international approach to standards and certification enables businesses to scale the deployment of new AI-enabled products and services and provide access to global markets.

There is also a clear opportunity to create a strong ecosystem across the European region that boosts investment and research. The UK should lead the European development of AI ecosystems and increase collaboration on applied research. This could be done through a network of AI innovation hubs, built around centres of excellence, with one or more in the UK, enabling them to learn from each other and share best practice – for instance on how to remove regulatory barriers to the uptake of AI.

This move would be important given that a European Commission report found Europe lags both the US and China[76] in terms of AI investment. According to CB Insights, Chinese AI start-ups attracted 48% of the total global investment in 2017, jumping from 11.3% in 2016 and outdoing the US, which claimed 38% of investment. The rest of the world attracted 13% of total investment.[77]

It is important to remember that realising the full benefits of AI and ensuring its sustainability requires active engagement by all global players and, therefore, all countries have a role to play. As with the UK, it would be beneficial to have an overarching legal, regulatory and ethical framework for AI that is recognised globally.

CONCLUSION

The UK has made a strong start in realising the economic and societal benefits of AI, by investing in an environment that allows AI to flourish. The UK's ambition must not stop here: it must continue to be proactive and provide strategic leadership at home and abroad. This is not a task for government alone: businesses, academia and the public must all be willing to engage in this task.

A thriving AI sector requires the right legislative and regulatory environment that supports sustainable innovation; underpinned by an ethical framework that puts people at the centre and enables principled decisions to be made on issues too complex or fast changing to be adequately addressed by regulation or legislation alone. This tripartite approach – legal, regulatory and ethical – has the potential to bake trust into the system at every level – an essential component of its licence to operate.

Data is also key. Fundamental to realising the positive benefits of AI in an ethical, responsible and sustainable way, data must be accurate, true and available at scale. AI systems are only as good as the data they use and access to good data must remain a focus for the UK.

AI is already transforming the nature of work, and the skills required to thrive in the workplace. Moving forward, the UK will need to ensure its education system is working flexibly and at pace to develop an AI-enabled workforce; alongside reskilling and retraining programmes which empower employees to embrace lifelong learning.

Finally, to ensure that the benefits of AI are felt by all, the UK must be nationally and regionally focused, whilst ensuring it is globally relevant.

Only a proactive focus on the above will ensure that AI delivers equitable and sustainable growth for the UK.

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