REALISING THE ECONOMIC AND SOCIETAL POTENTIAL OF RESPONSIBLE AI IN EUROPE
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Introduction

THE FOURTH INDUSTRIAL REVOLUTION

The re-emergence of Artificial Intelligence (AI) combined with the internet of things, big data analytics, nanotechnology and blockchain are underpinning the fourth industrial revolution currently underway. These technologies are having, and will continue to have, a significant impact on how we live and work. Whether this impact will be disruptive or positive is at the heart of the debate that surrounds this topic. Perhaps the biggest challenge, and key to realising positive benefits coming out of these technologies, is our ability to navigate uncertainty.

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. However, at Accenture we believe that AI and other technologies can be a force for positive change, provided the human is placed at the centre of the development, application and governance of the technology. In that sense, it is critical that humans are empowered and enabled by AI and that developers and users of technology remain 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 businesses, policy-makers, 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 debate in Europe about how to accelerate investment in and manage the growth of AI in a responsible 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 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, as a result, is not to tackle all the known or unknown challenges. Rather, we have looked to develop insights on how a partnership between businesses, policy-makers, academia and societal groups, can pave the way for future opportunities for business and society.

Spring 2018.
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, robotic process automation, unique identity, video analytics and many more.

AI is not a new technology, having existed since the 1950s, when Artificial Intelligence was first given a name. Since then, big strides have been made in Artificial Narrow Intelligence – algorithms that can process documents, drive vehicles or beat champion chess players.

However, no one has yet claimed the first production or development of Artificial General Intelligence (AGI) – machines that can think like humans, show common sense and empathy and distinguish right from wrong. The weight of expert opinion is that we are a long way off the emergence of AGI.

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 R&D (experimental AI) to the real-world application of AI (exponential 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 skyrocketed. CB Insights estimated there was a 141% increase in AI start-ups in 2017 on 2016 figures, and more than 1,100 new AI companies raised equity funding since 2016. This is more than half of the historic number of AI start-ups raising equity in this period alone.

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 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 there should be hype, is that AI is a transformational technology, which some would say, like electricity or the steam engine, not only impacts society directly but has a spillover effect on the broader economy. 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 SOCIETAL & ECONOMIC 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.
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 unconnected 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.6

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-centric 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. At the end of the three-month pilot programme, feedback from participants was very positive. One noted that she would be lost without the platform, while for another it reinforced his autonomy.7

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 truly innovative solution; one which empowers the visually impaired and improves their everyday lives.8

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.9

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.10

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.11
A STRONGER ECONOMY

With the recent convergence of a transformative set of technologies, economies are 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 analysed 12 developed economies and found that AI has the potential to double their annual economic growth rates and boost labour productivity by up to 40% by 2035 and enable people to make more efficient use of their time.12

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 takes 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.14

THROUGH AUGMENTATION

- Enhancing human capabilities and improving work through virtual assistants such as Amelia can relieve individuals of time-consuming tasks like record-keeping.
- As outlined above, pathologists leveraged machines to increase the accuracy of diagnosis on cancerous biopsies.

Figure 3: The economic impact of AI
AI Steady State - shows the expected economic growth once the impact of AI has been absorbed into the economy.
Real gross value added (GVA) (% growth)
Source: Accenture and Frontier Economics
Note: 2035 was chosen as a year of comparison as it takes time for the impact of new technology to feed through.

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 INNOVATION DIFFUSION

- Stimulating additional innovation and cross-industry spillover effects. Autonomous cars, for instance, can lead to innovations beyond the automotive industry such as mobile services, advertising, insurance 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.

REVIEW OF ECONOMIC POTENTIAL BY MEMBER STATE

We looked at a group of 10 EU member states to determine the economic potential for Europe of the development and growth of AI related industries. Our view is that the potential is significant, if each member state can leverage these channels to support its industrial capabilities.

**AUSTRIA**
**Gross Value Added (GVA) increase almost US$140 billion**
Austria’s economy is generally biased towards service-related industries that can profit from AI’s augmentation ability. Austria also has a presence in the iron, steel and chemical industries that can deploy intelligent machines in their production processes.

*Intelligent Automation: $61bn*  
*Augmentation: $63bn*  
*Innovation Diffusion: $12bn*

**BELGIUM**
**GVA increase expected of boost of US$93 billion**
While services account for a large part of Belgium’s economy, it also has a heavy industrial base including steel and machinery fabrication and a large transport and logistics sector. All these industries could leverage intelligent machines to improve current processes. Therefore, the intelligent automation element is relatively larger than the other two channels.

*Intelligent Automation: $52bn*  
*Augmentation: $32bn*  
*Innovation Diffusion: $9bn*

**FINLAND**
**GVA increase expected of boost of US$104 billion**
Finland’s economy has shifted from traditional industries like forestry to focusing more on R&D and hi-tech electronics. Today, its renowned telecommunications and strong foothold in manufacturing prime it for AI technologies.

*Intelligent Automation: $46bn*  
*Augmentation: $47bn*  
*Innovation Diffusion: $11bn*

**FRANCE**
**GVA increase expected of boost of US$589 billion**
AI can be deployed in France’s strong chemical industry that is a key sector for helping to develop other manufacturing activities. Other applications include France’s aviation sector and its prominent tourism industry. Overall, the intelligent automation channel is expected to drive the majority of the benefits.

*Intelligent Automation: $320bn*  
*Augmentation: $200bn*  
*Innovation Diffusion: $70bn*
ITALY
GVA increase expected of boost of US$227 billion

Italy is the second largest manufacturer in Europe. We expect almost half of the additional GVA to derive from the intelligent automation channel. Italy is also known for its high-quality automobile industry and its prominent luxury goods market. These sectors can benefit from the wider innovation effects AI will propel.

NETHERLANDS
GVA increase expected of boost of US$311 billion

AI can be deployed in France’s strong chemical industry that is a key sector for helping to develop other manufacturing activities. Other applications include France’s aviation sector and its prominent tourism industry. Overall, the intelligent automation channel is expected to drive the majority of the benefits.

SPAIN
GVA increase expected of boost of US$189 billion

With its strong telecommunications, transport and construction industry, the majority of the benefits to Spain’s economy result from the intelligent automation channel. Yet more than 10% of the boost can be attributed to wider innovations that will lead to new and improved ways of working and living due to AI technologies. This can be especially important for Spain’s tourism and agriculture sectors.

SWEDEN
GVA increase expected of boost of US$214 billion

Sweden has a variety of internationally competitive sectors such as automotive, pharmaceuticals, industrial machines and pulp. Owing to its highly-skilled labour force under the umbrella of Sweden’s ‘high-tech capitalism’, the majority of benefits will stem from the augmentation channel.

UNITED KINGDOM
GVA increase expected of boost of US$814 billion

The growth boost to the UK economy will result in approximately equal parts from the 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 bulk of economic rewards will stem from intelligent automation. Germany’s advanced manufacturing sector, coupled with initiatives like Industry 4.0, offer prime conditions for a seamless integration of intelligent systems into production processes.
ENABLING THE AI POTENTIAL IN EUROPE

We have outlined elements of the economic and societal potential of AI for Europe, we must now consider how to enable that potential. This includes acknowledging challenges and considering how to address them.

As a starting point, we should consider how to develop AI capabilities in Europe. Addressing the societal challenges associated with AI and other technologies, will also be key to building trust and support from all stakeholders for the wide-scale adoption of AI. The societal impact of AI is very much part of the debate on how to appropriately govern AI and how to manage the impact on the workforce. We have therefore addressed the topic through these lenses.
DEVELOPING AI CAPABILITIES IN EUROPE

When considering how we can develop AI in Europe, we should focus on three areas. Firstly, who are the global leaders in AI and what can Europe learn from them? Secondly, what are the existing capabilities on which Europe can build? Finally, what do businesses need to realise their AI potential?

WHO ARE THE GLOBAL LEADERS IN AI INVESTMENT?

A recent European Commission report set out where Europe was placed compared to the US and China demonstrating that the region is lagging behind. It is clear that the US and China are currently leading in AI investment globally – and by a long stretch. 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.

This trend is supported by the Tencent Research Institute, which estimated that in June 2017, there were 2617 AI companies in the world, with 1078 in the US, or 41%, and 592 in China, or 23%. Total capital investment in AI in the US was estimated to be nearly $15.5 billion, making up approximately 50% of global investment, with $10 billion in China, making up 33% of the worldwide investment. The rest of the world accounted for approximately 17%.

WHAT CAN EUROPE LEARN FROM THESE ECONOMIES?

US

The US Government is estimated to have spent $1.2 billion in non-classified research in 2016 and the Defence Advanced Research Projects Agency (DARPA) is seeking a budget of $3.44 billion in fiscal 2019, an increase of 8.5% compared with its request for fiscal 2018. However, US leadership in AI investment, has largely been driven by the private sector. The world’s leading companies in AI research in 2016 were Microsoft, Google and IBM, all US companies. According to CB Insights, based on 2017 figures, Amazon, Google and Microsoft dominate enterprise AI – again all US companies. It is estimated that more than half the world’s unicorns are from the US.

The digital eco-systems around the hubs of Silicon Valley, Seattle, Boston and New York, which bring together talent and research capabilities from leading universities, private investment and cross-science/industry collaboration, can be considered to have played an important role in developing the US’s AI capabilities.

CHINA

While still behind the US in terms of overall investment, China has clear ambitions to be at the same level as the US by 2020 and the world leader in AI by 2030, supported by a new development plan to create a $150 billion domestic AI industry. Its plans to build a new AI industry include a national fund that supports research, from the most basic research to critical AI projects. The top nine universities have received government funding to each establish an AI school and the remaining 32 to include an AI programme as part of their curriculum. The Ministry of Industry and Information Technology is planning to put nearly $950 million dollars per year into strategic AI projects for State Owned Enterprises and the public sector.

In addition to state investment, the government is expected (at the time of writing) to publish Next Generation AI Development Guidelines imminently. The guidelines are expected to include a clear governance structure, with allocation of responsibility and plans for research, industry and legislative action or each of 2020, 2025 and 2030.
While China’s approach is not necessarily replicable, in other parts of the world, there are two key learnings from its programme:

- Public sector investment, particularly in R&D, helps drive private investment.
- It has a plan with a governance structure and clear milestones. Having a plan instils confidence in inward investors. Based on interviews Accenture carried out with inward investors in the UK, there was consensus that the governments’ public messaging had a significant impact on companies’ confidence and therefore willingness to invest in a country.

**WHAT IS HAPPENING IN EUROPE?**

Applying the learnings from the US and China, let us look at how Europe stands in terms of digital eco-systems, investment and planning.

**DIGITAL ECO-SYSTEMS**

According to figures published by Venture Capital company Asgard in 2017, 50% of the AI companies in Europe were concentrated in the UK, France and Germany. With more than 120 firms, the UK had more than double the number of AI companies as Germany - which boasts 51, centred around Berlin – whilst France had 39 and Spain 31. The common denominator is that digital eco-systems are more mature in the leading countries than elsewhere in Europe.

In the UK, the universities of Cambridge and Oxford are considered centres of AI innovation; having already stimulated three start-ups that made major AI breakthroughs and later became prime acquisition targets. Google in 2014 bought DeepMind, Apple in 2015 purchased VocalIQ, and Microsoft bought SwiftKey in 2016. This success is supported by funding from organisations like the Leverhulme Trust, which provides annual funding of £80 million for research.

Other capabilities include The Alan Turing Institute: the national institute for data science. The Institute was established in 2015 by five founding universities (Cambridge, Edinburgh, Oxford, UCL and Warwick) and the UK Engineering and Physical Sciences Research Council. The Institute’s researchers work across disciplines and look at theoretical development and application to real world problems. It was announced as the national centre for AI in November 2017 and six new universities will join the institute in 2018.

The German Research Centre for Artificial Intelligence (DFKI - Deutsches Forschungszentrum für Künstliche Intelligenz) is one of the world’s largest AI research institutes. It has facilities in the German cities of Kaiserslautern, Saarbrücken, Bremen and Berlin and is partnering with companies on application-oriented basic research to develop product functions, prototypes and patentable solutions.

**PUBLIC SECTOR INVESTMENT**

The EU’s Robotics Public Private Partnership, launched in 2013, has seen the allocation of €700 million for research to 2020. This is coupled with private investment for an overall backing of €2.8 billion. It is believed to be the biggest civilian research programme in this area in the world and could be considered instrumental in the strong presence of Europe among service robot manufacturers. Clearly, public-sector investment has paid-off.

If we look at country-level investment, the UK seems to be the only nation that has announced investment figures. Investments include in its Digital Strategy, with funding of £17.3m from the Engineering and Physical Sciences Research Council (EPSRC) to support the development of new Robotics and Artificial Intelligence (RAI) technologies in universities across the UK, and £84 million announced in November 2017 for AI and robotics research and smart energy innovation, as part of the Industry Sector Deal.

**A PLAN**

In addition to the UK announcements, France is working on a roadmap to implement its AI strategy (#FranceIA) and the German coalition agreement refers to a ‘Master Plan’, with plans for investment in research capabilities domestically and in partnership with France and Poland. Finland is also exploring how it can become a leading country, in the application of AI.
Similar to the European Commission’s broader approach to Digitising European Industry\textsuperscript{40}, France and Finland are considering building on industrial capabilities, investment and developing ecosystems to support research and innovation capabilities, appropriate governance and investment in skills.

**WHAT DOES BUSINESS NEED?**

Understanding and addressing the current challenges faced by businesses will be key to ensuring Europe fully realises the economic potential of AI. Based on our AIQ research, the most critical levers to help small enterprises develop their AIQ are access to data, technology and people. Small businesses often lack awareness of the opportunities to exchange ideas and innovations between AI hubs when trying to scale beyond their home market. Compounding the challenge is a shortage of skills in many AI disciplines: according to Wolfgang Wahlster, CEO of the German Research Centre for AI, there were at least 5,000 vacant AI-related positions in Germany in 2017 alone.\textsuperscript{41}

For larger companies, success will come down to finding and retaining the right talent, mitigating the impact of AI on the workforce, prioritising investments, and allaying concerns about security. It will also depend on defining compelling business cases, securing leadership support, and acquiring more general technology capabilities. Implementing Responsible AI approaches to ensure companies retain and build consumer and employee trust with regards to AI will also be critical. Without these factors in place, adoption will be held back.

**CONCLUSION**

The same learnings apply for Europe as for the global leaders. Digital ecosystems are key, investment programmes leverage results, and having a plan is important. The challenge is the current concentration of AI capabilities in too few countries, and the fact that only a few countries have or are in the process of developing an AI plan.

Businesses will need to manage some of their challenges on their own, but some of them are driven by lack of understanding, or access to data and skills. In these cases, broader collaboration across government, education, the research community, businesses, and broader society will be required.
Ethical concerns around the evolution of intelligent robots have led to calls for the regulation of AI. There are three key challenges. Firstly, AI is not just a single technology deployed in a single use case. Furthermore, the speed of technological development means it is difficult for traditional regulation to keep pace. Finally, the discussion often jumps straight to the long-term risks of AI, which, it can be argued, we cannot fully understand because we do not know when we will arrive at general intelligence.

The danger here is that we fail to focus adequately on the short- to medium-term issues; namely the need to establish trust and accelerate the uptake of AI, as well as looking at whether existing regulation supports those objectives. These concerns can be distilled in three key areas: accountability, transparency and explainability; safety and security, and; access to data.

ACCOUNTABILITY, TRANSPARENCY AND EXPLAINABILITY

There is a danger that automated processes can ‘learn’ patterns that lead to outcomes we may not desire, through processes we may not understand or cannot explain. There is also the risk that algorithms will perpetuate existing bias and discrimination in society, adding to the lack of trust around implementing AI, particularly in areas that relate to people’s life choices or opportunities. There have therefore been calls to regulate algorithms, or the use of algorithms, to ensure transparency and explainability.

The General Data Protection Regulation (GDPR), supported by the recently adopted Article 29 Working Party Guidance, actually puts in place that regulatory framework for automated decision-making and the profiling of EU citizens. As a rule, there is a general prohibition on fully automated decision-making, with some exceptions:

1. when it is necessary for a contract between an individual and an organisation;
2. when it is authorised by EU or national law to which the organisation is subject;
3. when it is based on the individual’s explicit consent.

Under these exceptions there is a requirement to safeguard the individual’s rights, freedoms and legitimate interest which, at a minimum, provides individuals the right to human intervention, express their point of view, and contest the decision. On sensitive data, such as relates to health or racial or ethnic origin, there are even greater restrictions. The Guidance further expands on suitable safeguards, including frequent assessments of processed data sets to check for bias; auditing algorithms to test that those used and developed by machine learning systems are performing as intended; creating mechanisms for the data subject to express their point of view; and creating mechanisms for receiving human intervention.

That is not to say that this is clear or practical for businesses or organisations in understanding how they can meet GDPR requirements. There are additional questions on how to implement these safeguards and more generally beyond compliance, establishing citizen and consumer trust. For example, how can we audit algorithms, and do requirements differ depending on the specific AI application and the sector? What is the best way to set up assessments of processed data so that bias is caught? How do we unpack black-box decision-making?
SAFETY AND SECURITY

Safety and security will be required to build consumer trust in AI and automated systems. Establishing financial liability is one mechanism but ensuring physical safety and security will also be key.

To date, most discussion has been around the question of who is responsible when something goes wrong. The most advanced discussion is around autonomous vehicles. Germany passed a new law in 2017 that apportions liability between the driver and the manufacturer depending on whether the driver or the autonomous vehicle was in control. On the back of this approach car manufacturers, such as Audi, have said they will assume responsibility if an accident takes place, while their ‘traffic jam pilot’ is in use. Meanwhile, the European Commissioner for Transport has said in this context that ‘no matter how technology works there is a human being that needs to be responsible for how it is used. Either using a joystick or pushing a button.’

The response to this is also often positioned as an ethical dilemma, a much-discussed derivative of the ‘trolley problem’ in moral philosophy. Similar questions are raised by automated systems that are already used in rail and air transport. What is novel is considering liability where services are provided by car manufacturers, in the context of legacy insurance constructs.

Clarifying and developing a more universal understanding of liability, and addressing the role of insurance, will help address some concerns. However, beyond establishing financial liability, there are legitimate concerns around safety and security which need to be addressed; including ensuring security by design is applied in autonomous systems.

ACCESS TO DATA

DATA AGGREGATION

There are two different concerns driving calls for new regulation to protect consumers. Firstly, there are concerns that companies are harvesting significant amounts of consumer data and using it inappropriately to gain insights about consumers. Key here is that the consumer may not have access to these insights or the ability to derive value from them. EU data protection law already has strict provisions around the appropriate collection and use of personal data. Beyond compliance, companies can consider how to create awareness of how they use consumer information and the value they provide in return, which can build trust in their brand and services.

Secondly, there are concerns that companies are amassing large data sets and thereby building an unfair competitive advantage. Datasets themselves have little intrinsic value without the ability to extract meaning from them. The dataset is a necessary, but not the only, component of delivering meaningful insights from data. Having the tools to analyse it and the experience to understand its meaning are the others.

While those that have access to large datasets and by the nature of their business models have data network effects, which enables them in turn to build a first mover advantage when it comes to perfecting their algorithms and driving business value, this does not necessarily negatively impact the consumer. Within the confines of competition law, the key consideration is whether consumers could be put at a competitive disadvantage. We do not necessarily have to look at amending existing competition law or creating new competition law to address the underlying question of how do we open up access to data so that all companies, large and small, to derive insights and innovate.

We can see from European Commission cases that the current law can stand up to new technology and business models.

OPENING-UP ACCESS TO DATA

While it may change in the future, AI innovation today depends on access to large datasets. Firstly, governments can play a role in opening-up their public datasets to small enterprises, which unlike larger businesses might not have the resources to accumulate a critical mass of data. The directive on the re-use of public sector information provides a common legal framework for a European market for government-held data and encourages member states to make as much information available for re-use.
Yet until now, its implementation has been fragmented. The European Commission launched a review of the directive in 2017 and has plans to update the legislation this coming year. There has also been discussion around larger businesses opening-up their non-personal data, either to smaller players in the supply chain or on open innovation platforms. The challenges range from the business case for doing so to concerns around IP protection and how to manage ownership and use contractually, which is easier to do in a closed B2B arrangement than on open innovation platforms.

COPYRIGHT AND IP
Data mining is considered key to machine learning and an area in which regulatory barriers remain in Europe. In the US, ‘fair use’ defences apply, allowing for commercial data mining within certain constraints and without infringing copyright.47 This has enabled innovation and allowed US companies using big data to thrive. While the European Commission has proposed a reform of copyright rules to introduce an exemption for ‘non-commercial use’ data mining, this would only apply in a limited context to research and cultural heritage institutions, potentially depriving start-ups, SMEs and businesses of the opportunity to develop AI applications.

Equally, the lack of clarity around the ownership of machine-generated IP may prevent organisations from investing in AI. There is a need to review existing laws to determine whether they can appropriately address this issue and whether more generally they support the development of AI.

CONCLUSION
In some areas, the current regulatory framework is still fit-for-purpose but requires action around education, awareness and support for implementation; for example in the areas of algorithmic transparency, data aggregation and opening-up public sector information. In areas such as liability, greater consideration needs to be given as to whether new rules are required – as has been the case in Germany – to enable the uptake of autonomous vehicles. Finally, in areas such as Copyright and IP, greater consideration needs to be given to whether existing rules need to be updated to enable increased AI innovation in Europe. What is clear is that a one-size-fits-all approach will not work, and a more agile governance approach will be required to keep pace with technological development; including looking at use of the technology rather than trying to regulate the technology itself.

AN AI-ENABLED WORKFORCE
Technology is already transforming the nature of work, and the skills required. As AI technologies reach maturity, a new wave of intelligent automation will accelerate the transformation of employment.48 Already today, the biggest challenge is how to support workers that are forced by the technology to find new careers. The second most immediate challenge, particularly for businesses, is access to the skills they require; given the mismatch between supply and demand. The third, will be ensuring our education system is working to developing an AI-enabled workforce of the future.

MANAGING DISRUPTION AND DISPLACEMENT
Many commentators are concerned that AI will accelerate automation and eliminate jobs, leading to greater societal inequality. Already in the short term, AI is expected to create 2.3 million jobs by 2020, whilst eliminating 1.8 million, making 2020 a pivotal year in AI-related employment dynamics49 – and 2020 is only around the corner.
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.50

Virtually every job includes tasks that can be taken over fully by machines and tasks where AI can augment human capabilities and activities. In manufacturing, physical robotics can take on machine operation tasks. In back-office administration, such as accountancy and book-keeping, Robotic Process Automation can perform operational procedures and Smart Advisors can take over basic customer interaction, reducing the need for humans to spend time on this.

The susceptibility to automation risk varies by country, region and sector. In most European countries, the share of jobs that involve a large number of tasks that could be automated is around 20%. This is likely to decrease well below 10% by 2035, as people acquire digital skills and their work shifts to tasks that are augmented by technology.51

The key challenge will be to manage the transition of the immediate ‘at-risk’ workforce into sustainable employment. This will require policy makers, business, educators and civil society to work together to manage the transition, create awareness of existing support and develop relevant reskilling programmes.

ACCESS TO SKILLS

A well-known challenge is the lack of skilled workers. Almost half of business leaders we recently surveyed identified it as a key challenge.52 The traditional source of skilled workers has been through the education system. Given the pace of technology and the evolving nature of work, education and training bodies cannot keep up with skills demand. Investment in primary and secondary education, while very much required to meet future skills needs, is not going to meet short- to medium-term demand: it is a longer-term project.

In addition, until recently businesses have invested in robots, big data analytics and other technologies to improve process efficiencies. Now, we are starting to see investment in AI systems that can sense, communicate, interpret and learn; which moves beyond pure automation and efficiency to machines working alongside humans to drive value and create new products and services. This trend is supported by the findings of our Tech Vision 2018 survey: 81% of executives believe that within the next two years, AI will work next to humans as a co-worker, collaborator and trusted advisor.53

The imperative is therefore on companies themselves to invest in training and reskilling programmes for existing and new employees to meet their skills needs. Yet only 3% of companies we surveyed plan to significantly increase investment in training and re-skilling programmes in the next three years.54

The challenge is how to change mindsets from efficiency to building human capabilities and investing in continuous learning to prepare for this new human and machine collaboration. Part of this will include creating an understanding of how AI can augment human capabilities and the types of roles that will be created by AI.
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 nature’s 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 optimizing routing tasks as automation controls braking and speed.

Source: **Accenture Future Workforce Ethnographic Study 2017**

HOW DO WE BUILD THE WORKFORCE OF THE FUTURE?

While the objective of this paper is to focus on the short- to medium-term challenges, it is important to look beyond reskilling programmes to the education system. While education is a medium- to long-term pipeline, it needs to be looked at on an ongoing basis. In recent years the focus has generally been on investing in STEM education and training programmes for young people. Yet for the new roles identified above, creativity, arts, critical problem-solving, interpersonal skills and an open mindset to continuous learning, will be just as important. This highlights the challenge of ensuring that the education system remains relevant and can anticipate and adapt to skills demands and encompass informal learning. This, in turn, emphasises the need for greater collaboration between educators and business.

CONCLUSION

All actors – government, business, educators and broader societal interests – have a role to play in addressing the challenges of displacement and the skills mismatch between supply and demand. They also have an important role to play in realising the opportunities of an AI-enabled workforce.
RECOMMENDATIONS TO ENABLE EUROPE’S AI POTENTIAL

Outlined below are a number of targeted recommendations for policy-makers, business and other stakeholders to help address the challenges identified above and to support the development of AI capabilities in Europe, a fit-for-purpose governance framework and an AI-enabled workforce.
EVERY COUNTRY SHOULD HAVE A FUNDED AI STRATEGY

To leverage the economic and societal potential and address the impact of AI, every government should have a holistic and funded AI strategy, with these core reinforcing components:

- A plan to develop an AI ecosystem(s), that facilitate public-private partnerships to drive investment in AI research; the development of multi-stakeholder partnerships across industry and research institutes; and centres of excellence around which the ecosystem can thrive.

- A supporting regulatory environment to build trust and facilitate the uptake of AI, including appropriately opening up access to data.

- Programmes for skills development, based on collaboration between industry, government and educational institutions.

The strategy should have short-, medium- and long-term targets and milestones, with regular review periods to keep pace with technological development. Insights can be derived from programmes in China, Japan, the UK, France and Finland.

COLLABORATE ACROSS EUROPE AND WITHIN THE EUROPEAN UNION

For Europe to be globally competitive, it should ensure greater collaboration within the EU and in partnership with non-EU members in Europe. Beyond the important prioritisation of investment in AI in the next Multi-Annual Framework, and through EU-level projects and Public Private Partnerships, the European Commission could further support AI investment and collaboration within the EU and in Europe, in three areas:

- Expand the Digitising European Industry initiative, to support the 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 across member states, enabling them to learn from each and share best practices.

- Integrate AI into the Digital Economy and Society Index to measure member state AI R&D capabilities, investment, the supporting regulatory environment, and progress against objectives, which should be included as part of the European Semester process.

- Examine how to remove regulatory barriers to the uptake of AI and support the development of a governance framework for Responsible AI to build trust and enable companies to scale across the Digital Single Market.
A FIT-FOR-PURPOSE GOVERNANCE FRAMEWORK

SUPPORT PUBLIC DEBATE TO DEVELOP TRUST

Trust cannot be established if the public is not engaged. Business and governments should develop forums for public debate and engagement around ethical issues in the use of AI. As an example, the Royal Society’s Action and Research Centre in the UK established the Forum for Ethical AI. It has three streams for citizen engagement: a citizens’ jury; outreach workshop with specific demographic groups whose voice is often missing in tech debates or those that are more exposed to the effects of AI; and a final deliberation to decide on principles for how society can reap the most benefits from AI. The European Group on Ethics in Science and New Technologies, can also play a role in supporting debate and the education and awareness of EU citizens.

SUPPORT THE DEVELOPMENT AND RECOGNITION OF CODES OF ETHICS, STANDARDS AND CERTIFICATION

Codes of ethics, standards and certification can help build trust that AI is developed and used in a responsible manner and enable companies to demonstrate compliance with GDPR and other regulations.

There are different existing approaches including the joint IEEE Computer Society (IEEE-CS) and the Association of Computing Machinery (ACM) code of ethics for software engineering. Software engineers commit to making the analysis, specification, design, development, testing and maintenance of software a beneficial and respected profession. Other approaches have been developed by the Partnership on AI and Silomar. Partnership on AI, for example, is looking at best practices in areas such as accountability, transparency and explainability. Others standards-based approaches are the IEEE’s Global Initiative for Ethical Consideration in AI and Autonomous Systems and the establishment of the ISO/IEC/JTC 1/SC 42 technical committee focusing on standardisation in AI. The European Group on Ethics in Science and New Technologies is also developing a code of ethics with the future AI Alliance.

All approaches that are recognised by regulators as meeting regulatory requirements should enable companies to practically implement the requirements and to provide clear explanations for the actions that AI systems take in a format the people understand.

Accenture is developing a framework, called LaunchPad, in collaboration with specialised groups such as the Alan Turing institute, to provide applied solutions for explainable AI. Launchpad is an innovation friendly, agile approach to ethical development. It helps organisations determine what is technically possible when it comes to explainable AI and what is most beneficial for the user in each application case. This involves:

- Understanding the public perception and potential impact of the AI application;
- Understanding how humans would be impacted by the application and potential steps to mitigate any negative impact;
- Examining whether there is an inherent bias in the data or the algorithm;
- Determining where explainability of AI-driven decisions is necessary or desirable and how that can best be achieved;
- Developing an appropriate governance framework to monitor the deployment of AI in the organisation.

PROVIDE CLEAR GUIDANCE WHEN IT COMES TO PUBLIC SAFETY AND SECURITY

There should be clear guidance on the balance of responsibilities between parties when it comes to the safety and security of AI applications and automated systems, and when things go wrong. Ultimately, when it comes to safety, a natural or legal person should have responsibility. Regulation may be required to
establish that balance, but standards can also play a role in ensuring automated systems and AI-enabled products and services meet safety and security requirements before they are deployed or placed on the market.

**DEVELOP GLOBAL INDUSTRY-DRIVEN STANDARDS**

Industry, standards bodies and governments should work together at a global level to create a common understanding of existing international safety and security standards, certifications and methodologies that support the safety and security of AI-enabled products and services. Where there are gaps, industry can play a key role together with standards bodies to develop workable standards and certification. An international approach to standards and certification, is preferable, to enable companies to scale the deployment of new AI-enabled products and services and provide access to global markets.

**FACILITATE APPROPRIATE ACCESS TO DATA TO DRIVE AI INNOVATION BY**

Removing regulatory obstacles to the analysis and testing of big data: European governments should consider how to balance copyright with the benefits that would arise from greater possibilities for commercial data mining, particularly for small enterprises.

Creating public-data platforms: EU member states should fully implement the re-use of public sector information directive and lead by example by developing public data-sharing platforms so that small businesses can freely access public sector and research datasets that can support the development of AI ecosystems.

Extending sandboxing to data-sharing: Governments and regulators can encourage companies to open-up data to their supply chain and with other players by extending the concept of ‘sandboxing’ to data-sharing. This would 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. An example of such proposed approach, is the recommendation to establish ‘Data Trusts’, under the UK AI Review.

**DEVELOP A PLAN TO MANAGE THE TRANSITION**

Governments (national, regional, local), businesses, unions, educators and other stakeholders should identify, through economic forecasting, groups that are most at risk of displacement, particularly where there are concentrations of economic activity likely to be exposed to automation. They should together develop strategies to support the development of viable alternative economic activity and relevant reskilling programmes, including better matching skills demand and supply.

There should be a specific focus on developing and supporting SMEs to create new employment opportunities. SMEs represent 99% of all businesses in the EU and have provided two-thirds of private sector employment in the EU in the past five years. This could include providing financial incentives for training programmes, including in the use of technology to develop their businesses; plugging them into public private partnerships and supply-chains, which will enable them to access bigger markets.

**BUSINESSES SHOULD DEVELOP THEIR AI-ENABLED WORKFORCE**

Beyond acting as a responsible company, we believe there is a business case for skilling and reskilling our workforce. First, based on our analysis, the top performing companies – approximately 20% of all the publicly listed companies globally – are investing in AI. Simultaneously, they are also investing in training and reskilling their workforce around human-machine collaboration. Secondly, there is little alternative to meet their short-term skills demands.

Companies will need to establish insight-driven training programmes, which map their required skills against the current skills of its workforce. The programmes should be continually updated as technology develops and is implemented across the company. Much of it will be enabled by technology.
At Accenture, we have retrained over 160,000 employees with new IT skills and more than 100,000 to be job ready in less than two years. This was based on a ‘New Skilling’ framework to guide ambition based on a progression of skills from awareness to expert and a range of digital learning channels, which decreased the cost of training hours by more than 25%, while increasing the number of training hours its people spent by 40%.66

We have also put 60% of the money we save from investments in AI into our training programmes. Over the past two years, we have retrained tens of thousands of people whose roles have 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.67

**SHIFT THE EDUCATIONAL FOCUS FROM STEM TO STEAM**

While education is a long-term investment, action needs to take place in the short-, medium- and long-term; in fact it needs to be ongoing. Government efforts need to shift from STEM to STEAM skills – science, technology, engineering, arts, and mathematics, which reflect the more multidisciplinary skills that AI demands.

In addition to existing initiatives, success will also depend on partnerships between start-ups, universities and individual experts to access knowledge and skills at scale.

**DEVELOP AN AGILE CURRICULUM TO DEVELOP THE WORKFORCE OF THE FUTURE**

Curricula will need to be adapted to develop the multidisciplinary skills mentioned above. This will also require a degree of flexibility in education systems, including working with businesses more closely to forecast skills needs and adapt accordingly. Vocational training and apprenticeship programmes will continue to play a key role in preparing students for future working environments and help them refine the skills they need.

**CONCLUSION**

As the rest of the world races ahead, it is important that governments, together with industry and other stakeholders collaborate to enable Europe’s economic and societal potential.

This includes strategic investment and a governance framework for ethical AI that protects people while leaving room for innovation and keeping pace with technology.

Finally, all stakeholders need to work together to manage the transition to sustainable employment through this technology-driven revolution and build an AI-enabled workforce.
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ENABLER: DEVELOPING AI CAPABILITIES IN EUROPE

Every country should have a funded AI strategy

Collaborate across Europe and within the European Union

ENABLER: A FIT-FOR-PURPOSE GOVERNANCE FRAMEWORK

Support public debate to develop trust
Support the development and recognition of codes of ethics, standards and certification
Provide clear guidance when it comes to public safety and security
Develop global industry-driven standards
Facilitate appropriate access to data to drive AI innovation

ENABLER: AN AI-ENABLED WORKFORCE

Develop a plan to manage the transition
Businesses should develop their AI-enabled workforce
Shift the educational focus from STEM to STEAM
Develop an agile curriculum to develop the workforce of the future

REALISING THE ECONOMIC AND SOCIETAL POTENTIAL OF RESPONSIBLE AI IN EUROPE
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