Artificial Intelligence, a digital, industrial and societal revolution

AI Strategy for Europe

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EDITORIAL

AI: A NEW DIGITAL APPROACH

For the first time in human history, Artificial Intelligence (AI) enables us to collect *and process* unfathomable amounts of information. More specifically, AI refers to systems that show intelligent behavior: by analyzing their environment they can perform various tasks with some degree of autonomy to achieve specific goals.[1] Never before have we had the power to harness the movement and evolution of data without constant human supervision. This leap in technological capacity has left the biggest nations clamoring for a first-class ticket onboard this new trend in analytics. This technology is expected to take full advantage of the data collected by our personal devices and industrial sensors—however the way in which this will happen is still to be decided. As Europe stands on the forefront of human wellbeing and industrial prowess, the advantages from AI should be carefully and seriously considered. Although the United States of America (USA) and China may have already invested significant amounts of time and money into better understanding and deploying AI throughout their society, the European Union (EU) is not late to the party. In fact, through this edition of The European Files, one will find that the EU has particular advantages to support the Research and Development (R&D) of sustainable, ethical and impactful AI applications. The European Union (EU) is set to develop this important component for the future of industry and human development for the benefit of all its citizens. Unlike the USA or China, the EU is working to create a comprehensive strategy backed by intelligent investment, political foresight and dynamic enterprise. Throughout this issue, the potential of AI in a variety of sectors such as climate change, transportation and healthcare will be illuminated. Experts in this burgeoning technology sector as well as their political counterparts come together to outline a future in AI that is uniquely European and ultimately progressive.

AI's strategic gains are to be felt across society encouraging a larger *digital* approach to the future of European life. Member states as well as the European Commission are accelerating their own digital strategies and directives focused on creating the best environment for AI benefits to ripple throughout the economy. This is reiterated by the considerable sums of investment being set aside for R&D—no minister or commissioner will be able to argue against the EU's rich capacity in GDP to finance AI innovation. To guide this channel of investment, the Commission looks to high ranking expert committees and conferences from a diverse industrial and social background to best draft guidelines for ethical innovation. These are the unique qualities the European community can rely on to rub elbows with Silicon Valley's giants. Member states are working to encourage start-ups to challenge the international arena and coordination across borders is expected to usher in a new wave of AI champions. Some of these entrepreneurial cases rely on the proper infrastructure to promote the accessibility to and fair flow of data. A particularly exciting use-case can be found in healthcare diagnostics applications that improve the chances of correctly identifying and treating a patient's disease.

This issue of The European Files demonstrates just how the EU expect to support Europe's scientific turnout and industrial capacity. With all technological advances, it will be important to prepare the citizens of Europe with the best skills and understanding in a changing socio-economic landscape. This issue also delves deep into the latest and ongoing debate amongst policymakers and experts on the legality and standards required of robots and AI in an ethical framework. Amidst all these discussion, Europe looks set on accelerating its transformation into a digital society—one that rivals any other global player.

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1 *Courtesy of the European Commission, DirectorateGeneral for Communications Networks, Content and Technology.*
https://ec.europa.eu/digital-single-market/en/artificial-intelligence

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Realizing the potential of artificial intelligence via an EU-wide AI plan

Margarete SCHRAMBÖCK

Federal Ministry for Digital and Economic Affairs, Austria

Artificial Intelligence (AI) is a highly relevant topic that is very important for the future of the EU. The potential of this technology is virtually unlimited, allowing a broad range of applications. In addition, AI is closely connected to other essential strategic topics such as education, work, health and digitalisation.

To remain competitive in this area, administrations must establish and maintain close contacts with academia and industry, and close cooperation between member states shall facilitate the exchange of knowledge about AI throughout Europe. On a European Level, the High Level Group on Artificial Intelligence, the AI Alliance, and the High Level Member State Group are important means to foster AI and to establish common priorities for a coordinated AI plan. Just recently has the European Council in its Conclusion invited the Commission to work with Member States on a coordinated plan on Artificial Intelligence, building on its recent communication.

For these reasons, AI is also an important focus of the Austrian Ministry for Digital and Economic Affairs during Austria's EU presidency. In addition, the Ministry for Transport, Innovation and Technology has installed a council "Robotics and AI". This fall, the group will issue a whitebook on these topics.

In particular, 3 areas appear to be especially important in the immediate future:

> **Healthcare**: AI solutions are making healthcare more efficient, improving quality of care, and providing advances in the way humans diagnose and treat health conditions, for example image based diagnostics, data-based diagnosis support (predictive diagnoses), detection of pandemics, etc.,

> **Automotive industry**: Europe's automotive industry could benefit from the development of assistant driving systems like driverless cars and driver-assist features.

> **Manufacturing**: AI solutions can help Europe's robotics industries to increase their world leading position by the optimization of supply chain, production and logistics; enhance demand-driven manufacturing (smart production)

We consider human values and principles a fundamental basis for the development of AI systems. Europe should take the lead in developing ethical codes and frameworks for AI, and exploit its potential for the good of society as a whole.

We believe that merging sensor technologies, Big Data and intelligent evaluation procedures will result in new insights and open up new business areas. However, we stress that the application and dissemination of new technologies always requires the consideration of societal impacts.

From a digitalisation and skills perspective, it is noteworthy that there are specialized programming languages that facilitate the development of AI applications. I am convinced that such languages must be more widely used to create more competitive IT applications within the administration and also in companies. I will foster the relevant skills in this area by educational measures, dedicated funding programs and pilot projects to enable innovation by realizing the full potential of AI.

Let us also look beyond Austria's EU presidency. What can we expect from the more distant future, and what should we focus on? I classify upcoming AI-related activities into 3 broad areas (which depend on each other and may overlap):

1. Knowledge acquisition

In this phase, we *acquire knowledge* about AI technologies. We shall learn and teach programming languages that are especially well-suited for the development of AI applications.

We also contribute towards the *standardization* of such languages by participating in ISO working groups and other technical committees. We establish and maintain contacts between administration, academia, enterprises, and between EU member states to foster the exchange of knowledge and best practices.

In this phase, we are also evaluating and piloting the first AI applications within the government. This shall benefit citizens, companies and also the administration by improving quality of service and reducing costs. We accelerate AI-related developments in enterprises by providing the necessary funding and supporting the transfer of knowledge and skills by educational initiatives.

2. Knowledge representation

We create and foster the **European Data Economy** to gather relevant data of high quality, subject to all pertaining data protection and privacy regulations. Available data shall be shared as far as admissible, using Open Data principles.

In this phase, we start the *formalization of legislation.* This means that all laws and regulations shall be represented in a *machine-readable* way. Hence, existing regulations will become amenable to automated processing and reasoning. For example, it shall become possible to automatically answer legal questions in so far as they are logical consequences of existing laws and regulations.

3. Automated reasoning

In this phase, we reap the benefits of the preceding knowledge representation work: Using automated reasoning tools, we are now able to detect *redundancies* in regulations and information obligations. We are able to automatically simplify and optimise regulations.

In addition, we benefit from self-driving cars, robotic healthcare and geriatric facilities, automated medical diagnoses and operations. In education, intelligent tutoring systems (ITS) shall play a major role to free teaching personnel from all activities that can be automated.

New laws shall be automatically drafted by taking all existing data into account, and optimising for desirable parameters such as health, wealth and quality of life for all European citizens.

AI Strategy for Europe

Mariya GABRIEL

Commissioner for Digital Economy and Society, European Commission

Artificial intelligence (AI) has emerged as a key driver of a new era of technological change and is now recognised as one of the most strategic technologies of the 21st century. It has great potential benefits in most areas of our lives, from healthcare to climate change, from transport to assisted living.

All big economies such USA and China have been investing heavily in AI. The way Europe approaches AI will shape our digital future. In order to enable European companies and citizens to reap the benefits of AI, we need a solid European framework. For the EU, the goal is to be at the forefront of AI development and use.

The European Commission presented the new EU strategy on AI on 25 April 2018. One of the main elements of the strategy is an ambitious proposal to achieve a major boost in investment in AI-related research and innovation and in facilitating and accelerating the adoption of AI across the economy.

The target is to reach a total of EUR 20 billion in AI-related investment, including both the public and the private sector, for the three years up to 2020. For the following decade, the goal is to reach the same amount as an annual average. This is of crucial importance if we want to ensure that Europe can take its place among the global leaders of AI development.

The other two main focus areas of the EU strategy on AI are about preparing for socio-economic changes and ensuring an appropriate ethical and legal framework. It is essential to increase the number of people with advanced skills in new digital technologies. More broadly, it is important to give all citizens and workers every opportunity to acquire suitable skills for the digital economy. The European approach consists in nurturing talent and diversity while leaving no one behind.

At the same time, Europe has to ensure that new technologies are based on our values and on respect for our fundamental rights, with humans in command at every step of the way. As in the case of data protection, we are taking the lead in ensuring the development of ethical and responsible AI, and we hope that our guidelines and standards in this area will become a worldwide reference. The Commission has appointed 52 world-class experts to a new High-Level Expert Group on Artificial Intelligence and launched a broader European AI Alliance that will bring together all relevant stakeholders. They will address all aspects of AI and will draw up ethics guidelines for the development and use of AI.

The members of the new High-Level Expert Group on Artificial Intelligence come from academia, business, and civil society. It is a multi-disciplinary group that represents wide expertise, brings together diverse views, and ensures geographical and gender balance. The task of the Group is to draft ethics guidelines for AI and to make mid- and long-term policy recommendations on AI-related challenges and opportunities.

The High-Level Expert Group on Artificial Intelligence will also support the Commission in building a broad community of stakeholders through the European AI Alliance. The Alliance and its online platform have had a very successful start, attracting from the very beginning a large number of registrations from all over Europe and beyond. It is already shaping into the intended diverse community of citizens and organisations that are interested in and wish to contribute to how AI will influence our future. Anyone who is interested in participating in the debate can join the Alliance.

Under the next multiannual budget of the EU, the Commission plans to increase its investment in AI further, mainly through two programmes: the research and innovation framework programme (Horizon Europe), and a new programme called Digital Europe. Horizon Europe is the EU's flagship programme to support research and innovation. Out of a total of nearly EUR 100 billion for 2021-2027, the Commission proposes to invest at least EUR 16 billion in 'Digital and Industry', which also includes AI as a key activity.

Under the Digital Europe programme, EUR 2.5 billion of the total amount of EUR 9.2 billion should be for AI. The funding will target in particular testing and experimentation facilities and data platforms. Digital Europe also provides for investing EUR 700 million in supporting the development of advanced digital skills, including in relation to machine learning, and EUR 1.3 billion in supporting deployment projects, including for SMEs to engage in digital transformation, notably in areas like AI.

By acting in a coordinated and focused way as a whole, Europe can use its existing assets to play a role in the area of AI that matches its economic weight and its global reputation as a great defender of values and rights. The Commission will make all the necessary efforts to ensure that the EU stays at the forefront of the new technological revolution and has a decisive impact on the future shape of our digital world.

A moment to gain momentum – boosting European competitiveness with a joint strategy on Artificial Intelligence

Peter ALTMAIER

Federal Minister for Economic Affairs and Energy, Germany

The term 'artificial intelligence' (AI) was coined in the 1950s, and since then the underlying notion has been capturing the imaginations of people all over the world. Time and again, the prospect of creating AI spurred on previous generations of researchers, developers and artists, leading them to surpass themselves – and yet, what they were aiming for used to remain the stuff of science fiction.

Now this has changed, with machine learning having advanced to a stage where AI is becoming reality and with use cases emerging in virtually all sectors of the economy. In today's state-of-the-art factories, machines supervise themselves and ask for maintenance just when it is needed. In logistics, self-driving transport vehicles self-coordinate their tasks. Service robots assist humans at the assembly line. In the healthcare sector, self-learning software helps organise busy accident and emergency units and supports doctors as they make their diagnoses.

Artificial intelligence means a boost to productivity and growth – and it's an impressive boost: a recent study commissioned by the German Federal Ministry for Economic Affairs and Energy found that, over the next five years, AI will add €32 billion to the output of the German manufacturing sector alone. This figure corresponds to a third of the growth expected to be realised by the sector over that period. The study confirms what others have also shown: AI is opening up major opportunities for the economy.

At the same time, it is, of course, clear that it is not for government to decree technological progress or innovation. The car, the aeroplane, the computer, the world wide web and the mobile phone are all examples of inventions that millions of people across the world have embraced, because these inventions have changed their lives for the better. AI also has the potential to do that. It allows computers and machines to learn from their own experience and that of millions of other devices and to thereby constantly self-optimise. AI is an underlying innovation that will soon have found its way into all aspects of our economies and lives, forming the basis for assisted systems, autonomous transport systems and personalised healthcare services. Artificial intelligence is the number-one development, the most important key-enabling technology of our time.

It is therefore hardly surprising that there is a global race for talent, ideas and venture capital, nor that investments in AI technology are exploding. Now that AI is being used in practical applications, the race in research has become a race between economies. Global claims are being defined and redefined. Countries that have so far lost out in the globalised age now have a chance to benefit – and vice versa. We are very clear about the fact that we want to come out on the winning side in this race. Developing applications for artificial intelligence – whether it's self-driving vehicles, tools for diagnosing cancer, or the next generation of factories – is a key task for both Germany and Europe.

Europe has all it takes to be able to harness AI. We have leading research labs, young talent and we are good at innovating. The digital economy requires us to work even closer together than we used to. The more we stand together, the more competitive we will be. European companies need the capacity to make large investments, hire the best researchers from all across the world, buy up promising startups and help them thrive, and to ultimately be the first to release innovative applications for daily use to the market and set new trends. All this requires more insights and knowledge, i.e. research. But even more importantly, it requires the ability to transfer insights and knowledge, to use AI in practice and to access data. We must not leave these fields to our international competitors.

In my own capacity as Federal Minister for Economic Affairs and Energy I therefore expressly welcome the European Commission's initiative for greater European activities on artificial intelligence. Now that AI is high up on the political agenda, this is the perfect time to seize the moment. We must now make sure that Europe will remain competitive and at the forefront of international technological developments.

The German Federal Government has also recently adopted a key-points paper setting out a strategy on artificial intelligence. This first-ever strategy on AI in Germany will be presented at the Digital Summit hosted by the Federal Government in December. It is our firm intention to drive research, development and not least the uptake of AI in Germany and in Europe and to thereby pave the way for future economic growth in Germany and the EU. We want our strategy to fit in well with the European strategy. We will work closely with our European neighbours as we both develop and then implement it.

Whoever is the driver behind a development will also be able to control it. We must seize this opportunity for artificial intelligence "Made in Europe" and we must make sure to design it European-style. We in the EU should work together to ensure that AI is developed to comply with ethical standards. AI will only be justified and accepted if it serves humankind and human dignity. Who if not we in Europe should develop shared principles ensuring this? We must make sure that protective standards cannot be undermined by automation, that assisted systems must be designed to give humans better working conditions rather than replacing human labour, that data cannot be used in a way that violates people's privacy. It short, we must ensure that technology serves mankind and nature.

At the current moment, many people are afraid of artificial intelligence and fear that it will cost them their jobs. The strategy we are working on is designed to prevent this from happening. In history, technological progress has always meant change to existing professions and the emergence of new ones – often better paid. What is important for us is that these jobs must not be created just anywhere, but here. This is why our German AI strategy will come with a National Strategy for Continuing Training. We very much welcome the fact that the EU has also picked up on this point and made it part of its own strategy.

If, together, we succeed in alleviating concerns and consistently implementing our AI strategies we stand an excellent chance to see that AI can do more than just capture our imagination: it will also change our citizens' lives for the better and add to their prosperity.

AI technology systems, robotics and autonomous vehicles

Elżbieta BIEŃKOWSKA

Commissioner for Internal Market, Industry and SME's

Artificial Intelligence (AI) may change our economy as profoundly as the steam power or electricity did in the past. Many of us remember the world before another breakthrough invention - the Internet. We are living proof that we are able to adapt and profit from technological revolutions. Today AI is a reality. We are seeing it in products and services. Our role is to make sure that European citizens and businesses benefit from this emerging technology.

We have seen "smart machines" in science-fiction literature and movies. These robots were not always the heroes. But real-world AI systems have little in common with those sci-fi villains. AI offers innovative solutions for the benefit of all Europeans while opening new horizons for European industry. We should be at the forefront of these technological developments and ensure they are taken up by the economy.

Let's take autonomous cars as an example. AI is one of the key technologies used in autonomous cars. It is what makes cars understand their environment, for example by using shape recognition, and anticipate situations. To ensure that this technology is developed in the EU, we adopted the AI strategy that will support the development and industrial deployment of AI solutions in Europe.

But autonomous vehicles require other technologies that still need to be developed. We need new sensors, high definition maps, precise positioning through Galileo and connectivity solutions. So we put forward a dedicated strategy on automated mobility to support the development of these technologies and the relevant legal framework.

Ensuring that automated cars are safe will be essential for their acceptance. While in 2020s we expect quite widespread automated driving on motorways (e.g. truck convoying) and at low speed in cites (e.g. garbage trucks or valet parking), in 2030s the sector will be moving towards fully autonomous mobility. In public transport, a quarter of trips in cities could be serviced by automated vehicles. That's why we proposed to reinforce the requirements on cars to address safety and liability concerns brought by autonomous driving in the future – for example, there will be an obligation of having a black box fitted on automated vehicles to clarify liability in case of accidents.

The EU is one of the biggest car producers in the world, so we ought to lead in setting global standards for safe autonomous mobility. The existing framework is fit for purpose to meet the liability and safety requirements for autonomous cars developed by 2020. The strategy on automated mobility outlines the changes necessary for autonomous cars expected on the roads by 2030.

We are well aware that safety and data protection are the biggest public concerns when it comes to AI in general. We have to underline that our legal framework in these areas is already well developed. There is no legal vacuum as regards security or liability in the context of AI and robotics. However, we cannot predict, as with any new technology, how AI will develop in the future. That is why we must keep up with AI, autonomous cars and robotics' development in the future.

The existing rules on product liability make producers liable for their defective products regardless of whether there has been any negligence on their part or not. The Commission reviewed the rules and has not identified any specific problems related to new technologies at their current stage. However, there may be open questions in the future. For this reason, we set up an expert group to help us work out a new guidance on product liability and to look at the broader liability implications of new technologies (including AI). Again, this is why we proposed to fit black boxes on autonomous cars to clarify liability in case of accidents.

We already evaluated the Machinery Directive, which is the key regulatory safety framework for robots. Our findings show that the idea behind the Directive, providing essential requirements and leaving technical details to standards, is adapted to new innovations in a digital era. Building on this evaluation, the Commission will examine whether legislative changes are needed, namely to address certain aspects of the coexistence between people and AI robots, not explicitly addressed by now.

Although AI and autonomous cars are morally neutral in itself, it may raise - as any other profoundly transformative technology - new ethical and legal questions. To confront these challenges, we will present ethical guidelines on AI development by the end of 2018, which will be strictly based on EU's Charter of Fundamental Rights and taking into account principles such as data protection and transparency. A forum to discuss ethical issues for automated mobility will be established in the coming months.

We also explore the most critical industrial applications of AI, where we can create the highest added value for the EU, and keep European businesses ahead of the curve, e.g. in areas such as healthcare, pharmaceutical, chemicals, space and transport. And we support large cross-regional investment projects on AI and Human Machine Interface.

We also do not forget that creation of many new jobs in the AI sector will be linked to disappearance of other jobs. And therefore we are encouraging EU countries to prepare for this transformation, adapt their education systems and support labour market transitions. Additionally, the EU's next long-term budget (2021-2027) will strengthen EU's support for training in advanced digital skills, including AI-expertise.

AI and automated cars are here today and they are not going away. Nobody knows for sure how they will develop. But we need to prepare and be flexible. I am confident that our preparations will keep Europe at the forefront of exploiting this technology safely and to the advantage of all our citizens.

Create an Artificial Intelligence eco-system for a digital transformation to ensure a better cooperation

Boris KOPRIVNIKAR

Slovenian Deputy Prime Minister and Minister of Public Administration

The globalised digital society is increasingly based on the capacity to use large quantities of data (big data) for new products and services, for changing the existing and making new business models, for increasing efficiency and achieving economic benefits, based on sustainable growth. Exceptional growth of scale, variability and diversity of big data offer development opportunities and challenges, which require awareness of their economic and social value. The use of this digital potential can improve the competitiveness of the ICT and other industries, the quality of public services and - most beneficial for every Government – it can improve the productivity and quality of life of citizens.

Private investors and Member states are investing a lot of funds into the digital infrastructure. We believe that the "information highway" is mostly built in the EU, also thanks to private investors – operators. But we must continue to take care of the connectivity, especially to support 5G action plan and the signed 5G declaration, which will lead us towards the so-called *Gigabit society* until 2025. It is smart to be connected. All the technologies which are available now – 4G, 5G, HPC, Blockchain, Internet of things, Artificial intelligence (AI) - must be interlinked and none of them shall be treated separately, as all of them rely on unstructured (big) data. Since we are lost in this unstructured data most of the time, we have to focus on opening the data and having the possibility to collect, analyse and process them. But

the key to all this is to understand principles, hidden in them. Namely, if you understand the data and its principles and concepts, then you can get to useful predictions, based on AI technology. In other words, with better use of resources faster development is possible, bringing business opportunities for existing and new businesses. By opening public data to all interested parties, public administrations can contribute to the development of new, innovative services to improve public administration and to be in service to businesses and citizens.

Slovenia's legislation, for example, determines that all the data must be open by default, except for sensitive data related to personal, commercial or state privacy and security interests. We must never come into situation where we lock the data, but rather to look at data and monitor whether it is used only to agreed purposes. The role of technology related to big data will grow even more with the development of the future internet or the *internet of things*, faster communications and new information technologies. The release of big data's digital potential for economic growth and social advantages requires the adoption of measures that will prepare society and economy for new challenges and enable them to seize opportunities. AI is becoming increasingly central to modern life. We will all need to have opportunities to learn about them and experiment with them. It is crucial to follow the concept of citizens gaining trust in the new technologies, but the governments should make sure that the changes are made gradually and the risks are limited. Therefore, we must trigger and encourage debates aiming to prepare citizens for changes. Constant dialogue with key stakeholders, including researchers, providers and users of this technology are of high importance. Only cooperation, especially within digital coalitions, and wider discussions can demystify fears. In the digital society, big data are the fuel of the ICT sector and new oil for digital economy, which can only be used with appropriate new skills, skills to develop and skills to use. Having that in mind, the governments of all EU Countries and the European Commission as well have to raise the awareness of citizens, especially in labor market, stressing that:

› AI is the evolution (and part of the Fourth Industrial Revolution), and is going to transform many jobs and create new ones as well as drive economic growth; but on the other hand, people will be able to

spend more time on creative, collaborative, and complex problem-solving tasks that machine automation isn't well suited to handle.

› AI, as a new technology and especially a digital tool, provides faster, real-time and almost "zero error" decision-making which improves our life, resulting in a change of the job structure rather than being just disruptive technology.

› Benefits and risks cannot be ignored and must be transparently exposed and effectively addressed.

The Slovenian experience in AI started in 1972 at the Computer Science Department of the Jozef Stefan Institute (JSI) in Ljubljana, and later also at the Faculty of Computer and Information Science, University of Ljubljana. Today, the JSI plays the largest role in AI in Slovenia and there are additionally about 30 institutes and laboratories involved in AI research and development. Having around 300 AI and Robotics researchers (approx. 1 researcher/7.000 inhabitants) brings us to the group of well-advanced AI countries. However, we cannot imagine development in the field of modern technologies like AI without an adequate basis in the data. Therefore, in December 2016 we have set up *OPSI portal* that enables the free publication of databases and access to them in the form of „open data", in machine-readable form and under an open license, which allows the creation of new applications and visualizations. According to the latest ranking, Slovenia is treated as a trend-setter in the field of open data.

Artificial Intelligence is neither negative nor positive and like every technology in the world it depends on how we implement it. Key message is to let the innovation processes continue, while regulation must stay in its shadow, ensuring that the gap between them is not to wide. Having that in mind, all the further activities must rely on co-operation and co-creation, so AI is best used when teamed up with people.

According to the McKinsey analyses, China and USA with 15 - 23 billion US\$ dominate in investments in AI, followed by Asia with 8 - 12 billion US\$ and Europe with 3 – 4 billion US\$. It is hard to financially compete with these other economies and that is why we need to synchronize activities among all EU Member states and start sharing best practices, knowledge and activities between us.

The Finnish initiative on AI startups

Mika LINTILÄ
Minister of Economic Affairs, Finland

When discussing ways of ensuring European competitiveness in the age of artificial intelligence, we often talk about encouraging and incentivizing existing European companies to start utilizing artificial intelligence. This is very important challenge to tackle for Europe to remain competitive and an issue that has spurred a variety of activities in Finland as well. AI can be a significant competitive advantage for companies that adopt it early, take AI to the core of their business and commit to it. While AI can deliver great results in terms of e.g. increasing effectiveness and optimizing existing processes, we need to go beyond these types of applying AI and keep in mind the possibilities that lie in AI-powered new business models that might disrupt whole industries.

In many sectors, small businesses can challenge large traditional companies using new types of artificial intelligence solutions. These solutions not only improve the quality of services and reduce costs but also create completely new industries and services. We often talk about born digitals when referring to companies that have been digital in nature right from the beginning and thus have no need for a separate digitalization strategy. How about companies that are born in the AI era? While ensuring adoption of AI in existing European companies across sectors, we need to make sure that native AI companies have the best possible environment to grow. Functioning AI ecosystem is fertile ground for such AI success stories to get started.

Finland has been home to groundbreaking artificial intelligence research for decades, Academician of Science Teuvo Kohonen's pioneering work in neural networks is well known around the world. Currently, world-class research is carried out in numerous fields, for example teaching algorithms with small data sets, such as patient data of only one patient.[1] Finnish Center for Artificial Intelligence was established to bring together the leading research and make it available to companies, and the public sector. Besides research, Finland has good founding in terms of high level of digitalization, considerable data resources of the public sector and quality educational system.

Perhaps better known to the wider audiences than pioneering AI research are the technical product innovations that Finland has brought to the world, such as Angry Birds, and the companies behind them. We are proud of the startup scene in Finland. With over 500 startups in Helsinki alone, Finland's capital region is home to Slush, one of the largest tech festivals globally that gathers some 2,600 startups and 2,000 investors every fall to Helsinki from all over the world. A few years ago, an old hospital complex in Helsinki was transformed into the biggest startup hub in Nordics, named Maria 01. Some 500 kilometers north, Oulu-based Polar Bear Pitching competition allows founders to pitch investors for unlimited time – as long as they do it standing in freezing water in a hole cut to a frozen lake.

In addition to innovative activities that boost the ecosystem, Finland's startup game is strong also on the numbers side. When looking at venture capital investments in startups and early stage growth companies as percentage of GDP between the years 2013 and 2017, Finland takes first place in Europe. Venture capital financing received by Finnish companies is twice the European average.[2] In 2017 Finnish startups and early stage growth companies attracted EUR 208 million in foreign financing, a number that has increased tenfold since 2010.[3]

New competitive innovations from AI and platform economy are vital for the Finnish national economy. Business Finland's AI Business Program offers funding, networking and export services for research, development and utilizing artificial intelligence in business – for either a companies's own development projects, or joint ecosystem projects with other companies. [4] A recent tool of speeding up investment is creation of State Business Development Company VAKE that has been geared up to invest with focus on artificial intelligence and platform economy. Its funds come from transfer of state owned shares.

How can government help startup ecosystem to flourish? Besides funding, governments need to ensure that startups have the expertise and skills needed available to them. Government can invest in education and training. For the long-term strategy and early stages of learning path one example is addition of algorithmic thinking into the national core curriculum for all primary schools in Finland, starting at age six. New, modular ways of gaining new skills are needed for keeping those who are already in working world up to date with digital advances. University of Helsinki opened first year computer science studies recently to all those interested without application process or fees. This was possible through a government-funded pilot of flexible shorter trainings especially targeted to boost technical skills.

In addition to growing and training skilled workforce for startups, recently introduced Startup Permit allows for international entrepreneurs to build startups in Finland and join the startup ecosystem. This recidence permit is targeted towards innovative and growth-minded founders whose business idea shows potential for rapid international growth and who come from outside European Union.[5] It is naturally not the residence permit that attracts founders but business opportunities. It is still a good way of signaling the strong support for startup community.

Government's only role is not to support startups and invest in them. To remain agile and relevant in the age of artificial intelligence, there is a lot we can learn from startups. Creating a culture of experimentation is one of the key projects of Finland's current government and it has been greatly inspired by startups.

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Financing AI in Europe

Ambroise FAYOLLE

Vice President of the European Investment Bank

Artificial intelligence (AI) is at the cutting edge of innovation and stands out as a transformational technology of our digital age. AI is generating a lot of interest But the reality is that the field has finally begun to deliver on the promises it first made back in the 1950s. Machine Learning systems – as one of the most crucial areas of AI – have shown superhuman performance in areas ranging from recognising object in pictures, diagnosing diseases, detecting fraud, making customised recommendations to shoppers, and playing chess (with outstanding success).

AI's practical application throughout the economy is growing apace and the new generation of applications is based on a digital foundation. Early adopters are already gaining competitive advantages, and the gap with the laggards is set to grow. Perhaps most important of all, the world is now generating vast quantities of the fuel that powers AI : **data**.

Globally, there has been a huge increase in data available. The digitalisation of information, the expansion of the Internet and mobile networks and the progressive deployment of the Internet of Things (IoT) have created a massive amount of data. In addition, **data storage** costs have decreased dramatically and the use of cloud environments and big data technologies have

facilitated the access to this data. The availability of **computer power** has increased the speed and accuracy of AI technologies. Distributed computing has become popular and is available for researchers at limited cost. Moreover, there have been improvements in the **hardware** associated with AI, using new parallel architectures that are increasing the speed five to six fold every year.

AI is intrinsically linked to digitalisation, as it is embedded in numerous technology applications. For example, the fundamental aspect of machine learning is that it learns from itself, from exploring and discovering pattern and logic in the data. Thus, obviously, data is key – and the more data the better – implying that scale is key.

The question then becomes, *how to reach scale?* By having a large and well-developed digital economy, where data constantly can flow freely and in massive quantities. Both the US and China can benefit from highly developed digital industries, which a more digitally fragmented Europe cannot. The large tech giants all have the necessary ingredients to succeed in an AI driven future: access to data, the financial means to invest in state-of-the-art technology and buy necessary data, they also have sophisticated search engines and they have control over the IT

infrastructure – and thereby also the **ability to attract skilled human resources.**

However, luckily, there are **tremendous AI application opportunities in more traditional industries** – in industries where Europe in fact is leading, such as the automotive sector, energy or industrial automation. However, these sectors are underrepresented in AI in Europe. Since they are large and EU companies are at the frontier, we could expect technological development within AI to also be at the frontier. Problem is – key sectors in Europe have not yet embraced AI – meaning that many of **the true engines of the European economy have not yet embraced AI technologies.**

Why not? And how to change that? Here comes the **financing aspect into the picture.** External AI investment is growing fast – estimated to have been growing by three-fold over three years – as well as internal investment, dominated by cash-rich digital native companies, which are highly concentrated in a few technology hubs in the US and China. **Low investment in AI is a challenge for Europe**: the US invests about 5-6 times more, and Asia triple the amount of the EU – giving rise to a substantial investment gap. This gap, given the overall digital dominance of these two regions, is set to grow – if no actions

The US and China dominate the AI landscape, with Europe falling behind
Investments in AI, 2016 (USD billion)

US
USD 15-23 bn
60% of AI investment

Europe
USD 3-4 bn
10% of AI investment

Asia
USD 8-12 bn
30% of AI investment

Source: figure based on McKinsey Global institute (2017), Artificial Intelligence: The next digital frontier
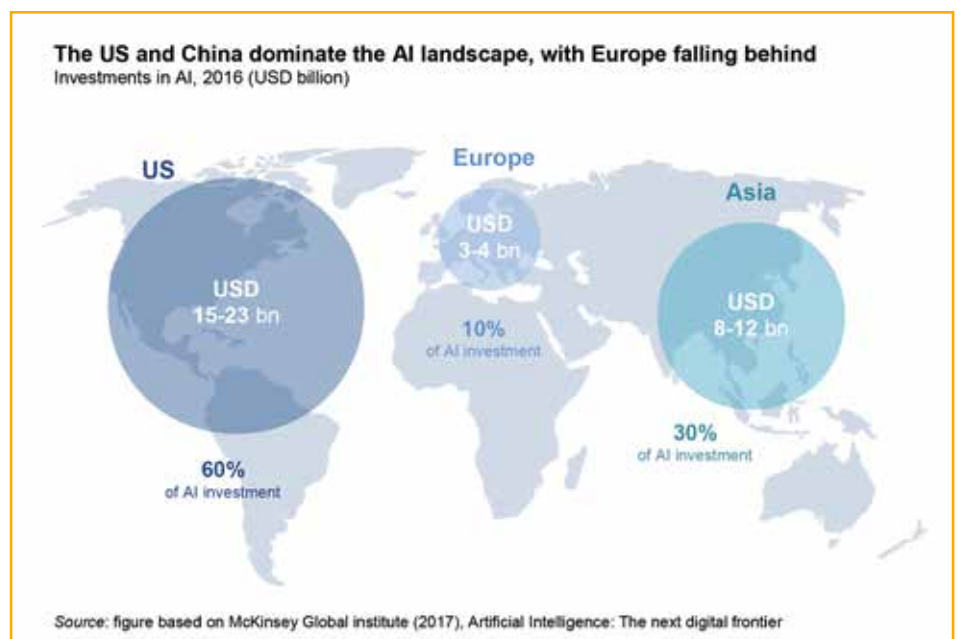
urgently are being undertaken. Besides, with Brexit looming, the lagging performance of the EU will only be reinforced as up to a third of all European AI activities are estimated to be taken place in London.

In line with other new emerging technologies and RDI in general – but RDI at the frontier/cutting-edge research in particular – investment in AI is associated with **high risk.** AI involves both a commercial risk: as the markets may not be mature enough and concrete applications may not be viable; and a technological risk since it involves high uncertainty whether the R&D will lead to a successful outcome (high risk of failure). Who are willing to take on higher risk? Equity investors, rather than banks. This points to a problem for Europe's bank based financial system. Another problem, even if equity investor would be willing to take the risk, they typically have a short-term investment-return horizon – which may not be aligned with the long-term development cycle of AI RDI activities.

This calls for a **longer-term view on return on AI investments**, in particular so-called patient capital. As the EU bank, the EIB provides long-term finance for sound, sustainable investment projects in support of EU policy goals in Europe and beyond. At the EIB, we support companies throughout their business life cycle. What we believe is a particularly crucial phase in the case of AI is the **scale-up phase**. We stand committed to support the growth of promising companies, as well as experimental research. We understand that we have to create a truly European innovation ecosystem where EU-based start-ups can grow and reach a sufficient scale in their home continent. We support the creation of an "AI ecosystem", with clusters of entrepreneurs, financiers, and AI users.

AI technologies are seen by the Bank as an important and growing part of the on-going digitalisation of the economy. Early adoption of AI capabilities will not only increase the operational efficiency of businesses, but also facilitate identification of new opportunities, new products, new customers and new channels, creating competitive advantages across many different industries. **On the demand side,** the use of AI has the potential to becoming a key factor for the competitiveness of European companies in the world market. Companies in various sectors, such as finance, retail or manufacturing, could benefit from EIB loans in order to accomplish the required investments to digitalise their businesses and subsequently embed AI components in the decision making processes. **On the supply side,** the EIB could play a role by supporting traditional software companies in the development of new AI related capabilities as well as being a fundamental source of long-term financing for SMEs that are developing AI technologies, ensuring the successful transition from R&D to commercialisation. AI technology is cutting-edge, hence proof of concepts and cost benefit analyses are not easily built, which limits access to finance from traditional financial institutions and provides an excellent opportunity to take advantage of EIB objectives to address such market failures.

The Bank stands ready to help financing the success of Europe's technology-driven future – and support investments in development and deployment of AI, crucial for EU's competitiveness. We combine proven financial expertise with the capacity to take on additional risk in order to explore new fields of innovation and help companies in the critical growth-stage. And we are in it for the long haul. EIB financing will reach the front lines of technological development, so that those sitting in the driving seat will keep on moving forwards, and those in the back seat keep on following. Now is about time to accelerate the EU innovation machine.
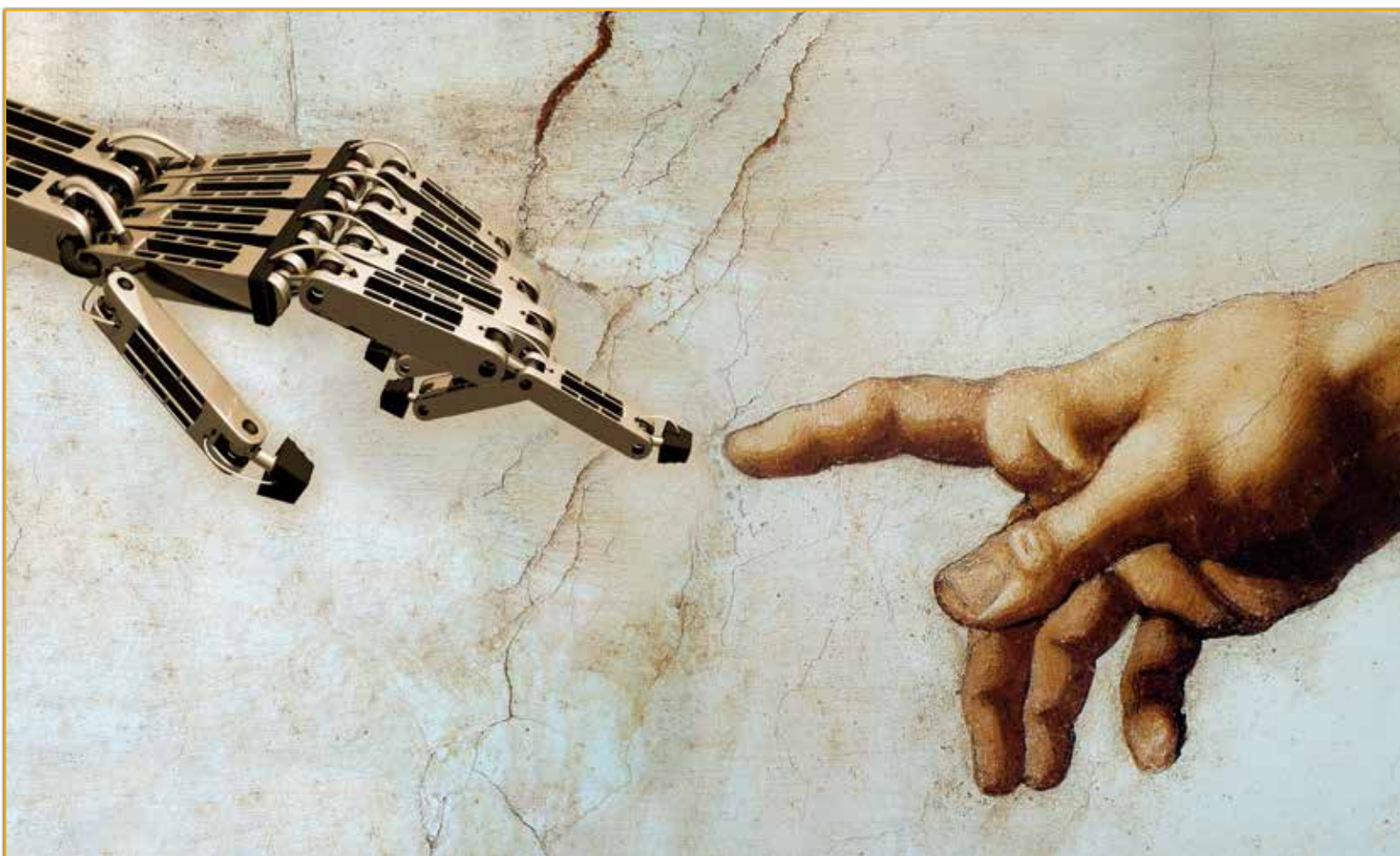
Artificial intelligence has to be the way forward for Europe

Siim SIKKUT
CIO, Government Office of Estonia

When we were preparing the Estonian national digital agenda 2020 way back in 2013, I remember us explicitly having a debate during the discussion of future trends – will long-talked artificial intelligence (AI) emerge during our strategy timeline? Should we plan for it? Experts thought that it may still not be the case before 2020. So, we left preparations of AI on the side then.

It is now 2018 and AI is here around us: in back-end of the online services and devices we use. We are still quite a bit away from superintelligence and general AI, but there are more and more useful specific or narrow AI applications emerging every day. Thus, we have to catch up fast in Estonia to compensate for lack of foresight before.

We have indeed made AI now one of priorities for the next years in our national digital agenda as we updated it in mid-term review. Under leadership of Estonian Government Office, a special group of key government agencies and area experts has been assembled to formulate the national "plan" for uptake of AI, in both public and private sectors. In Estonia, we always aim to be quick and thorough in uptake of new (digital) technologies. Even if we may not be able to invent the tech, we have built up ability to practical apply it to our lives and work.

This is exactly how we have built up a very advanced digital government and society through the years. Today, because of the maturity of our digital government set-up, tech-savvy population and eager start-up industry, Estonia serves as an excellent testbed for companies small and large from all over the world to come and try their next digital ideas in. We can be an excellent place to bring your product and service from labs to market: to try it out in actual real-life countrywide setting.

We intend to capitalize on these strengths in AI era, too – be fast in uptake and offer our country as a testbed. That is why we have tasked the national expert group also to draft legal proposals on how to enable the use of fully autonomous software systems (i.e. full AI) by solving the issues of liability, safety, etc in a robust manner. We expect to have such proposals and the national AI plan ready by April 2019 the latest.

In the meantime, we have already started work in our government on first concrete use-cases of AI solutions which bring greater effectiveness through better optimisation, precision, automation. This way practical experience from first application attempts and policy or legislation works will iteratively feed each other.

In Estonia, I see very many low-hanging fruits for very practical use of AI. One of our biggest economic challenges is that we have only 1.3 mln people and they are ageing fast. Thus, the usual fear that AI people will leave people out of their today's jobs, is actually an opportunity for Estonia! We want people to move along from their today's jobs, because we have skills and staff shortages in many other (fast-growing) areas. Sure, we need to manage their transition well by ensuring proper skills and reskilling. But in the end, Estonia stands to gain lots from AI and the resulting jobs change.

Estonia is not unique in this regard – ageing population pressures and productivity concerns are the same all over Europe. As such, AI should be the way forward for all of us in Europe.

As with Estonia, we do have to smoothen the transition well on the education and labour market side. Of course, we also have to manage the AI-related ethical and cyber-security risks. But we know from Estonian 25 years of digital society building that these risks can be managed to an acceptable level well. We have built up a digital government with very high trust, for example – one that also has stood up in face of actual battletests in cyberattacks and has not become a threat to people's privacy. Thus, the risks of AI do not have to remain barriers to its uptake. We just need to work on managing them properly.

Instead, our biggest risk in Europe is that we do not move fast enough to build up enablers or preconditions of AI. From Estonian point of view, the biggest challenges are in areas of talent and data (because of our small size). In both, joint actions in European Union level will give a chance to tap into AI deeper that we otherwise could.

Talent shortage means that we'd better do all we can for joint research and development of AI applications and risk management tools, for networking the nodes of excellence and emerging players (across borders).

In terms of data, most countries in Europe will not have by themselves sufficient quantities or quality of data available to train good enough AI algorithms. This was one of the reasons why Estonia took up so strongly the issue of free movement (i.e. reuse and sharing) of data during our EU presidency in 2017, calling it even the fifth necessary freedom for EU. Only by pooling and reusing data across borders, across sectors, across companies and governments we can have sufficient base to match the USA or China in the started AI race.

Advances in ai technologies will enable the industry to leverage rapid growth in the volume of data to optimize processes in real time

Michal BONI

MEP (EPP Group), in charge the Digital Agenda for the EPP Group, Member of the LIBE Committee

Simply speaking - the Artificial Intelligence is some kind of the Digital Brain with all possibilities to process the data in a very fast way using algorithms.

The two issues are especially very significant.

The first one. How to prepare the AI, all kinds of the high quality machine learning to be advanced and useful?

We have to teach them. The key is - accessibility of all kinds of data: structured and non-structured (the last ones: very often used in the companies in many industrial processes). If we deliver as more as possible data to train AI - they will become more and more effective by aggregation processed data which allow for creation algorithms. And again - it will allow for the next processes of analytical efforts.

This is the best way to optimise many manufacturing processes, all kinds of services, all relations with clients in the real time. Optimisation means - make it better, faster, much more adjusted to the individual expectations of consumers. It is the perfect example of the possibility to shorten many processes. Something, which is now working and developing step by step, stage by stage, in the consecutive way - is changing its nature: starting to work in parallel. At the same time - it is the good and symbolic example of shaping the products and services due to our personal needs - as users, consumers, workers, citizens, patients in the healthcare.

What is the most important additionally? All those effective and efficient processes initiated by AI can be possible only thanks to the chain of the Internet of Things. It requires the proper 5 G infrastructure as a basis for the ultrafast connectivity.

The new competitive advantage of using the AI in many industrial and economic activities is coming from the unique possibility - as prediction is. The predictive opportunities are enormous and paradoxically unpredictable. The model is the same when we are using the AI for optimisation of all kinds of processes. As more data we can deliver - as much more precise the result will be.

So, everything is about data.

The second issue. Everything is about data, but at the same time is also about the new model of relations between AI and humans.

It is not only the question of the scale of replacing people by machine learning and robots in many areas. There are many fears and threats related to the impact of the AI on labour market and workplaces. But if we want to avoid many misunderstandings and social tensions - we need to start the explanation: what is going on with AI and us - as humans?

We have to understand the problem. What are the threats, but what are the opportunities and how should we be prepared to these new challenges.

It requires the digital literacy in the broad sense addressed to all generations, all social groups, all professional groups, all differentiated culturally groups. The digital literacy related to the AI development should be focused not only on skills, which will be needed in the new types of jobs under the AI influence. It also should be focused on competences (crucial for the new model of adaptability to the new requirements in jobs - ongoing changes) and attitudes. The last ones are meaningful to prepare humans for the new model of interactions with all kinds of robots: automated machines, learning machines, high quality Artificial Intelligence.

The AI should not replace us - rather we should learn how to cooperate with the AI.

It requires the skills for communication (language, vocabulary, translation and trust). It requires to understand all psychological and ethical dimensions of the model of interaction between us and AI. It should raise the problem of values. Our ethical needs and principles are linked to the values. The values are linked to cultural patterns - different in many nations and continents. And, cultural patterns - very often - are related to the religious values.

So, debating on the future interactions between humans and super smart robots we need to raise all those problems, and solve.... them.

It means that we need to have proper framework: institutional (how they need to cooperate), regulatory (what will need the strong rules, at which areas it would be better to have the soft law: co-regulation, self-regulation, codes of conducts, guidance), educational (new adaptability as a key goal for educational systems), promotional (clear messages and communication allowing to avoid the redundant growth of uncontrolled fears).

The last point. If we want to change the industries and open them for all benefits of AI functioning we need to build the trust.

It is clear that we should take care on secure, protected privacy, explainable, transparent system of the AI development, which at the end will give us the control.

Because technology is for humans, not humans for technology.

Digitalisation and artificial intelligence in the electricity system

Dominique RISTORI

Director-General for Energy, European Commission

To implement the Paris Agreement and lead the global fight against climate change, the EU needs to reduce its greenhouse gas emissions drastically, meaning that the energy sector will require a profound transformation. Indeed two thirds of CO_2 emissions in the EU are related to the use and production of energy.

Europe is in a good position to decarbonise its economy and efforts should be accelerated. Emissions and economic growth have now been decoupled for a number of years. Greenhouse gas emissions in the EU were reduced by 23% between 1990 and 2016, while the economy grew by 53% over the same period.

The EU energy system is already going through rapid transformation, characterised by greater decarbonisation, decentralisation and digitalisation. It is becoming more energy efficient and more renewables-based. Many of the technologies we need for a clean energy transition are already available, and their costs are coming down quickly.

This transformation is underpinned by the Clean Energy for All Europeans package which puts forward the most advanced regulatory framework to modernise the energy system, support clean energy technologies and innovation. Together with the European Parliament and Member States, we have made great progress on the Clean Energy package with the conclusion of the interinstitutional trilogues on the large majority of the proposals.

Just recently the EU has agreed to achieve a binding share at EU-level of at least 32% of renewable energy and an EU-level target of at least 32.5% in energy efficiency in 2030. Both targets include the possibility for a further upward revision in 2023.

If we want to successfully decarbonise the economy, electricity will play a key role. Indeed, we know that the largest share of emissions reduction will be achieved through electricity of energy services and other sectors - such as transport, heating and cooling and the industry – as well as more energy efficiency.

Today, over 30% of the electricity consumed in Europe is generated by renewable energies. By 2030, this share will be over 50%. With greater electrification and the growing share of variable renewables energy, the energy sytem is becoming more decentralised. This also calls for more flexibility in the energy system and changes in the way we build and operate our electricity networks. The new electricity market design proposed by the Commission as part of the Clean Energy package will ensure that the electricity system is adapted to this new reality and can support the energy transition in a cost-competitive way. It is therefore important that the negotiations are concluded as swiftly as possible by the end of this year.

But beyond the regulatory framework digital technologies will have a central role to play to increase the intelligence of the energy system, making it more flexible, secure and sustainable. Inevitably, there will be a multiplication of data to optimise all these distributed sources of generation, such as PV panels, but also the many points of consumption, such as electric appliances at homes or electric cars.

In such context, artificial intelligence could indeed play a key role in helping to compress and analyse this massive amount of data as well as in sending the right signals to all these distributed assets, thus helping to optimise the energy system.

Digital technologies also provide new opportunities for consumers to take control of their energy consumption as well as to invest in energy production, and for businesses to turn this into new consumer services. The Internet of Things (IoT) and Big Data enable the integration of home appliances with related home comfort and building automation services, matching user needs with the management of distributed energy across the grid, while exploiting the benefits of demand response.

Transmission and Distribution System Operators (TSOs and DSOs), electricity suppliers and aggregators need to cooperate to set up platforms where flexibility can be traded, in a coordinated way. Digital technologies and in particular artificial intelligence are the cornerstones for these markets: small volumes of energy or flexibility from many different consumers can only be aggregated and controlled profitably when they are automated.

Finally, in the context of greater digitalisation of the energy sector and the increasing use of data, the need for a strong cyber-security is even more acute. The Commission adopted a cybersecurity package last year proposing a wide-ranging set of measures to further improve EU cyber resilience and response.

The transition to a smart, secure and sustainable energy system is no longer a choice for Europe; it is a responsibility towards all citizens, our future generations and the planet. The EU's energy transition and the EU's digital single market reinforce each other and the European Commission supports research and innovation in all these areas.

Ahead of COP 24 in Katowice next December, the Commission will present a Long Term Decarbonisation Strategy in order to implement the Paris Agreement. In this context participation of all stakeholders including from the digital economy will be key for the successful long-term decarbonisation and modernisation of the economy.

TOTAL, a Global Energy Company, ahead in Artificial Intelligence and Robotics

Marie-Noëlle SEMERIA

CTO Total

Total is committed to deliver a safer, cleaner, affordable energy to answer the increasing need of energy, diversifying its portfolio towards Low Carbon Energy Mix .

Technology, and more specially Digital Technology at large, is a key differentiator to increase safety, operational efficiency and enlarge customers experience. We consider that Artificial Intelligence and Robotics are the key drivers of the digital revolution, progressively transforming deeply whole industrial sectors (4th industrial revolution). AI is speeding up research and innovation processes, is improving safety and efficiency in manufacturing, is changing the way supply chains, marketing and services are deployed, with the development of digital platforms and the growing expectation of people to be co-designer. This new economy is based on data collect, data analytics with more and more high speed computing, machines learning, robotics, connected sensors and powerful algorithm and "fitted on purpose" solutions. We are entering a new era of cognition and a new data-enabled economy. In this massive transformation based on data flows and mathematics States, Companies and people benefit of new opportunities but face new challenges including cybersecurity.

TOTAL is a pioneer in putting AI historically in the core of its businesses with applications across the whole value chains:

> In geosciences, we are developing AI tools to improve the exploration efficiency and a better knowledge of reservoirs, with in-house developments as well as a pioneering partnership with Google.
> In our upstream and downstream operations, we invest in digital sensors, robots, drones and AI to improve safety, with preemptive maintenance to improve our installations availabilities, our manufacturing and processes efficiencies (we recently opened a new center of digital innovation in India with Tata Consulting Services on the concept of a 4.0 refinery).
> In the electricity, the needs for a more decentralized, decarbonized and digitalized electricity system with the integration of a growing share of renewable intermittent electricity, require more energy storage at various scales and internet of things with strong AI. Total together with SunPower, Total Solar, Saft our leading battery company, Direct Energy & Lampiris, is developing specific tools and services for electricity supply, smart building & cities, with performing, competitive digital platforms for end-users to optimize energy consumption and reduce carbon footprint. A collaboration on AI with Ecole Polytechnique has been set up to design powerful algorithms with experimentation in buildings on the Saclay campus.
> In the field of materials, we are developing new tools to couple simulation, experimental data and AI to invent new materials with specific properties and speed up their development cycle, including through biotechnologies.

Robots and drones applications are more and more displayed in our operations, monitoring environment conditions, inspecting in hazardous, constrained or extreme environments, for intervention in deep offshore.

Total is a big INDUSTRIAL data company. We have maintained over the years very large computing capacities in the research center in Pau and owned today among the world top 10 most efficient industrial supercomputer with 6,7 petaflops, and we will continue to increase that. Maintaining strong capabilities in high speed computing in Europe is key to extract values from big data with more and more sophisticated algorithms to remain competitive at world scale.

The situation in European Union as regard AI and robotization is mixed: ahead but losing speed in robotization, partially behind USA & China in AI. We are used to say that USA and China are leading in data with their GAFA and BATS. This is true if we consider personal data, e-commerce, e-mobility (BtoC). But Europe can react thanks to its industry base, to its huge asset in industrial data (BtoB), its regulations to stimulate business opportunities, thanks to its researchers who are the best in math, computer sciences and engineering. The EU market is very deep and attractive. The battle of AI is not lost.

There is no mystery, to develop a performing AI ecosystem, four conditions have to be met:

> excellence in education,
> a strong entrepreneurship environment,
> efficient and adapted financing capabilities,
> and an incubating ecosystem (a Silicon Valley).

Europe has undoubtedly an excellent education system on AI, better than in US and China, considering the large number of European engineers in the Silicon Valley. The entrepreneurship culture and mindset has definitely grown up in particular in young generations in Europe. A significant number of seeds and startups in AI have been recently created and developed, in France and in UK in particular. Challenges are on the scale up & massification, time to market and speed: grow or die. The weaknesses of Europe are more on the financing side and on the geographical spreading of the efforts.

European Union has not organized yet a massive financing ecosystem with venture capital and funds fitting with the needs & specificities of its startups in the digital world for their scale up, continuous innovation challenges, competitiveness in a very fast changing landscape. In 2016, Europe has invested in AI four time less than the Bay Area in San Francisco. Clearly our most innovative startups in AI could be the target of takeover by US or Chinese companies or funds. The framework for screening of foreign direct investments into EU which is under legislative process in Brussels is certainly going in the right direction. However, it is urgent that Europe, at the same time, stimulates massively its European AI startups to put them on a level playing field to compete at world scale and coordinate in a better way the implementation of selected geographic AI ecosystem with appropriate research funding (basic & applied).

TOTAL is a global energy company at the leading edge of AI & robotics in energy. We are committed to pioneer new technologies for a cleaner and safer world matching energy needs and economical growth. Innovating is crucial to stay in the race, this is a strong message for young engineers and European stakeholders.

Big data, IA, augmented intelligence: Building grids for the energy transition

François BROTTES
CEO of RTE

The world is made up of complex systems, the causes and effects of which defy human intelligence and computing power. Big data as well as artificial and augmented intelligence are just some of the technologies that people are using to improve and even surpass themselves. How are these tools helping to build tomorrow's grids?

The French word "intelligence" denotes the ability to understand the nature of things and the meaning of facts. In British English, the term denotes the same meaning whereas in American English, it highlights "the ability to learn or understand from experience, the ability to acquire and retain knowledge".

While the latter definition does not dispense with ethical and societal considerations regarding artificial intelligence, it does remind us that originally, it is the gathering and use of past data that has helped IA to develop and to now provide amazing opportunities for augmenting mankind's abilities. These prospects are prompting transmission system operators to invest massively in digital technology, the backbone of smart grids, and to use these new tools.

Artificial intelligence is changing the power system

RTE is piloting an artificial intelligence system within the heart of its power dispatch function. This project seeks to move from an essentially manual system to a system where the operator will focus on the most complex tasks using the most efficient decision-making tools. At the same time, lower-value added tasks will become automated. A number of questions remain open about man/machine interactions and understanding how traditional computational learning systems can successfully interact with humans for teamwork, social learning tasks, and non-technical user training.

Artificial intelligence is helping to capture the future

In the future, this assistance will be essential when it comes to managing the volatility of renewables in near-real time and in so doing, helping to ensure that development lives up to the objectives of the Paris Agreement. The large-scale insertion of intermittent and decentralised energy sources makes matters more complex for transmission system operators. This complexity multiplies the number and diversity of parameters having to be included in studies being conducted to assess grid strengthening and expansion requirements. The tools we are using today do not cater for this complexity. RTE is currently testing a new simulation platform. It should be able to accommodate more climate scenarios and simulate their effects, around the clock and throughout the year, on a given structure – be it a substation, critical component or power line – as well as the consequences for the rest of the grid. This analytical data is essential for the successful planning of tomorrow's grid.

Digitalization is a match for the growing complexity of the energy landscape

Every year, RTE spends 1.5 billion Euros on upgrading the system and adapting its grid. The methods currently being used to decide on the technical choices of investments are not designed to cope with the upheavals affecting the power system. France's power consumption is expected to remain stable and even decrease, whereas it has long been a central factor to design the grid. Europe's plans to develop renewables are incrementally multiplying the number of scenarios having to be considered and are making load-flow analysis more complex. The growing interdependence between regional, national and European grids means having to consider more and more scenarios within an increasingly wider geographical scope. Last but not least, digitalization of the grid (via the introduction of automatic controllers or sensors, for instance) widens the range of available solutions (new infrastructures, greater flexibility, market mechanisms) having to be considered in these studies. It is also a way to give more value to existing assets.

TSOs are facing a tidal wave of investments

Investment planning is all the more important as transmission system operators prepare to cope with a tidal wave of

investments to upgrade or replace their grids, most of which were built during the second half of the 20th century. At the same time, the digital revolution also requires current and future generations to be trained in the use of new tools and new approaches. Neither should we overlook the potential impact of extreme events that could cause the power system to fail. Augmented intelligence could provide prediction tools to estimate the optimal split between operating expenses and investments on the one hand, and reliability of the generation and transmission system on the other. Considering all the aspects that are liable to come under increasing pressure over time – including physical assets, human resources and even financial parameters – augmented intelligence would be able to simulate the repercussions of each decision on budgets, on the quality of service and on potential risks, whilst providing an overview of the entire investment portfolio. Together with the start-up Cosmotech, RTE is running a pilot project to identify the most efficient maintenance policies in terms of cost, quality,

continuity of supply, environmental impact and safety.

Looking further ahead to the environmental transition

The potential optimisation opportunities being offered by new digital tools go beyond the scope of the electrical power sector. The electrification of transport systems (as well as driverless vehicles in the future) and the emergence of smart cities, coupled with individual and collective self-consumption, should give rise to new flexibilities that will support the successful completion of the environmental transition. The whole challenge lies in the ability to establish conditions that will support the development of aggregate or distributed flexibilities.

The growing place of digital technologies as a key factor to accomplish the energy transition requires to take into account the environmental impact of these solutions. Working in an open environment is also a way to fight obsolescence and facilitate recyclability.

Just as open source software has transformed automobiles, telecommunications, financial services, and healthcare, RTE, ENTSOE and the Linux Foundation launched the LF Energy to speed technological innovation and transform the energy mix across the world. A collaborative open source approach to development of these technologies across companies, countries, and end users, will provide the innovation needed to meet our respective goals in renewable energy, power electronics, electric mobility, and rapid digitalization for the energy sector overall.

Last but not least, transmission system operators are working together to make the electricity sector's digital transformation a long-term item on Europe's agenda. An initial meeting took place in Tallinn in September 2017. These discussions continued in May 2018 at a meeting organized by in Copenhagen. In January, all stakeholders will be meeting in Paris to ensure that Europe actually benefits from this momentum.

Consolidating europe's ai strategy

Pilar DEL CASTILLO

MEP (EPP Group), Member of the ITRE Committee, Chair of the European Internet Forum

Looking at the increased amount of events and articles that have seen the light in the last months, Artificial Intelligence can be considered the latest hot digital topic. To the extent that Big data, IoT, 5G, and now Artificial Intelligence seem to be at the top of the every public Institution agenda.

Nevertheless while I believe that research and institutional awareness has been undertaken for some time, the truth is that today AI has become an area of strategic importance and a key driver of economic development.

Indeed, Artificial Intelligence is not an entirely new concept, however due to the current massive sets of digital data around people and systems, together with today's sophistication of processors, its potential to affect all sectors of the economy and society has never been bigger.

Its impact will be such that, as the rest of digital technologies, it must be seen as a layer across multiple sectors, rather than a sector in and of itself. Its potential is enormous, significant benefits in terms of better healthcare, more efficient public administration, safer transport, or more competitive industry are easy to comprehend. In this regard AI can be used to make more accurate and faster medical diagnoses, carry out dangerous and repetitive tasks and free up valuable time.

One example in figures, according to the Commission, by 2025 the economic impact of the automation of knowledge work, robots and autonomous vehicles will reach between €6.5 and €12 trillion annually.

From the European Institutions we are indeed very much aware of AIs importance and potential to the extent that, at the highest political level, the October 2017 European Council Conclusions have identified Artificial Intelligence as one of the main pillars of a strong digital economy.

With this context in mind the European Union's strategy towards AI is consolidating at great speed.

The first tangible step in this direction has been the Commission's increase of annual investments in AI by 70% under the research and innovation programme Horizon 2020, reaching 1.5 billion Euros for the period 2018-2020. This increase means that at the end of the day in Horizon 2020 the EU will be investing around €2.6 billion on AI-related areas (robotics, big data, health, transport, future and emerging technologies). Consequently expectations for the next research framework, that is now started to be debated amongst the colegislators, can also be confidently high.

However, these amounts represent only a small part of all the investments from the Member States and the private sector and we must be aware that Europe is behind in private investments in AI, €2.4-3.2 billion in 2016 in Europe, compared to €6.5-9.7 billion in Asia and €12.1-18.6 billion in North America. With these figures in mind we must see EU research funds as the glue that links individual efforts, and in no way as the main investment source for AIs future.

Beyond these considerations, and although Artificial Intelligence has a purely technological research and innovation component, research on AI must also be undertaken in the social, ethical and liability areas.

For example, from a labour perspective, we must shape how technology enhances opportunities to work not destroys them. More precisely a reskilling revolution is needed. Consequently the EU should, amongst other: support business-education partnerships to attract and keep more AI talent in Europe, set up dedicated training and retraining schemes for professionals, support digital skills and competences in science, technology, engineering, mathematics (STEM), entrepreneurship and creativity, encourage Members States to modernise their education and training systems and elaborate a set of AI ethics guidelines.

These are all actions that the EU should start undertaking as soon as possible. In that sense it is worth underlining the role of the first ever Digital Europe programme whereby the Commission proposes to invest €9.2 billion to align the next long-term EU budget 2021-2027 with increasing digital challenges.

The proposed Digital Europe programme intends to tackle, with its own funds, and in a complementary way to the next research programme, Europe's persistent upstream investment gap. More precisely its aim is to provide a funding instrument that is tailored to the operational requirements of capacity building in the areas of high performance computing, artificial intelligence, cybersecurity and advanced digital skills, and to exploit the synergies between them.

It is the right approach if we are to make of Europe a thriving data economy. All of these areas are closely interlinked and interdependent. In addition the programme will dedicate, exclusively to AI, €2.5 billion. The aim should be to give better access for public authorities and businesses, especially SMEs, to AI testing and experimentation facilities in Member States.

Amongst the most promising Digital Europe programme proposals we find the development of common 'European libraries' of algorithms that would be accessible to all. In addition open platforms and access to industrial data spaces for artificial intelligence will be made available across the EU in Digital Innovation Hubs, providing testing facilities and knowledge to small businesses and local innovators.

The European Union is with the Digital Europe programme, consolidating its AI strategy. The EU has adopted legislation that will improve data sharing and open up more data for re-use, it has established a regulatory framework that will promote the deployment of the needed infrastructure, it counts with one of the most ambitious public research programme in the World and now is in the midst of adapting the first pan European digital fund that will help provide Europe with the right capabilities for AI to reach its full potential.

AI in the Water Industry: Framing the opportunity to foster acceptance

Christian BLANC

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One of the most compelling stories about Artificial Intelligence (AI) to watch in the years ahead will take place in one of the most seemingly unlikely industries: water management, known in the past for its conservative approach to technology. AI is still in its infancy in the water sector, but early applications of its methodologies are showing great promise. While challenges need to be resolved in order to fully realize its possibilities, innovation experts believe that AI has the potential to fundamentally transform the economics and productivity of the water industry – at a time when demand for water is unprecedented and rapidly accelerating. According to the UNESCO, nearly two billion people are expected to be living in countries or regions with absolute water scarcity by 2025.

AI, which can be defined in many ways, is essentially the advanced analysis of data by a computer at a speed and scale far greater than humans alone could accomplish. AI identifies patterns in data , continuously refining relationships between variables as it "learns" new information. For the water sector, the power unlocked by AI-enabled problem solving is critical. Water systems globally are facing escalating challenges – from overpopulation, to severe weather patterns from climate change, to aging infrastructure. Water system managers face a constant battle to mitigate these issues and uphold rigorous standards to

protect public health and the environment, while struggling to fund crucial repairs.

While use of AI in the water sector is still in its very early days, water managers are deploying AI methodologies on several fronts:

› AI was combined with a wireless sensor network at one large utility to eliminate more than a billion gallons of combined sewer overflows per year.
› Machine learning and artificial intelligence methodologies have been used by one water operator to identify underperforming meters, identifying $750,000 in hidden revenue.
› Smart wastewater pumping systems are incorporating AI to sense operating conditions and adapt performance, helping eliminate expensive maintenance callouts.

In the future, AI has the potential to be deployed much more broadly across the water sector to provide predictive and prescriptive analytics that will help significantly drive down costs, improve customer service and lessen environmental impact.

However, while the promise of AI is incredibly powerful, barriers to adoption do remain. One of the most crucial hurdles is whether AI advocates can frame the opportunity appropriately to earn wider industry acceptance. One way to address this issue is to examine AI within a broader, historical context. While it's often spoken about as revolutionary, AI can also be positioned as the next evolution of tools that can help the water industry resolve three major challenges:

First, resource deficiency– Water stakeholders, including operators, are frustrated there are never enough resources to do what needs to be done to protect the environment and public health.

Second, quality of life for utility professionals – Utility workers are thwarted by the absence of information, visibility and tools they need to make better decisions.

Third, volatility of outcomes– Persistent variability in operations causes problems like overflows or drinking water quality violations, resulting in financial penalties and potential public health issues.

In all three cases, AI can drive progress: The potential economic benefits of AI will scale dramatically as the water sector gathers more data about its operations.

AI offers new ways to empower utility professionals, giving them a higher level of efficacy and agency over the infrastructure they manage. In turn, AI relies upon and is fueled by human experience and insight.

In terms of outcomes, as utilities begin to incorporate AI methodologies, they will develop a vastly greater understanding of the unique water challenges in their local environments, from seasonal weather shifts to customer behaviors, enabling operators to manage more effectively.

Like the emergence of variable frequency drives three decades ago and the rise of online sensor instrumentation, AI is the latest innovation with the potential to propel the water sector forward. The best way to help the industry become open to this opportunity is to focus on the core value drivers that unite water stakeholders: How do we do more with less? How do we make the life of the operator better? And how do we ensure that water systems continue to deliver substantial public health and environment benefits?

AI can be a blockbuster story for the water sector, if stakeholders can succeed in merging its technological capabilities with human intelligence and expertise, and a rigorous code of ethics. But, as with any transition, overcoming fear of change is critical. For the constantly challenged water sector, leaders should focus on the fact that AI is simply a new generation of technologies with broad-based application for improving productivity and safety. It's not about firepower or fireworks, it's about answering the major issues facing water managers globally and helping them advance their all-important charge – to serve their communities and be responsible stewards of their local environments.

AI is a promising field for European Industries: focus on SME's

Dr. Andreas SCHWAB

MEP (EPP Group), Member of the IMCO Committee

Artificial intelligence is already a big part of our everyday lives. We use a virtual personal assistant to organise our working day, our phones suggest songs or restaurants that we might like and even autonomous driving is possible. There is no doubt that artificial intelligence is the technology of the future.

The development of artificial intelligence is a very promising field, also for the European industry. This is why we need to think about **how to provide the best possible framework for innovation** so that our European companies and especially SMEs can compete on an international scale with regard to artificial intelligence. Many SMEs in Europe are active in the area of artificial intelligence, but they can only grow and compete on an international level, if the framework conditions in Europe for artificial intelligence innovation are favourable and take into account their needs.

In this respect, it is important that we **avoid fragmentation** in Europe. If different rules and regulations apply in different Member States of the EU, SMEs have to adapt to 28 different frameworks for every activity. This creates a heavy administrative burden and severely hampers innovation. We therefore need to find a European approach to artificial intelligence with a European framework and European cross-border projects that foster innovation and keep administrative hurdles low.

Of course we want our European companies to compete on an international level. With the US and China **investing** heavily **in the development of artificial intelligence**, in Europe we have to ask ourselves how we can keep up. The European Union wants to boost investment in artificial intelligence by about 70 percent to 1.5 billion euros by 2020 to catch up with China and the United States, which are each investing at least three times more than Europe. Of course this is already a big step in the right direction. However, we need to do more in order not to fall behind further. This means that we need more investment, but we also need to further cross-border research and development of artificial intelligence within Europe.

In order to develop artificial intelligence, large data sets need to be put at the disposal of researchers and companies. Regulation in the EU is much stricter than in the US and China with regard to this, which might also be one of the reasons why the US and China are ahead of the European Union. One could therefore argue that we should loosen regulation in order to facilitate the **use of big data sets** by our companies and especially SMEs. However, it is crucial that we find the right balance between furthering innovation and providing data sets to this end on the one hand, and data protection on the other hand.

This is especially of importance as the success of artificial intelligence also depends highly on the **trust** of European citizens. Data protection and cybersecurity are therefore very important for the development of artificial intelligence. The **General Data Protection Regulation** (GDPR), which entered fully into force in May 2018 and is a big step towards the protection of data of European citizens and therefore the trust that European citizens place into digital applications including artificial intelligence. With regard to **cybersecurity,** one has to note that the EU is planning on investing 1,8 billion euros into cybersecurity by 2020. The United States have invested 18 billion euros in 2017 alone. This shows that we are not doing enough. We have to do more in Europe to further our cybersecurity capabilities. The threat of cyberattacks will only increase as systems are more and more interconnected across borders, meaning that a cyberattack on a system in one Member States can affect other systems across several other Member States. If we want secure artificial intelligence, we need to ensure cybersecurity throughout Europe.

To conclude, we need a solid European framework for our companies to be able to compete on an international scale. The European Union should have a coordinated approach to make the most of the opportunities that artificial intelligence presents and in order to address the challenges that come with it. However, we should develop artificial intelligence by building on our European values and not sacrifice data protection or cybersecurity for innovation.

Europe can take pole position in the global AI race – by focusing on our strengths

ORGALIME

Malte LOHAN

Orgalime, the European Technology Industries, speaks for Europe's mechanical engineering, electrical, electronics and metal technology industries

The global race for AI leadership is on. The US was first off the starting blocks, powering ahead from the get-go. And China is hot on its heels, gathering pace after a fresh sprint. Meanwhile, Europe is struggling to hold third place and fast running out of steam.

Or is it?

We have heard this scare-story so often, we could be forgiven for taking it as fact. Worrying indicators abound: McKinsey reports that 83% of AI investment is happening outside Europe[1]; the EU lags behind in patents filed[2]; and public policy is also playing catch-up, with the European Commission's first strategic statement on AI in April 2018 arriving one to two years later than national plans in the US and China respectively.

The received wisdom is that Europe lacks the innovation culture of Silicon Valley; or that our privacy fixation will shift investment to laxer regulatory environments like China. But Europe can still become a global AI leader – not by trying to emulate the Googles of this world and not by sacrificing our principles, but by leveraging our specifically European strengths. Because our technology industries are already world-leading: in AI applications integrated in consumer and industrial products ('embedded AI').

Start with manufacturing, currently ranked third of all industries for AI spending.[3] AI has been a key enabler of industrial digitisation, with Europe leading the global charge. Our firms are already pioneering AI applications to boost productivity and accelerate efficiency in supply chain management and production.

Considering that Europe's manufacturing base accounts for 23% of GDP, these gains can ripple throughout the economy.[4] Yet Europe's technology industries are also using AI to create another kind of opportunity – integrating AI into products and systems that enable solutions to the critical societal challenges of our time. AI is making energy grids smarter, mobility greener, healthcare more precise. And by meeting these emerging demands, EU industry can create completely new markets – laying the foundation for sustainable growth.

How can policymakers help the European technology industries maintain this momentum? Representing the companies driving innovation on the ground, Orgalime is making a number of recommendations.

First, we need to be aware that understandings of AI vary today depending on the use case under discussion. Are we in the realm of R&I, looking to all future possibilities – including what remains for now science fiction? Or are we talking about how the technology is actually used today in industry? To make smart regulatory decisions, each policy discussion must be rooted in the realities of the issue being addressed. Part of the problem today is that we lack more nuanced definitions reflecting distinct applications; industry and policymakers should work together on clarifying terminology across the AI lexicon.

Next, we must coordinate EU efforts to boost AI investment and compete with the US and China on equal footing. Policymakers should draw on all instruments to strengthen capital investment, R&I, and skills development. And better coordination is needed between national and EU level; fragmentation can weaken the European ecosystem and damage our competitiveness. Funding should play to Europe's strengths, focusing on domains where we already lead such as automation, semantics, and edge computing analytics.

When it comes to regulation, flexibility is key. Recognising that AI is an emerging technology, the Commission has so far been prudent with legislation. Let's keep it this way. The innovation principle should guide all regulatory decisions. A sound data policy will be one building block of an innovation-friendly framework. To encourage AI uptake by large companies and SMEs, policymakers and industry must strike a new balance between boosting the data ecosystem while protecting privacy and business confidentiality.

Finally, we must work together to foster acceptance of AI through open debate involving all stakeholders. It is to Europe's credit that we take ethical questions seriously, and it is right to address safety, employment, or liability concerns. Discussions should be rooted in foreseeable realities, focusing not only on risks but also on the benefits of AI. We must share success stories from our industries to gain buy-in from business and citizens alike. By fostering a market built on trust, this approach can prove a competitive advantage. Orgalime will be addressing these and other questions through our engagement in the Commission's High-Level Expert Group on AI.

By taking these steps, Europe can edge past competitors to take pole position in those fields where we have most potential. Because ultimately the global AI race is not a sprint but a marathon. Artificial intelligence is transforming all industrial sectors, and the long-term economic and societal benefits of that transformation have only just started to materialise. Happily for Europe, it is here where our industries already have a head start.

1   McKinsey Global Institute, *Artificial Intelligence: the next digital frontier?* Discussion paper June 2017:39.

2   Roland Berger, *Artificial Intelligence: A Strategy for European Startups*, March 2018 : 15.

3   iCom Institute for Competitiveness, *Data-Driven Innovation and Artificial Intelligence: Which Strategy for Europe?*, June 2018: 10.

4   European Political Strategy Centre, *The Age of Artificial Intelligence: Towards a European Strategy for Human-Centric Machines*, 27 March 2018: 4.

AI in industrial technologies – Europe's hidden champions

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The most visible applications of Artificial Intelligence, such as speech and face recognition, do not originate in Europe. However, for business to business applications, Europe is a champion. For example, 20% of industrial robots are produced in Europe and three of the world's largest producers of industrial robots are European. Human robot collaboration has brought impressive efficiency gains for manufacturers - the backbone of the European economy, providing 32 million jobs and generating 16% of GDP.

Artificial Intelligence takes various other forms in manufacturing in addition to self-learning systems and robotics, ranging from automated quality control to zero defect manufacturing, from predictive maintenance to demand driven production.

The analysis of 22 EU-funded projects in industrial technology, representing an investment volume of EUR 130 million, confirms the main expected benefits from applying Artificial Intelligence in manufacturing: higher productivity and reduced cost. Less obvious, but equally characteristic for Artificial Intelligence, is the expected improvement of the working environment and job satisfaction due to human-robot collaboration.

And yet, we are facing a double challenge: implementation and keeping up with fast developments in the field of Artificial Intelligence.

Let's first look at implementation. There is no lack of awareness: Artificial Intelligence is widely recognised as a pervasive technology that transforms industrial production. And yet, only about one in five companies incorporates Artificial Intelligence into processes and uses big data analytics[1] - for SMEs this figure is closer to 10%. Also, while the EU has increased funding for Artificial Intelligence under its Framework Programme for Research

1 https://sloanreview.mit.edu/projects/
reshaping-business-with-artificial-intelligence/

and Innovation by 70%, investing annually about EUR 500 million, only a small share of industrial technology projects, about 6%, include a dedicated Artificial Intelligence component. As T.S. Eliot noted, "Between the idea and the reality, between the motion and the act, falls the shadow".
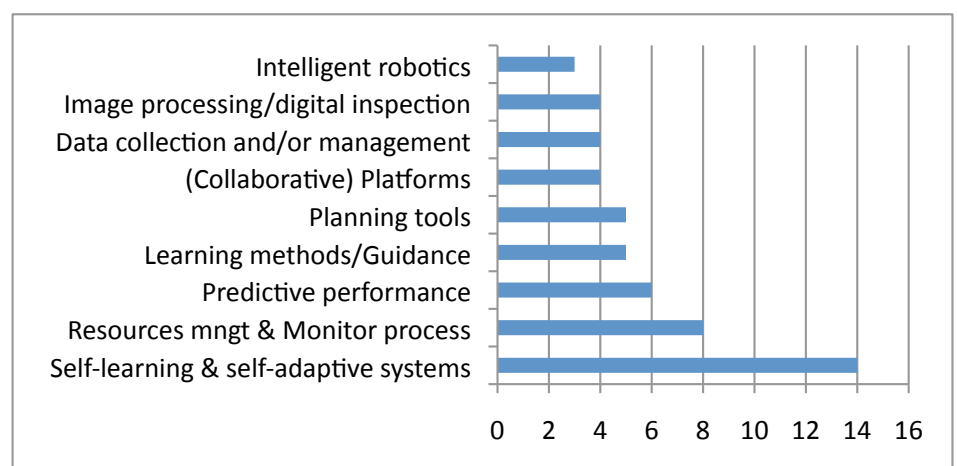
Secondly, fast developments in Artificial Intelligence are related to breakthroughs in deep learning and the use of big data. An illustrative example is the robotic arm learning how to flip a pancake[2]. First, it fails miserably and the movements are clumsy. But 50 attempts later and thanks to motion caption and reinforced learning, it gains 100% accuracy and very efficient movements, all on its own.

How do we address these challenges at EU level? Firstly, the Artificial Intelligence Strategy for Europe[3] sets out the measures to boost the EU's technological and industrial capacity and to ensure the uptake of Artificial Intelligence across the economy. Secondly, Artificial Intelligence has been recognised as a new Key Enabling Technology, as suggested by the High Level Group on Industrial technologies[4]. With this, Artificial Intelligence will feature more prominently in EU funded industrial

2 https://www.youtube.com/watch?v=W_gxLKSsSIE

3 https://ec.europa.eu/digital-single-market/en/
news/communication-artificial-intelligence-europe

4 https://publications.europa.
eu/en/publication-detail/-/
publication/28e1c485-476a-11e8-be1d-01aa75ed71a1

(Figure 1 – EU funded industrial technology projects with an AI component)

technology projects. Thirdly, breakthrough projects under the European Innovation Council[5] will be particularly relevant for a fast moving area like Artificial Intelligence. Fourthly, the future research and innovation programme, Horizon Europe, will prioritise investments in digitisation and industry.

As the use of Artificial Intelligence and autonomous systems raises many moral questions, these actions can only succeed within a proper ethical frame. The European Group of Ethics therefore proposed, as a first step towards global standards, a set of basic principles related to Artificial Intelligence, Robotics and Autonomous Systems[6], based on the EU's fundamental values. These principles are highly relevant also for the success of Artificial Intelligence in manufacturing, notably that autonomous systems must honour the human ability to choose whether and how

to delegate decisions and actions and that, in addition to safety for their environment and users, the "emotional safety" with respect to human machine interaction must be secured and tested before release.

How could the future look? Going back to the robotics example, today's human robot collaboration in manufacturing is still characterised by co-existence rather than collaboration - Intelligent Assistance rather than Artificial Intelligence. This is because most industrial robots are high-powered and of high speed – and therefore dangerous; they need to be fenced. Thanks to fast developments in sensing and data computing, we start to see more and more fenceless cooperation, allowing interaction. In the future, we could see real team work with intelligent robots communicating verbally and non-verbally with humans. This transition from co-existence to fenceless collaboration and team work with the human in the centre holds a strong promise of further efficiency gains, of reversing the trend of declining jobs in manufacturing, and of more manufacturing champions in Europe.

5 https://ec.europa.eu/programmes/horizon2020/en/h2020-section/european-innovation-council-eic-pilot

6 http://ec.europa.eu/research/ege/pdf/ege_ai_statement_2018.pdf

AI to resource the EU

Jean-Christophe LAISSY
VEOLIA,
Global Chief Information & Digital Officer

The future pervasiveness of artificial intelligence (AI) makes no doubt. Recent technological developments have converged to lead to its take off and the trend is accelerating with: (1) an increase in the quantity/availability of data ("big data", enabled by the Internet of Things) ; (2) sustained computing power improvements ; and (3) better handling of complexity and adaptation thanks to progress in algorithms ("machine learning").

AI's impact on our society will be considerable. Our personal and professional environment will change swiftly and deeply, making the AI uptake an industrial and societal revolution.

There is no point in doing AI for…doing AI. **The stakes for Europe are to define an AI approach that would optimise the benefits of AI to the people and the environment.** This way, **Europe will become not only the leader but also the global benchmark in AI.**

That is why Veolia welcomes the release of a European Commission strategy on AI and its reflexion on ethical guidelines.

Veolia was the first company to monitor and optimise water, energy and materials (waste) flows in real-time.[1] Our Group is today a major IoT (Internet of Things) operator with more than 10 million connected devices around the world. As 75% of our activities take place done within the EU, we support a European leadership based on three pillars: (1) AI must contribute to the circular economy; (2) AI must benefit people - citizens, employees, etc. ; and (3) AI must be understood as part of a broader digital ecosystem.

(1) AI for the circular economy

Europe is already facing unprecedented challenges in areas such as quality and availability of water following droughts or heat waves, as well as waste management, air pollution and the energy transition. AI developments must thus enable a systemic shifts that is beneficial to European citizens and the environment.

First of all, **AI can reduce the costs of environmental services.** Veolia for example uses it to detect leaks in water pipes and maintain networks preventively. Similarly, thanks to its Hubgrade "energy hypervision" centers, it reduces energy consumption for its municipal clients by 5 15%.

However AI computations on servers and information flow on the cloud may require a lot of energy. If not mitigated, AI can lead to *accrued* energy consumption and carbon emissions. For this reason, Veolia takes great care in finding the right equation to reduce the carbon footprint with and for our clients, based on use cases.

The EU is already a trailblazer for the circular economy. Thanks to AI, it could consolidate its leadership in this field, an AI-circular economy win-win association. **"AI for sustainability" provides value for money.** Every euro invested - public or private - delivers concrete benefits to our environment and citizens, solutions to problems that *do* exist and may worsen.

Thus, AI for the circular economy should be set as a priority in the EU budget and research programmes, starting with the 2021-2027 Multi-Annual Financial Framework and the associated Horizon Europe research and innovation programme.

Photothèque Veolia - Olivier Guerrin

AI for sustainability: Waternamics, Veolia's hypervision centers
Relying on a network of connected meters, Waternamics helps water operators face challenging situations linked to aging infrastructures, declining resources (in quantity and quality), accrued risks (storm overflow, etc.) and increasing customer expectations.

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1   Source: FACTS Report, 2017, "Artificial Intelligence and Robotics in the City", https://journals.openedition.org/factsreports/4373

(2) AI for the people

Because AI will lead to socio-economic overhauls and paradigm shifts, Veolia believes that **citizens and employees should be associated along the way**. There are concrete solutions to develop the inclusiveness potential AI. In short, the proper approach is **not 'what people can do for AI' but instead 'what AI can do for the people'.**

It starts with providing solutions that empower the city, based on a clear digital transformation vision. Abylon, a subsidiary of Veolia, help cities and citizens co-create and implement strategies on e.g. air and water quality, urban services transparency or social inclusion. AI also provides tools to the direct benefit of these 'smart citizens'. Our app 'Urban Pulse' brings to inhabitants and tourists real-time information on traffic, events in the neighbourhood, etc. **Like water or materials, information should not be lost.** If everyone can contribute by providing or rectifying an update, everyone will benefit.

In addition, human-centered AI does not overlook employees. At Veolia, we deeply believe in the "**symmetry of intentions**": digitally, as in other regards, employees have to be treated as well as clients. This way, we make sure that AI becomes neither a sole marketing instrument, nor an instrument to cut the workforce. We bring value to our employees, who bring value to our customers.

A first step is to build a day-to-day digital atmosphere, based on an internal digital roadmap, which then eases the adoption of IT business applications. However, this digital culture will not be sufficiently shared and thus will not bring meaningful improvements if there is a missing link in the value chain that blocks the use of new tools. In fact, all functions can benefit, from the customer-facing teams to the back office.

And as for every transition, training is king. Veolia was the largest publicly traded French company to completely give up its data centers and move to the cloud-based internet services. We trained more than 300 people both in IT and in the business units, with a special focus on employees from the ditched data centers.

(3) A digital ecosystem for AI

Without a supporting ecosystem, AI developments will be hampered and the EU will be dwarfed. AI needs scale. Investments in algorithms are costly. **The introduction and expansion of smart solutions may be** hindered in some cases due to an unclear legal framework and divergent approaches at national level.

Veolia historically has data stored and processed in different places across the EU. Allowing data to move more freely within the EU is necessary to enhance operational performance and use innovation in different settings. In this context, Veolia has been supporting the European Commission's proposal on a framework for the free flow of non-personal data within the EU.

Similarly, the EU can export its data vision in its trade agreement negotiations. In July, the EU and Japan agreed on reciprocal adequacy regarding their data protection systems, creating the world's largest area of safe data flows. Veolia favours such an approach, which guarantees high standards of protection.

Yet, trade frameworks have to be careful and precise enough not to allow for protectionism.[2]

The same goes with open public data policies. Veolia welcomes the European Commission's initiative to "foster transparency, data-based innovation and fair competition". However, sectoral (water, public transport, energy, etc.) data transparency obligations, with share-alike licenses and reciprocity, also look promising in this regard. **This framework is not only the perfect ecosystem for Europe, but - through the 'Brussels effect'[3] will also bring a positive human- and environment-centered stance to global AI developments.**
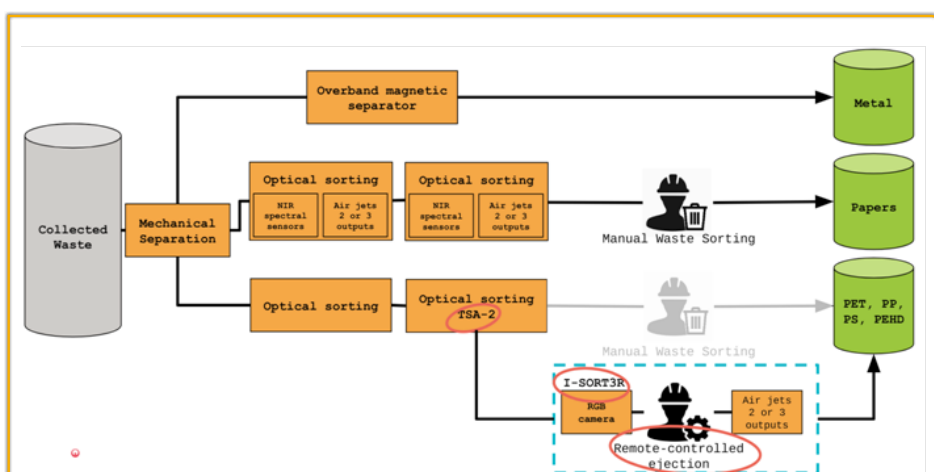
AI for the employee
Veolia's automated waste sorting based on AI solutions: more accuracy, more comfort and less danger for the employee

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2   The recently adopted "EU Horizontal provisions for cross-border data flows and for personal data protection in EU trade and investment agreements" may give countries too much leeway in this regard. Template adopted: http://trade.ec.europa.eu/doclib/docs/2018/may/tradoc_156884.pdf

3   'Brussels effect': how EU norms are adopted by non-EU actors. Concept coined by Anu Bradford, https://www.law.uchicago.edu/recordings/anu-bradford-brussels-effect-rise-regulatory-superstate-europe

Paving the way for the digital economy of the future

Anna Maria CORAZZA BILDT

MEP, (EPP Group), Vice-Chair of the IMCO Committee, Rapporteur for the regulation for the free flow of non-personal data in the EU

The digital revolution is changing all parts of our lives: how we shop, handle our private economy, book our travel arrangements and much more. Though much has already changed compared to only a decade ago, we are actually still only in the beginning of these exciting developments. The possibilities seems almost endless.

With the digital single market strategy the European Union is step by step creating a framework for the digital economy. The goal is to set rules that create a level playing field for European companies to compete globally, without putting unnecessary burdens on them and hinder innovation.

I am proud to be responsible for the European Parliament's work on the *Regulation for the free flow of non-personal data*. This regulation removes national data localization requirements and facilitates switching and porting of data between cloud service providers.

Together with the GDPR, the Free flow of non-personal data regulation creates a common *European Data Space* where both personal and non-personal data can move freely. The potential GDP gains are estimated to equal those of the EU free trade agreements with both Canada and South Korea.

It is a regulation to de-regulate, to create one common set of rules throughout the EU, instead of having 28 national rules. It is a good example of *better regulation* that give a clear added value.

I am pleased that we reached the agreement with the Council under the Bulgarian Presidency in record time, and that it was adopted in IMCO with overwhelming majority. The final vote in plenary will be in the autumn.

Of course, the digital economy is global and rules like these should also be global, but achieving free data flows within the EU is a major step in the right direction. The next step should be to include data flows in future free trade agreements.

That free movement of data across national borders is important is increasingly evident. It both complements and facilitates the other four freedoms on the internal market. Movement of goods, services, capital and people are one way or another accompanied by data.

As rapporteur for the Parliament I have made it a priority to ensure that the free flow of data principle is not undermined by different exceptions. We succeeded to overcome some member states' concerns that data stored and processed outside of their territory would be less safe and accessible, which made them reluctant to give up their localization requirements and to include public procurement.

For me it is an old fashioned way of thinking, a remnant from the days when information was stored on paper. Most people prefer to save their money in a bank instead of at home, because it is considered safer. The same goes with data, cloud providers specialize in keeping data safe and accessible because otherwise they do not have a business anymore.

We have to remember that we are only beginning to see the advantages to free movement of data. For public authorities and many companies it could already be more efficient, less costly and more climate friendly to use a cloud provider located in another member state. Especially companies that operate in several member states will benefit as they will now be able to store and process their data in one place instead of several.

For many new and innovative tech-companies free data flows creates substantial benefits and paves the way for new technologies such as Artificial Intelligence and big data analysis. Many applications, for example Google Assistant or Siri, are fueled by data flows. So are the algorithms in services like Netflix and Facebook that selects what films or posts you see. In order to reap the full benefit of big data analysis large quantities of data must be available.

Many sectors like for example transport will also directly benefit from free data flows in the EU. Data from vehicles that move across national borders need to flow freely for their new, more efficient, systems to function properly.

And this is only the present, who knows what new applications and services will revolutionize our lives in the future?

That is why it was so important to get the Free flow of data regulation right. Europe has both the expertise, the entrepreneurs and the financial power to become a digital power house. We policy makers have a responsibility to deliver a clear and future proof legal framework to back it up and to stand up against digital protectionism.

The key element of AI to improve competitiveness in Europe

Eva MAYDELL

MEP (EPP Group), Member of the IMCO Committee

"Science fiction writers foresee the inevitable, and although problems and catastrophes may be inevitable, solutions are not." Isaac Asimov wrote these words back in 1975 yet today they resound with the same power – if not even stronger. We are at the brink of the Fourth Industrial Revolution, where AI, big data, robotics and cloud computing are shaping the new normal.

Nevertheless, the new rapid advancement of technology can only bring solutions if we, as policy-makers and society, are looking for them; otherwise if we leave it unattended - we will face completely new crises. I am a strong believer that the Fourth Industrial Revolution awaits with more opportunities than threats and to unleash its potential we need to understand AI, embrace AI-powered solutions and up skill the society, as people are the key element for a competitive Europe.

Understanding Artificial Intelligence

In November 2017, in the European Parliament I hosted the second edition of the high-level conference #Regulation4Innovation where policy-makers, industry representatives and citizens came together to discuss the advancements and the solutions AI already provides in our everyday lives. Commissioner Moedas, Belgium's Deputy Prime Minister Alexander De Croo, Denmark's Tech Ambassador Casper Klynge and representatives from Sage, Google, Cisco and Facebook agreed that AI has a positive net value for society, but the biggest task ahead of us is to build trust in customers and tackle the misperceptions.

It appears that in many instances we do not even notice the help provided by AI-powered apps and technologies. Assistants such as Siri, Cortana, Alexa and Google assistant have become a part of our daily tasks and routines, helping us get a hold on our most important asset: time. However to find out what the artificial intelligence can and cannot do, we need to understand its capabilities and limitations. Data is the oxygen of AI, and AI is only good as far as the data provided is of quality. For more than a year, I have been advocating for free flow of data in Europe - a cornerstone legislative initiative that was confirmed in July 2018. Removing data localisation restrictions is the most important factor for the data economy helping double its value to 4% of GDP in 2020. But one initiative is not enough to bring the desirable change in attitude towards AI. A comprehensive approach is paramount - positive outcomes and solution powered by data and artificial intelligence shall be communicated widely, not only within the tech bubble.

Embracing Artificial Intelligence

AI enables breakthrough inventions and solutions in sectors such as healthcare, agriculture, transport and even education. And this is just the beginning. To succeed in the age of the Fourth Industrial Revolution we need a strong cooperation and shared sense of mission across government, industry and civil society. We must not compete with AI but rather work with it.

A very promising example of platform embracing AI, connecting people with projects and ultimately leading to the creation of trust in stakeholders and citizens is the Trust-Factory.ai. Inspired by the UN AI for Good Summit 2018 the Trust Factory is a matchmaking exercise that introduces "problem owners to solution owners." AI initiatives like this must be open to the public – as the world wide web was once given by Tim Berners-Lee for free – thus giving the all human kind an equal opportunity to benefit from the connected world and the knowledge pool.

It is without a doubt that AI is one of the strategic technologies in the 21st century and Europe has the right mix of knowledge and capabilities to be competitive on a global scale. Not to be overlooked, the core European values are setting the direction for an ethical AI - and this is where our competitive advantage lies. Europe is making sure that data is not only protected, but citizens have control over it. Europe will be working for AI that is fair, safe, inclusive and transparent and where liability and accountability are clear. This does not necessarily mean that Europe has to regulate AI, rather to establish the ethics around it. Investment is key and the Commission is increasing the resources to €1.5 billion for the period 2018-2020 under the Horizon 2020. This is expected to trigger an additional €2.5 billion of funding from existing public-private partnerships, for example on big data and robotics. Nevertheless, one piece is missing and this is the national debate on AI and how it impacts our society and industry.

Up-skilling people

Understanding and embracing AI will not be possible without the key element of our societies, industries and policies - the people. There is no disruptive innovation that had happened by itself - talented human factor had always been the trigger.

Estimations show that 65% of the kids entering school will graduate and work in jobs that do not exist today! Investments in up-skilling and re-skilling our citizens are necessary. A resilient workforce is the solution against the fear-mongering rhetoric of populists who claim people will be put out of jobs. If we use the power of AI to prepare people for future jobs, those who resist these changes will have less arguments to make against them.

By 2020, it is estimated that about 30% of the desirable skills for an employee will be comprised of soft skills - such as emotional intelligence, teaching others, interpersonal communication, critical thinking, problem solving and teamwork. AI will hardly become better than humans in any of the above-mentioned skills. Instead, we can combine the power of human capabilities with the technological opportunities of AI to accomplish even greater tasks and convert the digital euphoria into a permanent engine for the economy.

Artificial Intelligence: Optimizing Industrial Operations

Thomas HAHN

Chief Software Expert Siemens AG Corporate Technology

Manufacturing industries today benefit from technology trends such as Artificial Intelligence and is adopting new business models!

All digitalization initiatives for manufacturing industries worldwide should be driven by the essential requirements of - reduced time-to-market, enhanced flexibility, guaranteed increase in quality and efficiency.

Technology trends and digital business models will support this! We therefore expect in the next five to ten years for the real and the virtual worlds to continuously merge. The entire value-added chain will be digitalized and integrated from product design all the way through to on-site customer service.

Additionally, it's important to consider a value-network perspective, i.e. looking to entire ecosystems of companies involved in value-networks. The ecosystems will increasingly be shaped by platform-providers, which offer their open platform based on open standards to their customers. The economic success and sustainability is driven by ecosystems which need to have a critical size, speed is also necessary for the development of ecosystems.

Artificial Intelligence plays an important role for Manufacturing Industries and is supporting the achievement of customer benefits

Artificial Intelligence (AI) is currently generating a lot of hype, especially since Google software defeated the world-best Go players. From an industrial point of view AI means algorithm-based computer systems that provide machines with capabilities such as perception, reasoning, learning and even autonomous decision-taking. AI is based on the perception and interpretation of vast amounts of information (data), which might originate from multiple and heterogeneous sources, such as sensors, images, language or text. From this information, software draws conclusions, learns, adapts, adjusts parameters accordingly (e.g. in feedback loops) and generates hypotheses. In the end, it reaches decisions on its own or makes recommendations that human partners can use to underpin their own actions.

With recurrent self-improvement and self-coping AI systems – ultimately the essence of AI technology compared to conventional programming code – there is seemingly no upper limit to AI applications in society and the economy. The prospect of machines that

Amberg more than 1,000 SIMATIC products are produced with a quality rate of 99.9988%. This is achieved by collecting data from a wide range of data sources from product, throughout production, all the way through to services, analyzed with the help of e.g. AI technologies to generate valuable insights to help improve business processes.

Examples of how AI can add value to our customers include:

> Availability guarantee for train service. Outcome is a significantly increased on-time rate and as a result due the high reliability passengers switched from aircraft to train

> At the biggest man-made machine at CERN huge amounts of data/messages are collected and analyzed to enhance the availability of the system – the LHC Large Hadron Collider!

> Autonomous learning is helping to reduce the NOx emission from our gas-turbines by 15%-20%

Siemens research focus		Example use cases
Distributed AI / AI on the edge: Bringing AI down to the field	**Analytics for non-experts:** Data analytics tools for MindSphere	Using data analytics to guarantee availability and performance of high-speed trains
Deep reinforcement learning: Autonomous control applications	**Digitalized domain know-how:** Capturing and using knowledge	Using machine learning to diagnose control data of CERN's large hadron collider – the worlds most complex machine
Machine intelligence: From perception to cognition and decision	**Artificial engineer:** Automation of engineering tasks	Using autonomous learning to reduce NOx emissions from gas turbines
Digital companion: Context-specific decision support on site	**AI-driven enterprise:** Using AI to re-invent internal processes	

are self-operating and have data analysis and context-specific decision making capacity beyond the level of human performance must be taken seriously, especially regarding the consequences, benefits and risks.

Real examples for the usage of Artificial Intelligence in Manufacturing Industries exist today!

Siemens are using AI technologies in our own plants. In the electronics assembly factory

A potentially holistic approach to addressing the challenge!

Siemens has recognized the potential of AI very early, and has been conducting active research in this area for more than 30 years. Neural networks were already being used in steel mills back in the 1990s. Today, at Siemens Corporate Technology about 200 experts are working on data analytics and neural networks. All in all, the company employs about 500 AI experts.

Europe needs to ensure it obtains a leadership position in the development of advanced AI techniques necessary to foster the continued growth and a strategic advantage in the global economy.

We see a real benefit, an opportunity for us and for European industry to obtain benefit from industrial data e.g. AI technologies – where we know the domain and context in which the data is produced.

In January 2015, the *Big Data Value* PPP (Public Private Partnership) was initiated together with the EU Commission. The *Big Data Value* PPP (Public Private Partnership) - an industry-led organization representing large businesses, small and medium-sized enterprises (SMEs), and research organizations in Europe - defines the strategic research and innovation agenda for Big Data and AI technologies as well as so-called iSpaces establishing test environments for joint data experiments. This foundation has been established for implementing real applications that incorporate domain industrial know-how and that help to continuously advance technology expertise. In addition, joint initiatives with technology-wise closely related / complementary PPPs help to foster promising technological advances at the intersection of technical boundaries.

Artificial Intelligence as a job supporting machine

Artificial intelligence is not the dreaded job killer, but rather a job supporting machine - and on top of that a very promising opportunity for us. However, it is a prerequisite that European industry, together with politics and academia, work together to develop a master plan similar to the Industrie 4.0 initiative and that companies - from corporations and SMEs to craftsmen - can use AI extensively for their needs. Today, Industrie 4.0 is a household name throughout the world and will in future be upgraded by artificial intelligence because this technology will permeate everything, be it IT, production, plant operation, the products themselves or services. Ultimately, there is much greater potential in industrial AI than in the use of AI for the consumer industry!
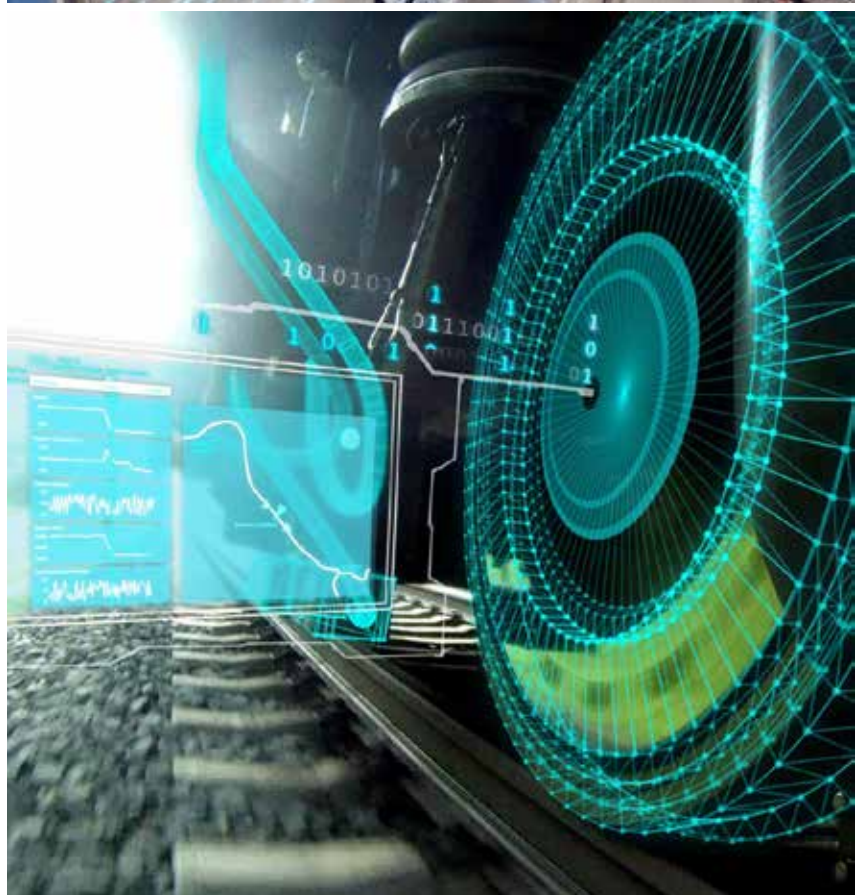
Building a human-centric AI strategy in Europe

Cecilia BONEFELD-DAHL
Director-General DIGITALEUROPE

The opportunities we can see with Artificial Intelligence (AI) benefitting society and the economy is only limited by our imagination. AI represents a very broad array of data-driven digital technologies bridging gaps in society and connecting everyone across borders. AI can save lives and become the new growth driver for Europe, however we must ensure that our younger generation has the skills and the understanding of AI, and that the companies and institutions know how to include it, and the time is now! AI is not future sci-fi - it is already here, and it is a useful tool for humanity.

Today we are beginning to see progress in the healthcare sector. For example, diabetic retinopathy is one of the fastest growing causes of blindness globally. Even though such pathology is preventable, developing countries do not have enough ophthalmologists to provide screening and diagnostics. Machine learning can now be used to scan pictures of patients' retinas, flagging those that present signs of the illness to a doctor. This ensures people who need treatment seek it and allows doctors to use resources more efficiently.

The EU can benefit from AI which will accelerate our strongest industries. Europe already has a manufacturing sector with one of the highest concentrations of advanced robotics, where AI will boost capacity, value, efficiency and sustainability for all industries. When applied to the manufacturing sector, AI will boost Europe's potential to be a world leader for the development of cutting edge technology such as connected vehicles. While also paving the way for a more eco-friendly and secure industrial landscape and transportation sector, all these technologies play an important role in improving productivity and making innovative services available.

Digital age requires digital infrastructure and digital education

But to fully realise this potential we must continuously advocate a comprehensive innovation strategy, across public and private sectors, education and investment. For instance, the digital age requires vital digital skills to be embedded in every national education system. It has become urgent to enable our youth as well as the workforce to possess the right set of skills for them to make an impact in the digital age. It's equally important to bridge the existing gaps in market capital access and investments, for the EU to remain competitive and become a global innovation powerhouse. Finally, we need to continue building the communications infrastructure needed for an a ubiquitous digital environment. This requires more investment to make sure that no EU region or community is left behind.
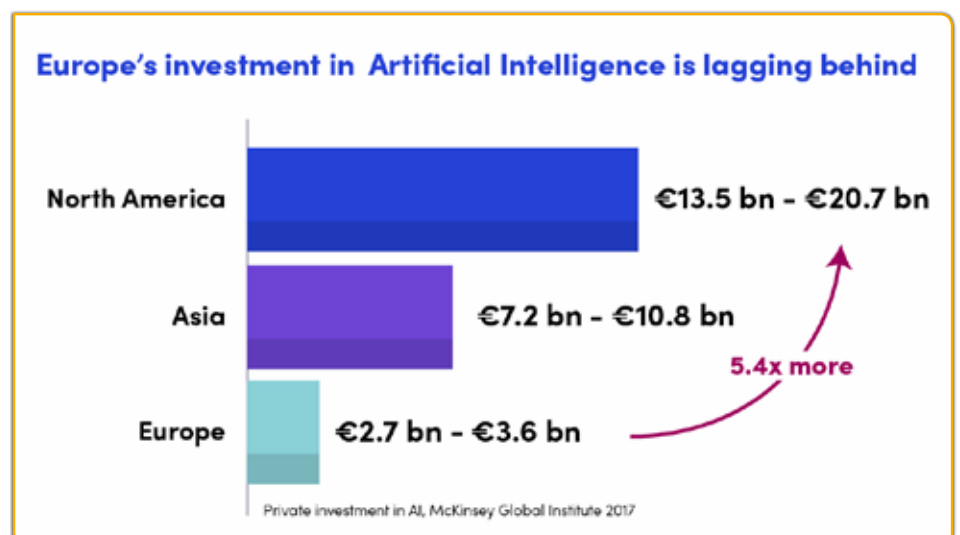
We also face challenges with the advent of these technologies that can be poorly used or misunderstood. To pre-empt that from occurring we need a holistic vision.

AI, robotics and data-driven technologies should always be seen as tools enabling human activity - either social, humanitarian or economic. Conceiving and rolling out a human-centric AI, that respects our common values and norms, is the way forward. Europe already has a rich and diverse cultural tradition, with some of the brightest and most innovative minds in the world. This can give us a strong competitive edge to ensure that there is an acceleration in the diversity of developing non-biased data, programming and the development in areas such as linguistics and translation.

Industry and researchers are listening closely to academia and civil society on issues of fairness, accountability and transparency to address concerns of bias and discrimination. We believe the best way to reduce bias is through robust data policies that can make available high-quality data sets. The better the input, the better the output. Keeping this in mind ensuring there is an open, inclusive and international dialogue on ethics will be important for developers, implementors, users and regulators of AI technologies. Many companies have set in place constant re-evaluation processes, to detect anomalies, and quickly correct flaws.

We need a global framework ensuring that AI is used for good and innovation

Together with a renewed education system, both for training a diverse generation

Europe's investment in Artificial Intelligence is lagging behind

North America €13.5 bn – €20.7 bn
Asia €7.2 bn – €10.8 bn
Europe €2.7 bn – €3.6 bn

5.4x more

Private investment in AI, McKinsey Global Institute 2017

of software engineers as well as educating everyone's awareness on the role of digital technology, we can be confident that Europe is ready to benefit from AI.

Much work remains to be done but it is already a positive signal to see many European countries stepping up and integrating programming or computational thinking in their curricula, also as a way to boost other competences such as problem solving, logical thinking and creativity. Schools are opening to technology thanks to initiatives such as the EU Code Week, but more must be done!

Although digital is part of everyday life, children are not necessarily digitally savvy. In 2017, only 13% of young people (age 16-24) had written a computer programme, ranging from 2% in Romania to almost 30% in Denmark.[1] It is important that children are

1 Eurostat, 2016

exposed to technology at early ages, when they can develop digital skills and learn how to use the internet and smart devices in a safe and intelligent manner.

Many challenges are ahead of us, and a comprehensive EU strategy is of paramount importance. We need to work hand in hand together across ages, sectors and borders to build that strategy for AI that leaves no one behind. This would be a great step towards European unity. It would also pave the way for a global framework ensuring that AI is used for good and innovation, while being a chance for Europe to take global leadership. These opportunities are to be seized now for an open international dialogue on tech policy alignment.

Dialogue between all stakeholders and a long-term strategy is of critical importance

In this context, I was pleased to participate in such discussions for common AI ethics at

the Japan-EU ICT strategy dialogue in Tokyo earlier this year, and I am honoured to be part of the European Commission's high-level expert group on AI, where we can discuss the principles of ethics as a guidance to developers and users.

Dialogue between all stakeholders and a long-term strategy is of critical importance. We must go beyond an elite discussion and consolidate our views to demonstrate leadership in the EU and support the Member States in defining and implementing AI into the lives of citizens for the benefit of an inclusive human-centric society – through a strong ethics framework, investment, education, empowerment and innovation friendly policies.

Eurostat, 2017
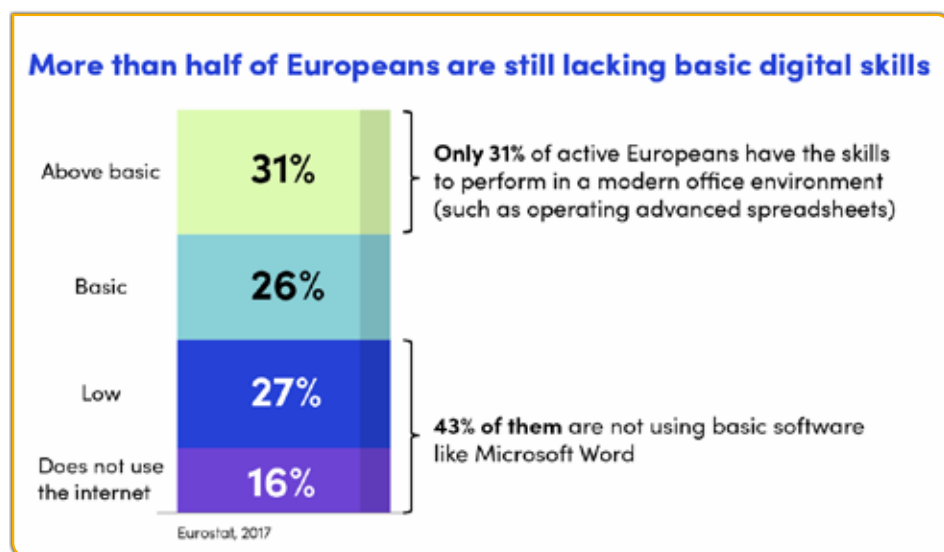
Ensuring European leadership in Artificial Intelligence (AI) for industrial applications

Alain DEDIEU

Senior Vice President, Strategy, Industry Business, Schneider Electric

Artificial intelligence technologies could increase global GDP by $15.7 trillion, a full 14%, by 2030[1]. Industrial markets are probably the most likely to benefit from wide deployment of these new technologies. Considering Europe has a very strong position in industry as a leader in smart manufacturing (the World Economic Forum considers that five of the top nine manufacturing "lighthouses" are in Europe)[2], there is an opportunity for the European Union to take a leading role in the development of such emerging technologies, and their application in the industrial world.

How? By ensuring a coordinated, EU-wide approach that leverages the best innovation and investment practices from each country and breaks down current nationalised and siloed policies. At Schneider Electric, we see four key areas where common policies and practices can help to increase investment in AI technologies in Europe.

1. Data must be easy to access and combine

The first and most critical consideration to get the most value from AI is to create a data-friendly ecosystem with integrated data models and the ability share data across different platforms. This ensures data can be leveraged when building, using, and improving (in real time and by self-learning) AI in industrial applications.

Data scientists spend about 60 percent of their time cleaning up and organising data[3], and acting as "data janitors"[4] before they can even think about analysing data and applying it to specific community problems. If we want to enhance the contribution of data scientists in both small and large companies, which will encourage investment in AI, we need alignment on data semantics and the creation of reference models to make data compatible and easily integrated and aggregated to be analysed. This alignment must take as a single EU market and, in addition, at least data models and semantics must also be aligned at an international level.

The only way businesses will invest is if it is easy for different information to be gathered and put together. If data proves to be a "roadblock" then investment will certainly be slow, and the potential contribution of AI to GDP growth reduced.

We also believe that the emergence of multiple industrial platforms that serve data is critical to develop new applications and new solutions for advanced services using AI, particularly in industrial markets where applications and uses cases are diverse and still under development. Such an ecosystem should be encouraged at a EU level and it should encompass big companies, small-to-medium enterprises, and start-ups to ensure a wide field for experimentation and foster the right conditions for innovation.

2. Trusted data infrastructure and policies and procedures must be implemented and monitored

Collecting, storing, and working with the type of data required to feed AI needs a high level of infrastructure, reliable power, and a cybersecure environment. To facilitate data processing and design effective and efficient AI models, it is necessary to invest in high performance infrastructure and high-end computing systems, including the ability to run applications at the edge to reduce latency and increase reliability.

In addition, to accelerate innovative services and effective AI, trusted policies and procedures on how de-identified, geo-localised data can be collected and used must be built. The recent General Data Protection Regulation (GDPR) goes some way to developing these models of trust. But to go further to promote investment in AI and allay concerns over data collection, use, and storage, companies must be transparent in the way that data is used and how AI models are built (as much as the technology will allow).

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1 *PriceWaterhouseCoopers*

2 https://www.weforum.org/press/2018/09/europe-asia-lead-the-way-to-the-factories-of-the-future/

3 CrowdFlower

4 MIT Technology Review

3. Investment in skills, training, and education

Investment in training and education is essential to develop AI and to upskill people to gain all the potential benefits offered by AI. Training should focus on the combination of AI technologies and the development of human expertise to ensure that the best combination of both can be put to work to ensure the strong development of digital AI industrial applications.

AI represents a new way for humans and machines to work together – to learn about predictive tendencies and to solve complex problems. In industrial applications, many variables need to be factored in to achieve a successful outcome – and the quality of the data that trains the AI algorithms needs to be combined with the human expertise, which is always needed for interpretation and guidance. With the support of AI to make better operational decisions, critical factors such as safety, security, efficiency, productivity, and even profitability can be optimized.

At Schneider Electric we are fostering applications leveraging the latest AI innovations to support self-decision making by machines and processes, combined with human intervention as needed. In the Oil & Gas industry our Realift™ rod pump control leverages Microsoft machine learning capabilities to monitor and configure pump settings and operations remotely. After a learning phase with experts, the AI model can detect data anomalies in temperature and pressure, for instance, and can flag potential problems. In this scenario, intelligent edge devices can run analytics locally without having to access the cloud. As we mimic the expert diagnostics, predictions can be easily validated, explained, and interpreted. This means that operators are only needed onsite for identified maintenance when the application indicates that something will go wrong – which can create a lot of savings when maintaining expensive, remote assets such as oil pumps.

4. The co-existence of human intelligence and AI

AI is not a direct replacement for humans and we do not anticipate that machines will replace the advanced capabilities of interpretation and decision making that human beings bring to industrial operations. The co-existence of both will require a political definition to be created and regulated – where ethical considerations are at the heart of any such regulation.

Not only do we need to invest in the technical skills of programmers, designers, and coders, but we also need to define the framework of their responsibilities for the outcomes of shared decision making between machines and people. To achieve this, it is essential that private companies, academia, and governments work together to develop the understanding of the technology and its applications and define what needs to be regulated in regard to the broad usage of AI. It's also essential that the different skills and tools for the design, validation, control, and audit of AI models are accessible to diverse people and groups in order to provide well-rounded regulation considerations on any AI model.

In conclusion, AI brings with it the great potential for innovation to dramatically increase the productivity of industrial assets, better manage the evolution of the workforce, and achieve a more sustainable use our planet's resources.

European and International Standards for the next digital revolution

Elena SANTIAGO
CID – Director General, CEN-CENELEC

The 4th industrial revolution: a primer for AI

Today, industry is undergoing the fourth industrial revolution, driven by digital transformation through the uptake of a new generation of digital technologies including the Internet of things, Big Data and Cloud Computing. This digitization of industrial systems, processes and supply chains gives rise to a wealth of opportunities, but also brings new challenges and threats in data security, privacy and trust.

AI represents the next disruptive revolution of ICT and will play a vital role in the on-going digital transformation of European industry, but is AI not the 4th revolution? Indeed, it is an essential technology, which will influence all digital devices and applications, processes, systems and supply chains, bringing another layer to the already complex landscape of the interconnected world, as well as new challenges and opportunities.

Standards in support of the digital transformation of industry

The success of AI uptake by European industry relies on the effective engagement of, and a common understanding with all stakeholders, from network operators, suppliers, equipment manufacturers, ICT professionals, consumers and regulators, to standardizers. CEN - the European Committee for Standardization and CENELEC - the European Committee for Electrotechnical Standardization, offer a platform for those stakeholders to discuss their needs, facilitate consensus at European level and agree on state-of-the-art solutions ensuring principles of transparency and openness.

In 2017, CEN and CENELEC explored the need to further improve the effective standardization environment in support of their traditional sectors such as manufacturing, healthcare, mobility, services, living or energy. This resulted in the establishment of the "Strategic Plan for Digital Transformation" to support the digitization of European industry with a flexible and timely standardization response, offering modern tools and platforms to develop machine-readable and interpretable standardization solutions. To lead the digital transformation of European standardization and get closer to industry, CEN and CENELEC will establish key partnerships to ensure cross-fertilization between industry sectors and horizontal digital domains, such as cyber-security and data privacy, and the uptake of innovative development.

This Plan has been complemented in 2018 with a "Strategic Innovation Plan" to engage with researchers and innovators through recognizing research contributions as well as offer deliverables and processes that meet researchers and innovators needs through a fast–track approach.

European Standards & AI

European industry is digitizing its processes and systems and therefore increasingly using digital technologies, calling for rapid and agile solutions to address the ever-raising level of technical complexity.

European Standards provide a basis for the integration of technologies into complex systems, prevent vendor lock-in, and facilitate interoperability and data exchange. This is key at a time when traditional sectors, that have not previously used IT, need IT standardization responses.

However, the already existing complex landscape of standardization responses needed will expand, not only in terms of safety and product liability but also in softer aspects, like privacy and ethics, which will have to be addressed appropriately.

AI is a new area for CEN and CENELEC where we firstly need to understand the relevance for industry, the consequence on their on-going digital transformation and the specific industry's needs to support the up-take of AI technologies, platforms and applications to be covered by standardization activities.

The move to the AI space can be organized around a clear strategy based on real and bottom-up needs. To this end, CEN and CENELEC, are organizing a workshop to receive appropriate input from relevant stakeholders, pinpointing how standardization can support the up-take of AI technologies and ensuring that the CEN – CENELEC system can provide the flexible and agile responses needed at European or International level.

The event will address the importance of AI for Consumers and Industry, exploring what trust means for humans and how to ensure the perception of trustworthiness in AI systems.

The outcome will define the main themes for standardization action needed at International level through ISO, IEC including ISO/IEC JTC1 or at European level through CEN and CENELEC.

The digital world is indeed not limited by national borders – an international approach is always preferred when market relevant, giving rise to the opportunity to address global requirements related to sectors as robotics, healthcare or transport. CEN's and CENELEC's links with ISO and IEC are key strengths and we will take full advantage of the significant international ICT standardization activities that meet the needs of European industry. European specific context and values linked to AI, are also addressed in the CEN and CENELEC standardization acivities, in particular data protection, digital rights and ethical principles such as accountability and transparency.

CEN and CENELEC are building on their significant 'footprint' in 30 industry sectors, all undergoing digital transformation, being the key providers of digital standardization solutions including AI standardization in support of European industry and society.

www.cencenelec.eu

Artificial Intelligence: A "Game Changer" for Cyber Defence

Guillaume TISSIER

Managing Director of CEIS

Humans are unable to single-handedly deal with cyber attacks. There are several reasons to this: the volume of attacks, their constant mutations, the speed of reaction they require, and the lack of expertise on the market. Artificial intelligence (AI), already widely used in fraud prevention, increasingly appears to be a major "game changer" in cybersecurity, in particular in defensive cyber warfare.

What role for AI in cybersecurity?

AI has become a marketing buzzword that covers diverse realities, with some solutions relying more on engines made of sophisticated rules than on real AI features. AI relies on capacities for:

> environment perception through training, whether supervised or not;

> analysis and problem solving;

> action proposal, or even autonomous decision-making.

Theoretically, **AI could greatly contribute to cybersecurity, in terms of prevention, anticipation, detection or reaction**. Practically speaking, vulnerability or threat detection is one of the most mature uses of AI. Action is needed quickly since the existing detection systems based on signatures are showing their limits: high number of false positives; incapacity to adapt to the latest threats, especially APTs; and cumbersome signature databases, which impact performances. After detection, incident response is also largely impacted by this trend. Indeed, the idea is to multiply the efficacy of SOCs and CSIRTs by granting ever increasing intelligence to SIEMs. Finally AI is used for authenticating users

from a footprint established through the analysis of their own behaviour (see DARPA's Active Authentication programme[1]).

Beyond the technical layers of the cyberspace, AI can also play an ambivalent role on the semantic layer since it allows the creation of fake news at an *industrial level* - as demonstrated by the fake speech of Barack Obama produced by the University of Washington[2] - while facilitating their detection. DARPA just launched a forensic media *programme* to certify information[3].

AI will therefore progressively permeate all cybersecurity technologies and processes.

If using technology for cyber defence purposes seems then promising, its limitations should also **be taken into account as they are less technological than human (understanding AI) and psychological (accepting AI).** Are we ready to let machines make decisions that may have severe implications? For instznce, IP address blocking, and *especially* attack identification, are decisions that involve "commitment". Generally speaking, AI **cannot replace human intelligence. Its mission is mostly to enhance it.** This implies that technology is not a black box: users must be able to follow and understand the various reasoning stages and understand the decision. This is the essential *prerequisite* for the trust that they may or may not put in the system.

What cybersecurity for AI?

The connection between AI and cybersecurity has therefore a negative side linked to the misuse of technology which can be the victim of embezzlement and attacks.

> **attacks by cache poisoning** : injecting biased or poor quality data during the training phase. Tay, Microsoft's *chatbot* (or conversational robot) was one of the victims[4]…

> **attacks by inference**: forcing AIs to disclose their internal operation (thresholds, rules…) by using various scenarios. This method is

already widely used by cybercriminals to deceive fraud prevention systems.

> **deceiving AI systems** by slightly modifying their environment, as Google researchers recently demonstrated with image recognition[5].

At the military level, these risks are all the more worrisome in that AI will soon be omnipresent in weapon systems, which some countries envision to be largely autonomous in the near future. While the United States primarily conceives AI as a mean to increase human performances, both at the physical and cognitive levels, Russia is working on the full automation of some platforms. **The aim is to robotise 30% of military equipment by 2025 in order to progressively exclude human beings from the frontline**. In this global competition, China has not been left behind and is now seeking to use civil technologies as a lever for its military capabilities with the ambition to become a world leader by 2030.

AI **has therefore become a major sovereignty issue.** In view of the proactive approach of its Russian, American and Chinese competitors, France has a card to play, both scientifically and with regards to available data and industrial outcomes. It is therefore a matter of **creating the conditions for the security of artificial intelligence and trust in this technology.** Firstly, **by investing in artificial intelligence security;** secondly, **by defining an ethical framework** to reconcile the right to oblivion and data protection: finally, by focusing efforts on a few sectors in which France is a leader. Cybersecurity is definitely one of those.

As a matter of fact, the French President recently presented France's ambitions and strategies related to AI[6] and set 4 priorities:

> To strengthen the AI ecosystem to attract the best talents;

> To develop a policy for opening up data;

> To create a regulatory and financial framework in favour of the emergence of AI champions;

> To initiate a discussion on AI regulation and ethics.

1   https://www.darpa.mil/program/active-authentication

2   https://www.sciencesetavenir.fr/high-tech/le-vrai-obama-prononce-un-faux-discours-un-trucage-criant-de-verite_114855

3   https://www.darpa.mil/program/media-forensics

4   https://www.lemonde.fr/pixels/article/2016/03/24/a-peine-lancee-une-intelligence-artificielle-de-microsoft-derape-sur-twitter_4889661_4408996.html

5   http://www.ladn.eu/tech-a-suivre/hello-open-world/des-pirates-ont-reussi-a-hacker-lia-via-les-attaques-adversarial/

6   https://www.gouvernement.fr/argumentaire/intelligence-artificielle-faire-de-la-france-un-leader

Research projects on robotics and AI: Public-private partnerships and European funding prospects

Eva KAILI

MEP (S&D Group), Member of the ITRE Committee

Artificial intelligence is one of the most discussed topics in the fields of science and innovation the last couple of years turning it into one of the most strategic technologies of the 21st century. It has achieved spectacular results in helping us deal with challenges ranging from operating and treating chronic or other diseases, to enhancing our capacities in our everyday occupations and simplifying our lives overall.

As the EU aspires to be a global leader in the field of investing in research of AI we need to have a strategic plan in order to focus on fields that the will benefit the most from public investment. It is common knowledge that some high-risk, high-reward fundamental research funded by public money across the world, has led to revolutionary technological discoveries which have enhanced our standards of living, such as the internet, GPS, heart monitors and cancer therapies.[1]

First of all, it is of utmost importance that the EU becomes an attractive area for private investments which coupled with public funding can propel the EU to becoming the biggest investor in the world. We need joint effort and coordination at national (member states) and EU levels. We have seen already President Macron in France, promising further public investments in France, which is very welcome, but I strongly believe that Europe as a whole, has to join forces in that direction.

In April 2018, the European Commission launched its communication "**Artificial intelligence for Europe**" which sets its main strategy to put AI at the service of Europeans and to enhance the EU's competitiveness on this field. This communication shows the willingness of the EU to boost investment in AI research to 1, 5 billion euros by 2020, which constitutes an increase of almost 70% in an attempt to catch up with global powers in the field, such as the USA or China.

In terms of public funding the EU is going to increase investments on AI under the Horizon 2020 to 1,5 billion by the end of 2020 which is clearly not enough compared to what China and the USA are spending, but we have great hopes that this amount will be increased in the following decade. We must also stress that through the European Innovation Council (EIC) the Commission aspires to strengthen innovation - including AI with a budget of 2,7 billion euros for 2018-2020 in total.

But is public funding alone enough? The European Commission admits that overall, Europe is behind in private investments in AI which totalled to around 3 billion euros in 2016, compared with 6.5-9,7 billion in Asia and 12,1-18,6 billion in North America. [2]. But Europe has a powerful financial tool at its disposal. As rapporteur of the ITRE committee on EFSI 2 in the European Parliament, I also share the idea that the EFSI can be mobilized to attract further private investment in AI as well, something it has achieved successfully already in other sectors. The optimistic scenario for Europe is to attract at least 20 billion euros in total private-public investments in AI by the end of the 2020. We cannot aim for anything less, if we don't want to lose the fight on who will be the global leader on AI technology.

In terms of PPPs the European Commission, together with the European robotics industry, research and academia, joined forces to launch a new program in order to boost the competitiveness of the sector. The PPP in Robotics covers all the innovation steps, from R&D to testing and piloting in real settings of innovative robotic technologies. Therefore the Partnership for Robotics in Europe (SPARC) with €700M in funding from the Commission for 2014 – 2020, and triple that amount from European industry, SPARC is the **largest civilian-funded robotics innovation programme** in the world. [3]

Last but not least, we must not forget that investing in AI research and aiming to attract investments should go hand in hand with investing in educating Europeans on all aspects of AI and on where and why a big sum of public money is spent on it. We have to be sure that the technological advancements of AI are communicated and understood fully by the citizens and that we, politicians are allocating funding for information campaigns and the acquisition of advanced digital skills including AI-specific expertise. Furthermore I strongly believe that public funding to AI research and development has to go hand in hand with ethical standards. This means that all parties conducting AI research have to respect an EU ethical conduct before being able to apply and get EU funding. This is the reason we have to create an EU code of ethics on AI.

Concluding, as an MEP, and Chair of STOA (Science and technology Options assessment) panel in the European Parliament, I will work with all my colleagues in order to support the European Commission in every ambitious proposal for funding on AI for the next EU MFF (2021 - 2027), a position that has to also be reflected in the AI report that the European Parliament is set to start drafting in September of 2018 if all the political groups agree on it. My view, is that Europe can be the leader of the Second Machine Age and lead in the era of Blockchain and Artificial Intelligence, just like the US was the global leader in the era of internet.

[1] https://www.nitrd.gov/PUBS/national_ai_rd_strategic_plan.pdf

[2] https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe

[3] https://eu-robotics.net/sparc/about/index.html

The legal status for robots has opened the public debate on liability

Mady DELVAUX-STEHRES

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Over the next few decades, the increased use of robots and AI will not leave any stratum of society untouched. As technological innovation continues to get ever faster, robots and AI will play an increasingly important part of our daily lives. This can bring huge benefits to our societies by assisting us with difficult and unpleasant tasks.

The EU has huge potential in the field of robotics and AI: talented entrepreneurs, motivated research centres and a great consumer market. It is an important opportunity that we have to seize now.

Indeed, **we need clear rules to ensure robots serve human interests at all times and t**he rest of the world is not waiting to be led by Europe on this issue. If we don't decide how we want to shape our future, it is highly likely that China and the USA will decide for us, leaving the EU as simply a follower.

With the advent of robots and AI, we are facing new challenges that we urgently need to address: ensuring safety by standardisation, defining ethical principles to frame the development of these new technologies, monitoring the development on the job market, adapting our educational systems to ensure our children are well prepared for the future, and last but not least adapting the liability regimes where necessary.

With regards to the last point, my concern as a socialist MEP lies in the guarantee of compensation to victims: Does the applicable law permits a compensation to victims of accidents implying robots?

Currently, the general rule is that the producer is liable for the accidents caused by the defect in his product. To be compensated, the victim has to prove the damage, the defect and the causal relationship between defect and damage. With the development of smart autonomous robots and AI, it is very unlikely that the current liability rules are still adequate.

For instance, the multiplication of intermediaries makes it difficult to identify the liable producer for the damage caused.

Another crucial point is that the degree of autonomy reached by the self-learning robots makes it difficult for the victim to prove the causal link between the defect product and the damage. Was the product already defective when it was put on the sales market or did it become defective after its circulation? Moreover, how to prove the defect of the product? What is the degree of safety which can be expected by the consumer? And who can control this degree of safety?

And last but not least, would a reversal of the burden of proof provide more protection to consumers?

The most difficult task is to identify which liability regime is the most convenient one to be applicable in this field. In the report on civil law rules on robotics, we asked the European Commission to study different possible liability regimes that always keep the human and not the robot at the centre of attention.

The first possibility is the strict liability regime. It requires only proof that damage has occurred and the establishment of a causal link between the harmful functioning of the robot and the damage suffered by the injured party. I don't think that it is a balanced solution for all protagonists.

Another solution could be the "*risk management approach*"[1]. This approach does not focus on the person "who acted negligently" as individually liable but on the person who is able, under certain circumstances, to minimise risks and deal with negative impacts. In my opinion, it is the most reasonable approach as it permits to protect consumers without stifling innovation.

In addition, there is the possibility of an obligatory insurance scheme, as it already exists for vehicles. Nevertheless, unlike the insurance system for road traffic which covers human acts and failures, an insurance system for robotics should take into account all potential responsibilities in the chain. This insurance system could be supplemented by a fund in case no insurance cover exists for the damage caused.

The most controversial point enumerated in our report, is the one of the creation of a specific legal status for robots in the long run. The idea behind was that at least the most sophisticated autonomous robots could be established as having the status of electronic persons responsible for making good any damage they may cause, and possibly applying electronic personality to cases where robots make autonomous decisions or otherwise interact with third parties independently.

As this topic was highly debated in the European Parliament and in the media with a lot of misunderstanding and misinterpretation, I want to clarify our will: We did not want to give robots human rights! It was simply a matter of studying the need, in the long run, to create a legal fiction to ensure the triggering of a guarantee fund for the victims when the autonomy of the robots could not allow the determination of the person liable. There have been many criticisms of the producers' disempowerment and I do not find them unjustified. However, I just wanted to start the public debate and stay open to all possible solutions. I do not pretend to find the panacea alone. I think that in this sense, I reached my goal

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Artificial intelligence and the right to informational self-determination

Mathias CELLARIUS

Global Data Protection Officer;
Head of Data Protection and Privacy
Head of SAP Export Control

Artificial Intelligence (AI) will be a core driver for innovation, growth and productivity. It will help to effectively address some of the most pressing societal challenges in areas such as healthcare, traffic congestion and disaster management. At the same time, AI raises legitimate social and ethical concerns like its impact on jobs, privacy and possible loss of human control.

Benefits of new technologies vs data protection and privacy risks

While most people enjoy the benefits of digital technology, of being able to connect themselves and communicate at anytime and anywhere, there is also a growing unease among individuals about possible misuse of their personal data and the increase of cyber threats. Data protection and privacy laws have been conceived to protect people against the threats of a digital world. Today their purpose is more relevant than ever. Unfortunately, achieving a well-functioning data protection framework is challenging. Striking the right balance between the benefits of new technologies and managing data protection and privacy risks may very well be one of the biggest challenges of our times.

AI only becomes meaningful when it has access to a large amount of high-quality data, including, in many cases, personal data. The European Union (EU) adopted the new General Data Protection Regulation (GDPR), underlined by traditional data protection principles regarding the legal grounds for data processing, data minimisation and purpose limitation. The former EU data protection law, known as the Data Protection Directive, was conceived in the pre-Internet age. While it has proven to be remarkably resilient, and has been flexible enough to retain relevance even in today's globally-networked world, the emergence of new data-driven technologies and business models has put increasing pressure on the underlying principles.

What is personal data?

The dilemma starts with the definition of personal data. The logic of an expansion in scope of 'personal data' is appealing and sounds simple: the broader the definition of personal data, the more data comes in scope, the more data is protected. However, if all data that can be linked back to an individual comes under the full scope of data protection laws, access to the many beneficial uses of data become uncertain. Companies and authorities are faced with the unmanageable reality that, in effect, all data could be considered personal.

This raises the question whether the concept that has been underlying data protection laws in Europe for the past 20 years – to limit data processing and to keep the digital footprint of a person as low as possible – has failed or, to the contrary, helped prevent the worst. I believe that neither is the case. Data protection and privacy are still relevant, in fact, they are more relevant than ever. Now,

however, it may be time to re-consider its core concepts. If one does not want to go as far as reversing today's general practice of prohibition (the processing of personal data is prohibited unless expressly allowed) to generally allowing the processing of personal data unless expressly prohibited, then we should at least consider introducing statutory permissions that define the boundary conditions for what is socially acceptable. We should start concentrating more on what matters to people and less on what we believe should matter to them.

"Trying to eliminate every remote privacy risk may jeopardise valuable data uses in return for small privacy gains".

Now that the GDPR has been enacted and that, according to some sources, is meant to be relevant for the next 20 years these conceptual changes may be future reflections. Much will depend on how the new law will be put into practice: whether the EU and its' citizens will be able to participate in data-driven, next-generation innovation, or not. At the same time a modern way of interpreting and implementing the regulation should not assume a "one size fits all" approach. Going forward, we should concentrate on what is important: where the individual's right to informational self-determination (the right to determine the governance of his/her personal information) is significantly impacted. Not all data processing is equally intrusive, and not every piece of

data is equally sensitive. We need to recognise the importance of context and how it affects potential consequences to users. Trying to eliminate every remote privacy risk may jeopardise valuable data uses in return for small privacy gains.

Several tools and approaches (foreseen under the GDPR) including pseudonymisation, privacy impact assessments and privacy by design which, when properly applied, can help reduce or minimise the impact on privacy. Companies have the possibility to enact technical safeguards, such as pseudonymising and encrypting data; automating data logging; restricting data analytics; access rights managment; and automating data validation. A legal system that is closely attuned to these additional safeguards will enable organisations to maximise data utility while minimising privacy risks. If companies set tighter controls on access to such data and provide consumers with meaningful controls to start, this should enable more liberal legal treatment and softer obligations.

All fundamental rights must be ensured

In addition, data protection rules do not exist in a legal vacuum. There is no question that privacy and the right to data protection are fundamental rights. However, they must be balanced against other fundamental rights, such as the right to liberty and security, the freedom to conduct business, the right to choose an occupation and engage in work, the freedom of expression and the freedom for the arts and sciences – to name but a few. Informational self-determination is a fundamental element of human dignity but so are the rights to physical well-being and economic prosperity. Therefore, we need to excel in research and education if we want to safeguard these values for the generations to come.

We must foster an approach with innovation, technology, business and European competitiveness in mind, while putting the necessary controls and balances in place to ensure that society will not be put at crossroads. In this context, we must ensure fruitful dialogue, avoiding polarised debate with each side dismissing the concerns of the other. As little as we like the idea of having machines make decisions on our behalf, we must ensure we take conscious decisions on the right balance for the future of Europe. I am not suggesting that key issues around our human individuality and dignity should be subjected to automated, algorithmic decision making. Clearly, the individual is at the centre of society and critical decisions must always remain under the control of a human being. However, in a world ruled by economic principles, our European values will only be able to prevail if we manage to translate them into clear and easy-to-follow rules that people understand and accept and that our businesses can easily implement and comply with.

This A.Ideas series presents opinion pieces based on the discussions from the OECD Conference "AI: Intelligent Machines, Smart Policies"

Spartacus or legal personality as a human right

Evelyne GEBHARDT

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When Spartacus, the probably most famous slave in ancient history started his rebellion against the Roman Empire, desperately demanding freedom, he was, from a legal point of view, claiming for a better definition of legal personality. In other words, he wanted to increase the quality of being a legal person or, even simpler, he wanted to upgrade his legal rights and duties.

Since then legal personality has come a long way. Legal personality has not only been granted to humans, but also to non-human entities like companies or government agencies. Furthermore, in October 2017 Sophia, a social humanoid robot became the first robot to receive citizenship in Saudi Arabia. Today, this is still the beginning of IA and robot technology. However, like humans IA and robots are already capable to understand, to interpret, to analyze, to learn, to choose own goals or to make own decisions by imitating human brain patterns. They build a part of our modern social system and one day they could even pay taxes. Besides, compared to corporate persons they appear to be real. In order to align legal framework with the ongoing technological progress granting them basic legal personality including the right to acquire property or to conclude contracts seems to be the next logical step to take.

In January 2017, the European Parliament seemed to have already taken this next step by adopting its report with recommendations to the European Commission on Civil Law Rules on Robotic (2015/2103/INL). In there the European Parliament called on the Commission, when carrying out an impact assessment of its future legislative instrument, to explore, analyze and consider implications of all possible legal solutions, such as creating a specific legal status for robots. In this sense the most sophisticated autonomous robots could be established as having the status of so called "electronic persons" responsible for making good any damage they may cause, and possibly applying "electronic personality" to cases where robots make autonomous decisions or otherwise interact with third parties independently.

The position of the European Parliament found a huge echo in controversy discussions, though the call on the Commission did not particularly meant to provide AI or robots with direct legal rights. Instead, it was seeking to fill a gap regarding the question of liability in case of damages caused by a robot capable to make autonomous decisions.

There are good reasons not to grant legal personality to AI or robots.

The first one is simple but true. Autonomous robots and AI significantly differ from human beings and unlike legal persons such as firms and corporations, where final decisions are always been taken by humans and only humans are taking the risk and the profit of the consequences of these decisions, this is obviously not the case with AI or autonomous robots.

The second reason is similar to the first: AI and robots significantly differ from human beings; AI and robots are programmed or are programming themselves to follow certain and even complex, but still syntactic rules. Humans do not, at least not necessarily. In Stanley Kubrick's epic historical movie "Spartacus" recaptured slaves were asked in an dramatic scene to identify Spartacus in exchange for clemency. Instead of identifying him each slave responded, "I am Spartacus" hence taking the consequence of sharing his fate. In this scene, the slaves were responding with a simple lie caused by a firm and truly emotional conviction of solidarity and therefore accepting the negative impact of their response. I truly doubt that robots could adopt such a contradictory emotional behavior. Bluntly said: A smart robot cannot be capable to act seemingly stupid.

Finally, autonomous robots or AI significantly differ from human beings. Their sole purpose is to serve humans without any proper will, intended to be used as a highly smart tool. Spartacus, our human role model, was trained or, more precisely, programmed to be a slave. Still, despite all the manipulation of his mind trying to make him accept his destiny he decided to struggle for becoming free man or, in a legal sense to struggle for a higher level of legal personality. Such an ambition was part of his genetic heritage; a heritage we all share from our common ancestors, which constitutes the main difference between human and robots.

Art. 6 of the universal declaration of human rights designates the right to recognition as person before law a human right. In this spirit, I have reluctance in granting legal personality to non-humans, a questionable generosity that appears to be unnecessary and harmful when shifting original responsibility and liability of humans to robots as well as degrading human rights.

My current position to deny legal personality to robots or AI mainly bases on ethical reasons and I am ready to reconsider, if technological progress one day will create smart robots or AI capable to equal individual persons, in particular to decide on the base of emotional convictions and regardless of programed rules. However, if this is happening, it might be the time to reconsider the whole idea of smart robots and AI.

Security and Privacy are paramount in IoT solutions

Catherine STIHLER

MEP (S&D Group), Vice-Chair Internal Market & Consumer Protection Committee

According to a recent survey of IT professionals at large companies, internet of things (IoT) and artificial intelligence (AI) are the chief areas of focus for enterprise investments in new tech this year.

Most of us possess a number of IoT devices, whether it is our mobile phone, or wearables, such as a Fitbit or smart watch.

These web-enabled devices gather, send and act on data they obtain from their surroundings by using embedded sensors, processors and communication hardware. IoT depends on being able to gain insights hidden in the vast and growing seas of data available.

The big problem for us is finding ways to analyse the deluge of data and information that all these devices generate. It's simply unfeasible for humans to review and understand all of this data – and doing so with traditional methods, even if you cut down the sample size, for this would simply take way too much time.

This is where machine learning and AI comes into place. It can help to process all of this data and learn from it.

How are IoT and AI used already in the real world? Some examples include:

Automated vacuum cleaners: smart and connected vacuum cleaners can map and "remember" the layout of a home or a flat, adapt to different surfaces or new items. They can also clean an area with the most efficient movement pattern, and dock themselves to recharge.

Self-driving vehicles: several companies which have invested in smart vehicles employ AI (and many hundreds of thousands of road-miles of test data) to predict the behavior of cars and pedestrians in various circumstances in order to 'teach' the cars to respond appropriately.

At first glance this may seem straightforward enough.

There is a flip side, however, to living in this hyper-connected world of devices that collect and process one's data. As the use of these devices continues to increase, so do the accompanying risks. Security and privacy breaches, as well as cyberattacks, are persistently on the rise.

According to UK's National Fraud and Cyber Crime Reporting Centre, fraud and cybercrime cost the UK nearly £11bn in between 2015 and 2016. By 2020, it is estimated that 25% of cyberattacks will target IoT devices.

A contributing factor to this trend could be that many tech companies seem to be engaged in a frantic first-past-the-post-race in developing new technologies to keep up with their competitors. This may come at the expense of security and privacy. Unfortunately, best practices for security and privacy often lag behind the latest tech trend.

Moving too fast and not coming up with a sound plan for security can put speedily built platforms at risk for exploitation. In a rush to be first in emerging tech, one may be tempted to overlook essential quality assurance and security pressure-testing of new applications.

In a 2018 report from the University of Oxford, researchers suggest that engineers "take the dual-use nature of their work seriously, allowing misuse-related considerations to influence research priorities and norms, and proactively reaching out to relevant actors when harmful applications are foreseeable."

Prevention may be the key to security threats in IoT solutions.

IoT players should follow security guidelines, such as those issued by the EU's Cybersecurity Agency (ENISA) last year (Baseline Security Recommendations for IoT). Security by design is fundamental in all of this, and for the whole IoT chain: designers and manufacturers of devices, component makers, software vendors, solution integrators, data processing companies, telecom carriers and security experts.

Increasing awareness among consumers about how to protect their IoT devices (passwords, privacy settings, software updates, Wi-Fi, etc.) is also important and could help end-users protect themselves as well as their loved ones.

Nevertheless, it's not only individuals who could be the victims of cyberattacks. The UK's National Health Service was left vulnerable in a major ransomware attack in May last year. According to the BBC, at least 6,900 NHS appointments were cancelled as a result of the attack.

This is exactly why the correct transposition and implementation of the EU's first legislation on cybersecurity - the Directive on Security of Network and Information Systems (NIS Directive) which entered into force in May this year and applies to operators in electricity, water, energy, transport, health and digital infrastructure (providers of the so-called "essential services") - is so crucial.

As the examples above stipulate, the ever-growing use of IoT and AI can bring about better services tailored for individual users and their preferences. However, security and privacy remain an issue in need of addressing.

Educating end-users; a more responsible approach by tech firms; sharing best practice examples; allowing for proper testing; incorporating the security by design approach to IoT development, as well as an up-to-date regulatory framework may help to prevent or lessen the impact of a potential future cyber-attack.

It would be naive of us to think that our security and privacy will not be compromised again in the near future. They will. The question is: are we ready?

Artificial Intelligence Evokes Change in Society

Henna VIRKKUNEN

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Although artificial intelligence (AI) may sound like something in the distant future, it is already a part of our everyday life. AI is used to drive cars, plan daily commutes, make loan decisions in banks, translate texts and identify junk e-mail. Face recognition programmes can recognise us on social media and display advertisements based on our location and browsing history. Algorithms make more and more decisions on our behalf.

The ongoing global technological revolution is transforming both economic structures and the everyday life of people in a major way. The majority of Europeans perceive these changes as positive. 75 percent of Europeans believe that digital development will have a positive impact on the economy and 64 percent believe that it will improve their quality of life.

Robotisation both takes and creates jobs. On the other hand, new technology enables new products and services, which in turn generates new demand, lowers prices and creates new jobs. A great example of this is Germany: its industry has Europe's highest degree of robotisation, but the lowest unemployment.

The key to a successful transformation of work is to ensure that people are skilled. In addition to basic know-how and digital skills, it is becoming increasingly important to see that everyone has the opportunity to update personal competence throughout their career.

Work will be organized in a new way. It is becoming more project-like and entrepreneurial by nature. Due to this, each Member State needs to reform its labour market, taxation and social security.

Europe can cope with this change only if we substantially increase our investments in research and product development. The USA, Japan and Korea have invested a larger share than Europe of their gross national product in R&D already for a long time. Now China has also overtaken us. This, if anything, should be a wake-up call to everyone.

China has taken on a strong role particularly in the use of AI. It aims to be the leading AI hub in the world. Europe must respond to this challenge from its own starting points.

Luckily European Union is actively working on the topic. Recently, 25 European countries signed a Declaration on cooperation to jointly respond to the challenges posed by AI. This is an important initiative.

The work is divided into three parts: boosting investments, preparing for socio-economic changes and addressing ethical and legal issues. To support the work, the EU Commission appointed a High Level Group of experts.

The European Union has also decided to fund AI research with 1.5 billion euros through the Horizon 2020 programme in 2018–2020. The aim is to achieve 20 billion euros worth of investments per year in the next decade when national and private funding, in addition to EU funding, is included in the calculation.

However, the most demanding task that Europe faces is the formulation of an ethical and legal framework for AI. In China, AI and face recognition is already used in the streets in the identification and surveillance of people. In European democratic societies, this would be out of the question. We wish to maintain a high level of individual privacy and data protection also in the future. Still, we will encounter many difficult ethical questions.

Already two years ago, the European Parliament held a heated debate on the liability of robots. The proposal of the Committee on Legal Affairs on the legal status of robots was rejected as a result of a vote in the Committee.

The Parliament saw that the programmer or manufacturer is always liable, not the robot itself. To guarantee transparency, the Parliament proposed that it should be possible to display the computations of AI systems in a form comprehensible by humans and that advanced robots should be equipped with a 'black box', which records data on every transaction carried out by the machine, including the logic that contributed to its decisions.

In the next legislative term more work with robotics and AI is expected. Robotics and artificial intelligence need to be high on the EU agenda and an important concern of the European Parliament.

A world run by self-learning algorithms – where does that leave consumers?

Ursula PACHL
Deputy Director General of BEUC

The widespread use of automated-decision making (ADM) and artificial intelligence (AI) is a substantial technological revolution with profound impact on our society, economy and on consumers.

Like with many technological revolutions in the past, this one too should bring many benefits to our society and to consumers, in particular in the science, medicine, engineering, or manufacturing sectors. Consumers will benefit from that technological progress.

Equally importantly, this technological revolution is rapidly changing the way our markets operate and could significantly reshape consumers' position in our market economy. But, are we ready for this socioeconomic revolution? We don't think so.

Imagine this not-so-distant future scenario: you go for a stroll in the park and feel like having a refreshing beverage. You activate a smart gadget you are wearing and order your favourite smoothie. A driverless scooter or even a drone brings it to exactly where you are in just about no time. Very convenient, very efficient, right?

Now imagine a scenario that is already happening: you go to your bank for a loan, and without giving you any explanation whatsoever, your credit request is denied based on a complex rating calculation carried out by a machine, without any human oversight, and based on vast amounts of data collected to build a profile about you. Scary, no?

Over the past seven decades, consumers in the EU have benefitted from immense progress and increased comfort. Yet, the same market economy which allowed for this progress has always been in need of balancing measures to properly protect consumers. Consumer organisations have strongly campaigned for fairness and competition in the market and for consumers to have strong rights such as access to information, choice, safety, and redress.

Our core democratic ideals, our shared notions of human rights and fundamental freedoms, and our long-fought consumer protection laws are shared values that shall not change because of any technological revolution. It is rather the technology which needs to adapt to our values. The advent of AI and ADM technologies only exacerbates the need to respect the ideals and values that are indispensable to build consumer-friendly marketplaces today and in the future.

This is no easy task for EU policy-makers. Staying ahead of the curve will require ambition, determination and swift action. The list of things to be done in a short space of time is significant and can only be achieved if sufficient political will is assigned to this.

A check-list to protect consumers' interests

1. **Competition.** The use of AI and ADM technologies heavily relies on the use of massive amounts of data as an input for the autonomous and self-learning systems to work on, making access to data a condition for success. This circumstance poses a crucial challenge of ensuring a competitive landscape by avoiding the concentration of data in the hands of only a few market players so that competitors can offer innovative alternatives.

2. **Modern consumer protection rules.** Important EU legal instruments which exist to protect consumers, such as the Directives on Unfair Commercial Practices, Unfair Contract Terms, Consumer Rights, Product Liability, Sales of consumer goods, and Price Indication, are all designed for a different era. A careful evaluation and modernisation of the EU's legal framework including sector specific rules is necessary.

3. **Liability and safety rules need an urgent upgrade.** The EU's current safety and liability rules are not fit for purpose for an era where the safety risks posed or damages caused by a product can stem from a software or algorithm-malfunction.

4. **Safety is not enough. High standards of cybersecurity are also necessary.** As consumers move into an ever-more interconnected world, where increasingly complex connected products are all around them including in their homes, ensuring robust cybersecurity is paramount to protect not only individual consumers but society as a whole. The EU has no cybersecurity framework designed for the Internet of Things and must resolve that swiftly.

5. **Privacy and data protection are and will continue being the norm.** The EU's unique General Data Protection Regulation contains indispensable principles that must be respected at all times, such as transparency, informed consent, and the right to explanation of and to contest an automated decision. Specific attention to its application to data processing powered by AI is needed.

6. **The right business approach.** Protecting consumers in these new markets demands that companies strive to be consumer-friendly from the design phase of their products and services. They need to be compliant with the law, develop user-friendly interfaces, avoid undue discrimination and be as transparent as they can be.

7. **Continued market surveillance and efficient enforcement.** It is essential to ensure the enforceability of EU law in this new marketplace and thus establish accountability of algorithms. We also need to equip and empower market surveillance and enforcement authorities to look after how markets develop and to act swiftly when abuses and incompliant activities arise.

These are fundamental actions for the future wellbeing of European consumers and citizens. The European Commission must take the lead and devise an AI Action Plan for consumers to set out the policy work to be done to achieve the objectives above.

The clock is ticking, and technological revolutions do not wait for anyone. The EU should become a world leader by creating the right rules that protect our values and people's rights and at the same time promote the benefits of these new technologies for all.

How AI is poised to transform healthcare

Roberto VIOLA

Director General, DG Connect, European Commission

Exponential growth in computing power, availability of data and progress in algorithms have turned Artificial Intelligence (AI) into one of the most important technologies of the 21st century. Healthcare is one of the key domains where AI promises to transform service delivery, employee satisfaction and, above all, patient outcomes and well-being.

An area where AI can make a big difference is oncology. Nowadays, algorithms beat almost all but the most qualified dermatologists in recognizing skin cancer. In a recent study[1], for example, human dermatologists were able to identify 86.6% of skin cancers, while the computer found 95%. By the same token, detection of breast cancer by algorithms has improved significantly, too.

Detecting heart diseases is another area where AI can dramatically improve patient outcomes. Danish start-up Corti, for example, has developed an AI-powered system that analyses the words a caller uses to describe an incident, the tone of voice, and background noises. The software correctly detected cardiac arrests in 93% of cases, vs. 73% for human dispatchers, according to a study by the University of Copenhagen, the Danish National Institute of Public Health, and the Copenhagen EMS.[2]

Every year, 15 million people worldwide suffer a stroke, and only 10% recover completely. AI-powered robotics systems are increasingly used for stroke rehabilitation since they can produce highly repetitive and precisely controllable motions. Such systems also permit for the continuous monitoring of performance and biomarkers of movement that allow adapting the levels of treatment according to patient's needs.

Less glamorous but equally impactful are robotic systems used in hospital logistics. Currently, medical staff spend disproportionate amounts of paid time performing non-medical tasks. Nurses, for example, typically spend less than two hours of a 12-hour shift on direct patient care.[3] The remaining time is used for paperwork, changing bed linen, searching for medications, and delivering patient meals.

Using robots for some of these tasks can generate considerable time efficiencies and free medical staff from tedious, repetitive tasks. Instead, they can focus more on the patient. For instance, robots can deliver medication, transport blood samples, collect diagnostic results, and schedule linen and food deliveries.

In the European Commission, we have long understood the potential of Artificial Intelligence and AI-powered robotic systems for healthcare and patients well-being. We have already invested about €200 million into areas such as AI for data-driven diagnostics, personalised medicine, surgical robotics, intelligent prosthesis or exoskeletons.

The CyberLegs PlusPlus project[4], for example, has developed a prosthesis that enables amputees to perform locomotion tasks such as ground-level walking, walking up and down slopes, climbing/descending stairs, standing up, sitting down and turning.

With our recent strategies on Artificial Intelligence[5] and the digital transformation of health and care[6], we are proposing to strengthen our efforts in this area further and to use AI to tailor therapies even more closely to the needs of each individual patient.

With data being the lifeblood for Artificial Intelligence, we want in particular to make more health data available. Concretely, we want to provide access to at least 1 million sequenced genomes in the EU by 2022, and then to a larger prospective population-based cohort (beyond sequenced genomes) of at least 10 million people by 2025. With the European Open Science Cloud, an AI-on-demand platform and a network of High-Performance Computers, we are building the necessary infrastructure to extract knowledge from this huge amount of data.

AI-powered systems work on a narrow range of tasks and will need close supervision for years to come. Human doctors and expertise will not become redundant at any point in the future. Their work will be supported and augmented by artificial intelligence, but it will still be them taking the decision what to do with a particular diagnosis.

While AI can and will surely have a transformative effect on healthcare and patient well-being, we want to ensure that humans remain in control, be it the human doctor, caregiver or the patient him- or herself. Reflecting European values such as human dignity and autonomy, it should always be clear that the final decision is taken by a human.

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1 Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists, H.A. Haenssle, C. Fink, May 2018.

2 https://www.bloomberg.com/news/articles/2018-06-20/the-ai-that-spots-heart-attacks

3 http://www.fortherecordmag.com/archives/0915p10.shtml

4 http://www.cyberlegs.eu/

5 COM(2018) 237 final

6 COM(2018) 233 final

Ai for health applications

Dr. LEO KÄRKKÄINEN

Co-lead of Chief AI office of Nokia, Leader of deep learning research group in Nokia Bell Labs

On the Intertwined Relationship of Artificial Intelligence and Health

Solving the "Black-box" Issue

The biology of life is extremely complicated, and it would be hard to claim that one understands it and can explain it fully, even if the last 100 years have provided plenty of insights on how it works. In particular, in the medical domain we have gained a significant amount of knowledge about the pathways how chemical substances cure diseases.

However, a lot remains unexplained, and in many cases we have only a very limited understanding how a cure works, other than the mere experimental evidence with real patients. Indeed, proper experimentation and studies have provided us with enough confidence about the use of many beneficial chemical compounds so that we do approve their usage even if their real workings remain hidden and obscure. Now, with the help of large annotated data sets and high-performance computing, we are able to create models to understand how highly complicated systems, like life, functions and behaves. These models are not intrinsically complicated, their complexity rather lies in their scale - hundreds of millions of parameters that influence the inference. Some say that these are the "black boxes" of AI, as it is not possible to

easily fathom the interplay of all the parameters that affect the final result.

Let us avoid introducing double standards that would discriminate the discipline of AI compared to drug development for instance, which has a direct and much stronger impact on human beings. We accept the fact that we can't really require explainability on how drugs produce their results. However some suggest to require it from AI, even though this is equally unfeasible.

The solution rather lies in appropriate safeguards, and checks and balances, including transparency and an adequate control systems. Regarding drugs, the experimental data and research procedures from clinical trials have to be open to challenge and scientific debate. Equally, in AI, the datasets used in the training of the system have to be tested against biases and protected from malicious data entries.

Health Data, Privacy and AI

The crucial driver for the current success of AI is the quality and quantity of data. Data, which in the medical domain is protected by privacy laws, such as the European General Data Protection Regulation. For obvious reasons, we cannot be fully transparent with this private type of data. Hence, we need anonymization strategies that retain the value of the data and its annotation but severe the connection to the primary data source. This can be truly unfortunate as some of the ethical guidelines in medical research require that there shall be a potential benefit to the subjects whose data are used. And this is ultimately of course also what we do want to achieve. But as the connections to individuals are severed, there is no way to come back to a subject with specific information on the subject's medical case which has been discovered during the study – even in life-critical cases. So, now, privacy takes precedence over saving lives.

I would prefer a system where pseudonymization – renders the medical data anonymous but preserves and protects the key to re-access the patient's identity in a safe governmental repository. This would be highly desirable in cases where the patient could benefit from the AI information output – for example to correct or improve a diagnoses and

treatment. From the point of view of an AI provider, in practice, we have resorted to running our training codes within the hospital premises, as part of a collaborative effort, so that data never leaves their network. As the computational load is significant, one has to think how to solve related capacity challenges issue on a case by case basis. Already for efficiency reasons , the data has to reside on the solid-state drive of the GPU machine which runs the training code.

From the point of view of the AI recipients- the health care providers - it is important that they have tools to single-out good AI solutions. This can be achieved by running the AI outputs through a panel of experts, but also by having non-disclosed, and well annotated test sets of data that can be used to challenge the performance of the offered AI solutions. These test sets should be kept secret. Another possibility is to have a national or EU-level accreditation body with similar data sets to approve the use of AI methodologies. The resulting AI solutions are often very efficient, and run on standard laptops. So, X-ray classification for instance can be run locally at your family doctor's practice, ready to feed-in x-ray images as they arrive.

Conclusions

As patients , we would all receive consistent care with tools that combine the experience of the doctors with their annotations that have been used in the AI process. Also, it is possible to volunteer and participate in the future development of the system by volunteering data to improve the system even further. Aggregating large datasets for a successfulAI implementation is hard work and requires substantial resources . AI needs hundreds of thousands of images with careful annotations by experts. For rare diseases, it is not only money, but time that is required to collect enough cases for sensible training. It may amount to decades of waiting. This calls for a concentrated EU-level effort to create a "CERN of data and AI" with the powerful GPU machines and data storage for huge amounts of data.

This may consist in a virtual network of centers, but one has to keep in mind that for the training, the data and the highly performant processing machines have to be in close proximity. AI has the potential to solve, or at least alleviate, one of the most pressing problems of our society: the massively increasing costs of health care. Let us make sure that Europe has the proper framework to succeed in this.

Several AI technologies appear to be suitable for use in medical practices

Silviu BUSOI

MEP (EPP Group), Member of the ITRE Committee

Artificial Intelligence and all the research in this field has proven to be beneficial in more and more industries, from robotics to aeronautical engineering, from behavioural science to medicine. As far as medicine is concerned, AI research during the subsequent years can be characterised by advance and influence, boosting the medical performance that has been achieved to date. Ranging from clinical decision-making, precisions interventions or investigations, to systems integration, translational bioinformatics, and cognitive science, all faced improvements in the last decade due to artificial-intelligence-based technological medical practices, in both the modelling of expertise and the creation of acceptable systems.

To begin with, recent years have shown me that artificial intelligence that interacts with the physical world has numerous applications in the healthcare sector. AI systems and tools will provide the foundation and the basis of emerging and future smart services and sustainable healthcare systems, and will definitely bring advances in personalised healthcare, emergency response and telemedicine. Adoption of an AI tool or solution in clinical practice requires careful confirmation of its clinical utility and foremost, safety. One of the most popular applications of AI within the medical field is developing medical diagnosis systems. On another scale, AI has increased the accurate diagnostics percentage, allowing computers to do more than just repetitive tasks, enabling them to assist doctors to fast and accurate diagnose their patients.

Another point to consider is the ageing society and social side of intelligent medicine. Societies and health systems will need to adapt to the ageing process and elderly healthcare requirements, so they can provide adequate care and remain financially sustainable. The ageing process brings within high prevalence and incident rate of disabilities, chronic diseases, the risk of stroke, brain injuries and diminished abilities. Therapeutic and care robots that are to improve quality of life and reduce reliance on social services, but despite their potential, human caregivers will still be needed and will continue to provide an important source of social interaction that is not totally replaceable.

Online care and health apps can significantly reduce medical costs by eliminating medical visits. Movement assistance, such as pharmacy operations and pill dispensing can be done by robots at any time. Minimally invasive surgery advances offer the doctors superior visualisation of the surgically focus area, more precision and more comfort, aiming at reducing the risk of human error as well. Such robots already deliver small incisions, minimise need for medication and shorten the length of hospital stays.

However, despite the excitement around the technologies and their potential, it is yet rare to see examples of robust clinical validation ad trust. The effects of these newly introduced technologies will never be completely predicted and can only be successfully integrated if society can adjust to a new way of interacting with technology. Moreover, despite the potential of AI technologies, it cannot be denied that the application of AI in health care is overhyped to a certain extend.

The ultimate purpose of introducing AI into medicine is to achieve better diagnosis, safer and effective care for patients, precision treatment or interventions. Keeping in mind that the emphasis shall be laid on the doctor-patient relationship, I look forward to the continuous progress in innovation in health.

Human-centered approach needed for an ai that delivers for citizens

Dita CHARANZOVA

MEP (ALDE group), Vice Chair Internal Market & Consumer Protection Committee

Artificial Intelligence (AI) has become a Brussels buzzword in 2018. How will the EU prepare for a digitalized society where we increasingly rely on algorithms? Can the EU take the lead globally? Will robots mean the end of us? Some are fearful, many others excited, at what the future of AI can bring us.

Developments in AI are for the better and bring more potential for improved delivery and effectiveness of everyday tasks. AI development means more efficiency across all sectors and better services for citizens. And we are only at the beginning of this digital revolution.

While I do not believe that robots will replace everyone's jobs or take over the world, we should not continue developing these technologies without any vision either. We need technology that delivers for consumers and citizens, which brings added value to their lives. But if we want AI that helps humans to live a better life, we need to start defining our goals now. We need a general framework based on our values that will guide AI to developments in a way our citizens and society want and can trust.

Efficiency gains and better services for citizens are already tangible.

AI is not just something abstract in the future or in a laboratory; many of us are already interacting with it daily. From online services like seeing more posts from closer friends on Facebook, to being recommended shows for us through Netflix, and even asking Siri or Alexa a question. AI is helping to deliver what we want and like.

AI is also improving services for citizens, eliminating or reducing administrative tasks and more effectively resolving problems when they arise. Chatbots can now answer questions, which prevents citizens from having to wait in a call or go in person. AI can also help tell us which files to fill, or reroute questions to the correct office. This enables workers to have more time to spend addressing citizens needs quicker by leaving more simple, yet time consuming, tasks to AI. In the public sector, this means reducing public spending in infamously dense bureaucracy and providing more efficient services.

Not only is AI making our lives easier, but it is also saving lives. Computer algorithms can help detect diseases earlier that are difficult for humans to see, such as some cancers and eye diseases. Computers can now process thousands of images of diseases until the point that they are able to classify the images without external help. While studies show that human oversight is still critical, AI is found to be extremely complimentary to human abilities in the field of medicine.

Why ethics?

So why should we worry?

Ethical questions are and will continue to come up, and we will have to ask ourselves where we ultimately want to steer these developments. Imagine, what if there is an error and for whatever reason the computer says that you are not eligible to get a mortgage, or take an airplane? What if insurance companies can track everything you do, and then decline to pay when you make a claim?

We need to think responsibly to take advantage of the many opportunities AI can bring and make sure that it works for us. Where and how much do we want to incorporate AI into our lives? We need an idea of where we want to steer developments and ultimately how much power we should therefore give AI systems, as we gradually depend on algorithms in our homes, work and travel.

This does not mean an expect the worst case scenario and overregulating to try to pre-empt the evolution of these technologies. It is impossible to foresee all of the hurdles we will face eventually in a sector that is evolving at such a fast pace. And it would be a mistake by hampering innovation in an area that firstly is being tapped into by other powers globally, and secondly, given the huge benefits.

We need some basic guidelines, not laws. Having an ethical code based on our values will help guide us in the early stages of the AI revolution. The Commission's decision to make ethics a main pillar of an EU Strategy on AI is very important. We should not just create and create without an idea of what our general aim is. While the Commission's expert group discusses this, we need to also create an open and ongoing conversation with citizens and business alike to enable an outcome that best suits us.

Human in control.

While the question of a broader ethics framework is ongoing and too large a topic to fully delve into here, the basic principle that must be the foundation of any AI development is to ensure that humans remain in control. This means that consumers have a say about how their data is used and how much they want to delegate decisions over to machines. Citizens must always have the right to decide. Then, regardless of what decisions we do or do not delegate to machines, these decisions must always be possible to be overridden and explained clearly. People need to be able to ask how and why a decision was taken in order to be able to trust it in the first place.

To conclude, AI has enormous potential for citizens across the EU and we are already starting to feel some of these benefits. It is, however, crucial that the EU at this stage set up a united strategy on AI development by putting the citizen at the heart. It should be a strategy that not only seeks to create a rich environment for innovation, but that is prepared for future developments with an ethical framework to guide us and ensure that ultimately decisions are reversible and the human is in control.

European Commission

#DSM

Digital Single Market

ARTIFICIAL INTELLIGENCE FOR EUROPE
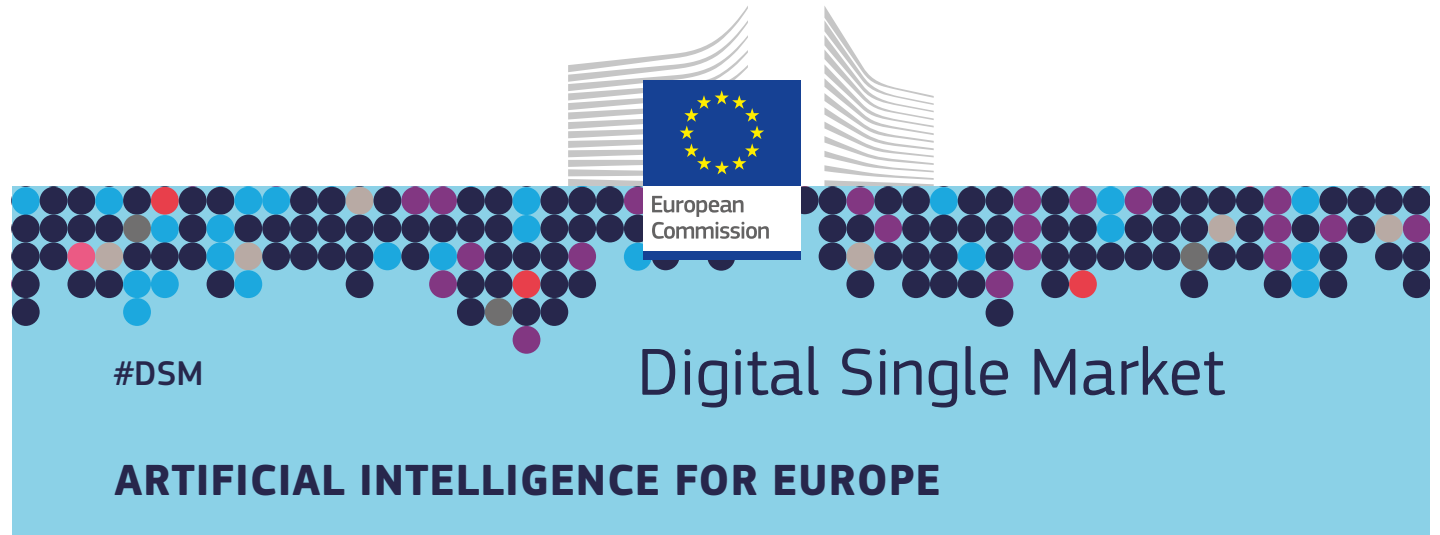
1. WHAT IS ARTIFICIAL INTELLIGENCE?

Artificial intelligence (AI) refers to systems that show intelligent behaviour: by analysing their environment they can perform various tasks with some degree of autonomy to achieve specific goals.

Mobile phones, e-commerce tools, navigation systems and many other different sensors constantly gather data or images. AI, particularly machine-learning technologies, can learn from this torrent of data to make predictions and create useful insights.

2. WHY IS IT IMPORTANT?

Artificial intelligence can significantly **improve people's lives** and bring major benefits to our society and economy through **better healthcare, more efficient public administration, safer transport, a more competitive industry and sustainable farming.** AI can be used to make more accurate and faster medical diagnoses, carry out dangerous and repetitive tasks and free up valuable time. It can also help in the fight against cybercrime and minimise the use of electricity.

Reduce use of pesticides and need for irrigation	Detect pollution and oil leaks in the seas and oceans	Reduce trauma after surgery	Help surgeons operate more precisely	Faster and more accurate diagnosis of diseases
Fewer traffic accidents	Better use of energy and water resources	Less risk of work-related injuries	Intelligent products that improve access to education	Smart machines that minimise their environmental impact

By 2025 the economic impact of the automation of knowledge work, robots and autonomous vehicles will reach between €6.5 and €12 trillion annually.

Europe is behind in private investments in AI: €2.4-3.2 billion in 2016, compared to €6.5-9.7 billion in Asia and €12.1-18.6 billion in North America.

3. WHAT IS THE EU'S ROLE IN ARTIFICIAL INTELLIGENCE?

A European approach on AI will boost the European Union's competitiveness and ensure trust based on European values. It is based on 3 pillars:

1 Boosting Europe's scientific base, technological know-how and industrial capacity

2 Preparing for socio-economic changes brought about by AI

3 Ensuring an appropriate ethical and legal framework

The creation of a Digital Single Market, including the free flow of data across borders, is key for the development of AI.

4. HOW MUCH IS THE COMMISSION INVESTING IN AI [2014-2020]?

The European Commission has already invested significant amounts in AI, cognitive systems, robotics, big data and future and emerging technologies to help Europe be competitive:

AI-RELATED AREAS

Around **€2.6 billion** over the duration of Horizon 2020 on AI-related areas (robotics, big data, health, transport, future and emerging technologies).

ROBOTICS

€700 million under Horizon 2020 + **€2.1 billion** from private investment in **one of the biggest civilian research programmes in smart robots in the world.**

SKILLS

€27 billion through European Structural and Investment Funds, on **Skills development** out of which European Social Fund invests, **€2.3 billion** specifically in digital skills.

The expert group on artificial intelligence will help with the implementation of the Communication on "Artificial Intelligence for Europe", support the set-up of a community of stakeholders – the AI Alliance – and draft AI ethics guidelines.

PROJECT EXAMPLES

Agriculture

AI can improve the process and minimise the use of fertilisers, pesticides and irrigation and provide better productivity, food and reduce environmental impact.

Trimbot2020
The project develops an intelligent gardening robot which can trim hedges, roses and bushes.
Contribution: €5.4 million

MARS
Mobile robot that plants seeds while workers monitor the process from anywhere.
Contribution to all ECHORD++ experiments: €19.7 million

Data & eHealth

AI can recognise a cardiac arrest during emergency calls faster and more frequently than the medical dispatcher.

BETTER
Earth observation through big data and machine learning to forecast risk scenarios.
Contribution: €1.9 million

KConnect
Multi-lingual text and search services that help people find the most relevant medical information available.
Contribution: €3 million

Public administration and services

AI can provide early warnings and prevent natural disasters; or simulate contagion in pandemic events to save human lives.

SIMPATICO
Personalise and simplify public e-services so citizens can easily understand and interact with their public administration.
Contribution: €3.6 million

SmokeBot
Civil robots support fire brigades in search and rescue missions to perform in harsh conditions.
Contribution: €3.8 million

Transport

AI can minimise wheel friction of a suspended train against the track while maximising the speed and impact and enables autonomous driving.

VI-DAS
Automated sensors detect possible dangerous situations and accidents. The driver is alerted and road safety is improved.
Contribution: €6.2 million

Transforming Transport
Data-driven transformation which will solve urban mobility issues, develop smart motorways, proactive rails and much more.
Contribution: €14.6 million

Manufacturing

AI can predict maintenance and breakdowns in smart factories to improves work experience.

SATISFACTORY
Collaborative and augmented-reality system to increase work satisfaction in smart factories.
Contribution: €4 million

SERENA
AI techniques to predict maintenance of industrial equipment.
Contribution: €5.5 million

Updated 24/04/2018

Website: https://ec.europa.eu/digital-single-market/en/artificial-intelligence – https://ec.europa.eu/digital-single-market/robotics

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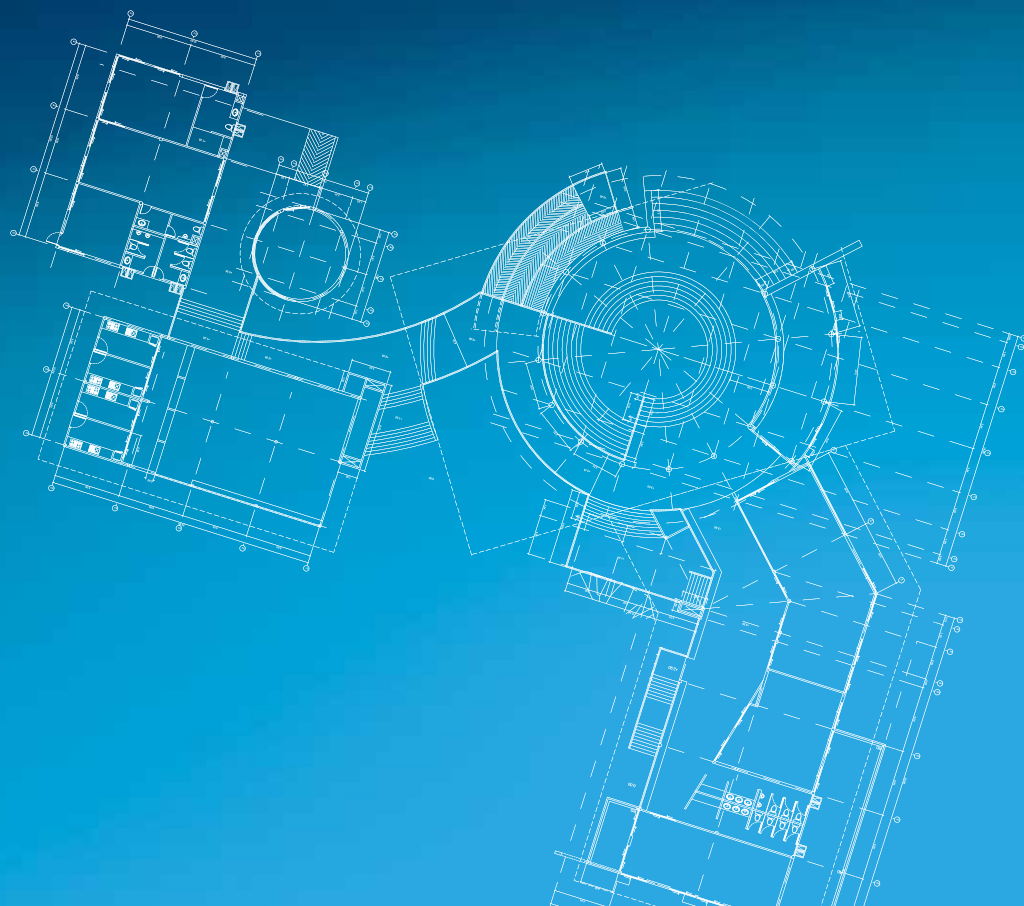
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