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# HARNESSING ARTIFICIAL INTELLIGENCE

Ulrike Franke

## SUMMARY

- Artificial intelligence is impossible to disregard – it is set to transform society, the economy, and politics.
- Europe has not yet taken all the steps it needs to benefit from these advances or to protect itself from AI’s potentially dangerous aspects.
- The US, China, and Russia are alert to AI’s power to change modern warfare: they grasp the geopolitics of AI and may pursue technonationalist agendas in recognition of this.
- Europe can develop sovereignty in AI by beefing up the talent, data, and hardware it draws on; and as a “regulatory superpower” it can set standards the rest of the world will have to follow.
- If Europe does not address these difficult questions soon it will find itself surrounded by more powerful rivals deploying AI against it.

Artificial intelligence (AI) is changing the economy: it is impacting on the way we shop, on the way we communicate, on the way we do research. AI is, in short, set to be nothing less than “vital to everything”. Indeed, it is difficult to think of areas that AI cannot speed up, improve, or otherwise change. US investment bank Goldman Sachs argues that AI: “is a needle-moving technology for the global economy [...] impacting every corporation, industry, and segment of the economy in time”.<sup>1</sup> AI is an enabler that some have likened to the invention of the combustion engine or electricity – technologies that it is impossible to disregard. This paper examines where Europe stands on AI; how sovereign it is in this area; whether Europe can or should aim for AI sovereignty; and what the risks are if it does not acquire such sovereignty.

## What is AI?

AI generally refers to efforts to build computers able to perform actions that would otherwise require human intelligence, such as reasoning and decision-making. It denotes a fundamental shift, from humans telling computers how to act to computers learning how to act. AI does this largely through machine learning, including ‘deep learning’ techniques. Although popular culture likes to speculate about ‘superintelligence’ and its consequences,<sup>2</sup> the focus of most research and development, and of this paper, is on more limited, focused AI applications (also called “narrow AI”).

The term “AI” first appeared at the Dartmouth Artificial Intelligence Conference held in 1956. Since then, the field has gone through several cycles of hype and disappointment, with the latter dubbed “AI winters”. The field is currently

<sup>1</sup> GS Research Unit, “Profiles in Innovation: Artificial Intelligence: AI, Machine Learning and Data Fuels the Future of Productivity”, 14 November 2016, p.3.

<sup>2</sup> Nick Bostrom, “Superintelligence”, 2014, Oxford University Press.

enjoying an “AI spring”, with AI development accelerating significantly over recent years. Previously, limited access to large data sets and a lack of appropriate computing architectures held it back. Recently, though, computers have improved in performance and more data have become available: in fact, a 2017 report estimated that 90 percent of the world’s data had been created within the preceding five years. The same period saw a fifteen-fold growth in the number of developers of graphics processing units (GPUs) – hardware crucial for AI.<sup>3</sup> Together, these developments have led to a significant increase in AI research around the world, resulting in better algorithms becoming more widely available. This, in turn, has generated more research.<sup>4</sup> As advances continue, the public and media outlets have become ever more interested in AI – and the technology has begun to inspire hype and hysteria in equal measure.

## Why AI matters

AI’s potential can appear almost limitless. It is not only ‘dual-use’, in the sense that it can be used for both civilian and military applications, but ‘omni-use’, potentially able to influence all elements of life. Although there is a danger of being drawn into exaggerated promises inspired by science fiction, AI applications already have significant economic and social benefits. In the health sector, AI is used to read scans and improve the accuracy of diagnoses. In agriculture, AI can help improve crop yields. Factories, server farms, and other energy-hungry businesses use AI to become more efficient in their energy consumption. According to Goldman Sachs, there is “potential for AI and machine learning to reshuffle the competitive order across every industry”. However, the bank also warns that: “Management teams that fail to invest in and leverage these technologies risk being passed by competitors that benefit from the strategic intelligence, productivity gains, and capital efficiencies they create.”<sup>5</sup> Given that companies are warning of the risk of being overtaken by competitors that adopt AI, states should take a hard look at whether they do enough with regard to AI applications to guarantee their economies’ continued well-being.

In addition to its potential economic impact, AI has quickly become an element of geopolitical competition. Vladimir Putin may have been engaging in hyperbole when he declared that “The one who becomes the leader in this sphere will be the ruler of the world”, but China and the United States also see AI as a factor in geopolitical power. In fact, China and the US see each other as the main competitor and are racing to be the leader in AI. They directly compete for talent – Qi Lu, one of Microsoft’s top executives, left the company in 2017 to join Chinese competitor Baidu – and in research: in October 2016, the White House conceded that China had overtaken the US in the number of journal articles published on deep learning. This competition can even touch on matters important to the culture and history of each country, such as when a reported 280 million people in China watched a machine owned by Google parent company Alphabet win at Go against one of the world’s best human Go players. As one observer noted at the time, a Californian firm “had conquered a game invented more than 2,500

years ago in Asia. Americans don’t even play Go.” Advances in US capabilities directly motivate Chinese research, and vice versa. Commenting on the event, former president of Google China Kai-Fu Lee remarked: “If AlphaGo was China’s Sputnik moment, the [Chinese] government’s AI plan was like President John F. Kennedy’s landmark speech calling for America to land a man on the moon”.<sup>6</sup>

If AI is indeed like the combustion engine or electricity in its transformative potential, failing to adopt this technology will have both economic repercussions and could lead to massive geopolitical gaps between countries. The first industrial revolution, associated with the invention of the steam engine, allowed first mover Great Britain to become the leading power in Europe, pulling away from France and Prussia. This advantage fuelled the expansion of the British Empire and gave Britain a lead that the rest of the world would take decades to close.

Given the power and influence new technology can bestow, it is striking that most European countries (with the notable exception of France), as well as the European Union itself, do not appear to consider AI a factor in geopolitics – contrary to the attitudes of Russia, the US, and China. The recently published “Executive Order on Maintaining American Leadership in Artificial Intelligence” takes a clearly geopolitical approach, and emphasises that: “Continued American leadership in AI is of paramount importance to maintaining the economic and national security of the United States and to shaping the global evolution of AI in a manner consistent with our Nation’s values, policies, and priorities”. In contrast, the European Commission’s “AI Factsheet” only emphasises the importance of AI in sectors such as healthcare, transport, and public services. Although the EU has considerably ramped up its AI efforts over the last year, it has been careful to avoid any appearance that it considers itself to be in a global AI competition. At a Council on Foreign Relations event on the “race for AI”, the EU’s Peter Fatelnig argued that it was not really a race for the EU to run in: “for a race you need a goal, and I’m not entirely sure we actually have an idea where the goal is”.

This is worrying, given the distinct risk that states around the world may adopt techno-nationalist agendas, including increased protectionism to support national champions. In a noteworthy essay, Ian Hogarth, a machine learning engineer and AI investor, warns that: “machine learning will be such a dramatic cause of instability that nation states will be forced to put their citizens ahead of broader goals around internationalism”. A world of AI-turbocharged global competition may be on the horizon. This would militate directly against the EU’s multilateral, pooled sovereignty approach to governance, as it places individual member states under pressure to respond. And it may leave the EU’s model vulnerable to geopolitical competitors that overtake it in AI capabilities across a range of practical applications.

Finally, AI is set to change warfare and military organisations. Armed forces around the world are showing an interest in it, including, but not limited to, AI-enabled autonomy. They are doing this because AI can: help them to improve their operations’ speed, stealth, precision, and efficiency; allow them to develop new military capabilities (such as swarming); lessen the need for manpower (thereby also limiting human error); and, potentially, reduce costs. However,

<sup>6</sup> Kai-Fu Lee, “AI Superpowers: China, Silicon Valley, and the New World Order,” Houghton, Mifflin Harcourt, 2018, p.98.

<sup>3</sup> GS Equity Research: Profiles in Innovation Revisited: AI hardware. 11 March 2018, p.7.

<sup>4</sup> GS Research Unit, “Profiles in Innovation: Artificial Intelligence: AI, Machine Learning and Data Fuels the Future of Productivity”, 14 November 2016, p.7.

<sup>5</sup> GS Research Unit, “Profiles in Innovation: Artificial Intelligence: AI, Machine Learning and Data Fuels the Future of Productivity”, 14 November 2016, p.4. Emphasis added.

the application of AI in warfare, particularly the potential use of lethal autonomous weapons, also raises questions about their legality and morality. This has provoked public protests and ongoing debates about a ban on such systems in the framework of the Convention on Certain Conventional Weapons.

In light of this, it is crucial that the EU, its member states, and European countries outside the EU more broadly avoid falling behind in AI research and use, and that they remain aware of the impact AI may have on their economies and societies. Where, then, does Europe currently stand compared to other actors? And what can it do to improve its position?

## Elements of AI – and how the main players fare

Three elements, or key inputs, are crucial for AI: access to talent; access to significant amounts of data; and access to hardware and software, including infrastructure and computing power.<sup>7</sup>

**1. Talent:** The rapid development of AI and the resulting demand for researchers has led to a scarcity of AI talent around the world. Ian Hogarth puts this nicely: “There are perhaps 700 people in the world who can contribute to the leading edge of AI research, perhaps 70,000 who can understand their work and participate actively in commercialising it and 7 billion people who will be impacted by it.” These numbers help to give a sense of the challenge, though it is difficult to say exactly how many AI researchers there are globally – or how many are needed. A December 2017 report by Chinese internet giant Tencent estimated that between 200,000 and 300,000 people were either AI researchers or industry practitioners. Another report, by Element AI, puts this number considerably lower, at 22,000 globally. The scarcity of AI researchers has made them a precious commodity, with Microsoft Research chief Peter Lee comparing the cost of hiring a leading AI researcher to hiring a National Football League quarterback.<sup>8</sup> This scarcity has even led to the practice of “acqui-hires”, whereby larger firms take over smaller firms with the primary aim of hiring their employees.<sup>9</sup>

**2. Data:** For the moment, most AI is trained by using large amounts of data – hence the related term “big data”. For instance, an AI system may be shown hundreds of thousands of pictures for it to learn to identify specific objects. However, AI can be trained without big data, using methods such as reinforcement learning, which generates its own data and trains by playing against itself. Several AI researchers argue that the future of AI lies in small data. But for now, most of the time: without a lot of data, there is no AI.

Data that can be used for machine learning can be created by almost any means and in virtually any context. This includes, for instance, census data, weather data, and health records. As an example, Tesla’s fleet of vehicles has accumulated more than 1.2 billion miles of driving data, and in 2011 alone US Air Force drones amassed about 37 years’ worth

<sup>7</sup> GS Research Unit, “Profiles in Innovation: Artificial Intelligence: AI, Machine Learning and Data Fuels the Future of Productivity”, 14 November 2016.

<sup>8</sup> GS Equity Research: “China’s Rise in Artificial Intelligence”, 31 August 2017.

<sup>9</sup> GS Research Unit, “Profiles in Innovation: Artificial Intelligence: AI, Machine Learning and Data Fuels the Future of Productivity”, 14 November 2016, p.11.

of video data. Global annual data generation is expected to reach 44 zettabytes (44 trillion gigabytes) by 2020. And data brokers have become shadow power brokers; these firms collect and combine data from different sources, and then sell them for profit – creating major privacy concerns in the process.

**3. Hardware:** With the complexity of AI models growing fast, the standard central processing unit – the hardware in a computer that carries out the instructions of the software – has proved to be insufficiently powerful. This is leading to increasing interest in and development of GPUs, which are a more specialised electronic circuit fast emerging as the pillar of AI.<sup>10</sup> Cloud companies (such as Google, Microsoft, Tencent, and others, which are primarily American and Chinese) are investing in such hardware. This allows them to charge considerably higher prices for the use of their application-specific processing units. For instance, Google charges \$6.5 per hour for its Tensor Processing Unit, while Nvidia can charge \$1.6 for its GPU. The standard CPU only costs \$0.06 per hour. The value of the AI-related hardware market (computing, memory, storage) is predicted to reach over \$100bn by 2025, with US and Chinese first-movers capturing most of it.<sup>11</sup>

How do the two leading AI markets – the US and China – compare on these three elements? And how does Europe do?

## The United States

When it comes to talent, the United States’ world-leading research institutions train significant numbers of AI specialists, including foreigners who often stay in the country to start firms. The Element AI report aiming to identify AI researchers globally found almost half of them living and working in the US. The US-based ‘GAFA’ (Google, Amazon, Facebook, and Apple) and smaller Silicon Valley companies successfully attract talent from around the world. The industry also engages in the aforementioned acqui-hires, such as Google’s purchase of British firm DeepMind (the firm behind AlphaGo). At the same time, the scarcity of talent continues to grow: LinkedIn’s 2017 “U.S. Emerging Jobs Report” finds that employers’ greatest need is for machine learning engineers, followed by data scientists.

On data, the GAFA companies’ vast number of users means they have gathered enormous databases that they can use to develop their AI applications. This is helped by comparatively lax rules about data collection in the US, which make it easier for companies to gather and handle data.

The US also leads in infrastructure, software, and hardware. Three American companies dominate the global chip market: Intel, AMD, and Nvidia.<sup>12</sup> In 2015 the US government banned Intel from selling high-end processors to China. The private sector also plays an enormously important investment role: in north America in 2016, it invested between \$15 billion and \$23 billion in AI. That is more than ten times what the US government spent on unclassified AI programmes the same year.

<sup>10</sup> In addition to more specialised silicon such as FPGAs Field Programmable Gate Array, and ASICs Application Specific Integrated Circuit. GS Equity Research: Profiles in Innovation Revisited: AI hardware. 11 March 2018, p.4/7.

<sup>11</sup> GS Equity Research: Profiles in Innovation Revisited: AI hardware. 11 March 2018, p.3.

<sup>12</sup> GS Equity Research: Profiles in Innovation Revisited: AI hardware, 11 March 2018.

## China

While not quite as attractive for global talent as the US, the Chinese education system generates strong skills in maths, and the country has a tradition of language and translation research. Goldman Sachs believes that: “talent of the highest calibre has and will continue to drive the innovative nature of the industry in China”.<sup>13</sup> While the Chinese BAT companies (Baidu, Alibaba, and Tencent) underspend Google and Microsoft slightly on Research and Development (R&D), they have higher percentages of R&D employees.<sup>14</sup>

China’s internet users are more numerous than those of any other country. And most of them access the internet using smartphones, which are more valuable than personal computers in generating data that is useful for AI.<sup>15</sup> On the Singles’ Day shopping festival in 2016, Alibaba recorded 175,000 transactions per second.<sup>16</sup> In addition, Chinese data privacy and data collection rules are lax, and Chinese users tend not to be as concerned about data privacy as the inhabitants of many Western countries are. As a result, *The Economist* has called China “the Saudi Arabia of data”.<sup>17</sup> Chinese start-ups have also been progressing more rapidly than their Western counterparts, meaning that China now already has a herd of AI “unicorns” – start-ups valued at more than \$1bn. China uses AI in facial recognition software and other security-related technologies. Through international cooperation (such as that with Zimbabwe or Venezuela), it is acquiring more non-Chinese facial recognition data – while at the same time increasingly exporting its surveillance systems to authoritarian regimes.

Authoritarian states have advantages over democratic ones when it comes to data. China’s relatively weak data privacy protections give data aggregators a freer hand in what they can do with what they collect. And the government can access personal data for reasons of public or national security without the same legal constraints a democracy would face. In addition, authoritarian states have other ways of making companies follow their rules. In China, as political scientist Gregory Allen notes, “essentially all major technology firms in China cooperate extensively with China’s military and state security services and are legally required to do so. Article 7 of China’s National Intelligence Law gives the government legal authority to compel such assistance, though the government also has powerful non-coercive tools to incentivize cooperation.” US companies, on the other hand, are much less national – “Google, Facebook, Amazon, Apple, and Microsoft consider themselves global companies much more than American”, as analyst Kara Frederick notes.<sup>18</sup>

On the hardware front, it appears that China has struggled more. Despite efforts since the early 2000s to develop its own PC processors (coming two decades later than the US), China remains dependent on foreign suppliers for chips. The country fares better in supercomputer research: Sunway TaihuLight, a Chinese supercomputer, secured the number one place on the TOP500 list of supercomputers

<sup>13</sup> GS Equity Research: “China’s Rise in Artificial Intelligence”, 31 August 2017.

<sup>14</sup> GS Equity Research: “China’s Rise in Artificial Intelligence”, 31 August 2017. P.7.

<sup>15</sup> *The Economist*, “China may match or beat American in AI”, 15 July 2017.

<sup>16</sup> GS Equity Research: “China’s Rise in Artificial Intelligence”, 31 August 2017.

<sup>17</sup> *The Economist*, “China may match or beat American in AI”, 15 July 2017.

<sup>18</sup> At WIIS DE conference, 15 November 2018.

in June 2017, with the number two on the list also being Chinese.

## Europe

Europe’s AI capabilities have received a lot of bad press, with Kai-Fu Lee claiming that Europe is “not even in the running for bronze AI medal”. Overviews of the state of AI often do not even feature Europe as an actor. (This is why efforts to map the European machine learning landscape such as Project Juno .AI deserve praise.)

Indeed, Europe struggles to retain the AI talent it educates, with researchers leaving for the US in particular. One problem is that European companies do not pay competitive salaries, a fact recognised by Cédric Villani, a French mathematician and member of parliament. In the AI strategy the French government commissioned him to devise, Villani recommends “hefty salary top-ups” and a considerable reduction in administrative formalities in research institutions and universities. The strategy aims to triple the number of people trained in AI in France in the next three years. Germany’s AI strategy, meanwhile, envisages 100 new AI-related professor posts. And, noting Europe’s difficulties in retaining AI talent, in late 2018 a group of European AI researchers founded ELLIS, the European Lab for Learning and Intelligent Systems. This is a professional body that aims to retain talent by creating a network of research centres, a pan-European PhD programme, and close links with industry. That said, the Artificial Intelligence Index 2018 states that 28 percent of all research papers on AI on the abstract and citation database Scopus originate in Europe – the largest proportion of any region. This points to good levels of education and research, though these do not always translate into commercial success.

Another challenge for Europe is one that China and the US do not face to the same extent: collecting data. European countries’ comparatively small size and their strong data security rules mean that, in comparison to their colleagues elsewhere, European AI researchers and developers have relatively limited access to data pools. As Angela Merkel has remarked, “In the US, control over personal data is privatised to a large extent. In China the opposite is true: the state has mounted a takeover.” She added that it is between these two poles that Europe will have to find its place.<sup>19</sup> Where China and the US benefit from large, homogeneous home markets, Europe struggles because of its fragmented market. The EU has worked hard to create the digital single market, but data collection has not been unified to the extent that is possible within individual countries. Of 66 key AI companies featuring in one recent listing, only nine were European.<sup>20</sup>

In terms of hardware, Europe remains dependent on US chipmakers. There are, however, areas in which European companies show strength, such as in natural language processing, where almost half of the 12 key companies are European.<sup>21</sup> *The Economist* has observed that: “Germany has as many international patents for autonomous vehicles

<sup>19</sup> *The Economist*, “Can the EU become another AI superpower”, 20 September 2018.

<sup>20</sup> GS Research Unit, “Profiles in Innovation: Artificial Intelligence: AI, Machine Learning and Data Fuels the Future of Productivity”, 14 November 2016, p.38.

<sup>21</sup> GS Research Unit, “Profiles in Innovation: Artificial Intelligence: AI, Machine Learning and Data Fuels the Future of Productivity”, 14 November 2016, p.38.

as America and China combined”.<sup>22</sup> With DeepMind based in London, Europe does have one global champion in AI – though it was, of course, acquired by Google in 2014.

## AI in Europe: Key issues

Europe is thus behind other global players because of gaps in the three key elements of AI. Existing dependencies, such as on chip companies, risk creating further dependencies, such as on foreign AI applications. This, in turn, creates opportunities for abuse – as seen in, for example, the operations of Chinese apps with questionable data security in Europe. Beyond the problems pointed out above, Europe’s development of its AI sector also suffers from a politically defensive mindset and from economic factors such as a lack of venture capital.

It is also relevant that European populations tend to see AI, as with technological advances more broadly, not as an opportunity but as a threat: survey after survey has found higher levels of scepticism, if not outright rejection, of AI in Europe than the US and, even more so, China. One study of the issue concludes that: “Asian respondents were the most bullish about the positive effect of AI in the future, while Europeans were the least optimistic ... The proportion of consumers preferring the AI robot doctor is highest in Asia, unsurprisingly given they appear to be more willing adopters of AI tech (especially versus Europe).”

Another survey reveals that, on the trust dimension, China ranks first out of ten countries (the other nine are: the United Kingdom, Spain, the US, Australia, France, Germany, Italy, Russia, and Japan). Key findings of this study include: “73 per cent of people in China [believe that] the future impact of digital technology will be positive overall, as well as in terms of its ability to create jobs and address societal challenges.” Although multi-country surveys rarely capture cultural nuances and should be used with caution, the results nevertheless point to generally higher levels of scepticism in Europe, and the impact of scandals such as that surrounding Cambridge Analytica. Coverage of these scandals could mean Europeans are more aware of the risks of, and potential for, technology abuse than inhabitants of other countries are.

This lack of both trust and a sense of the opportunities technology provides may explain why most European states approach AI in a defensive way. The official German and Italian approaches to AI, for instance, are markedly driven by fear of lost economic opportunities. Germany, in particular, appears to be primarily motivated by the aim of preserving its favourable economic position, as expressed in its national AI strategy.

A further hindrance to AI development in Europe is the absence of adequate (venture capital) funding. One bank remarks that: “The EU is prosperous, technologically advanced, and has a well-educated workforce. But when it comes to the availability of venture capital and an entrepreneurial (risk) culture, there is still a vast gap with respect to the US”.<sup>23</sup> In 2016, venture capital investment in the EU totalled about €6.5 billion, while the comparable US figure

was €39.4 billion.<sup>24</sup> And, as noted above, the EU’s regulatory framework and free-market policies forbid a Chinese-style government approach to sheltering and nurturing its tech industry.<sup>25</sup>

For Europe, the risks associated with missing the boat on AI are potentially enormous. Economic value is increasingly created by technology firms, particularly AI companies. Of the world’s ten most valuable companies in 2019, seven are technology companies and all of them are either American or Chinese. In 2008 only two of the world’s largest listed companies were tech firms.

## European hedging

There is no silver bullet for making Europe stronger and more independent in AI. The following five measures, however, can help Europe improve its standing and acquire greater sovereignty in this area.

- 1. Improve data collection and data sharing on a European level.** To improve their access to data, EU and non-EU member states alike should create shared, anonymised, cleaned-up European databases for research. This means accelerating efforts to complete a digital single market. The EU could also enshrine the movement of data as a new European freedom: on this, recent efforts by the European Commission in this direction are welcome. Europe should further incentivise companies to share their (anonymised) data. France’s AI strategy is already heading in the right direction on this when it argues that: “The public authorities must introduce new ways of producing, sharing and governing data by making data a common good”. It plans to achieve this by opening up data gathered as part of government and publicly funded projects, and by incentivising private players to make their data public and transparent. Policymakers can go further than even the French approach by ensuring regulators work with private sector technology experts to achieve true anonymisation that citizens can trust.
- 2. Increase investment and spend smarter.** While state spending can only be one part of the overall investment picture, European governments should support innovative start-ups and increase funding for AI research. Europe spent \$4 billion on AI research in 2016, but China spent \$7 billion. Both numbers are dwarfed by the \$23 billion for north America. Europe’s AI industry has made clear its concerns about falling further behind its international competitors: more than 2,000 experts from CLAIRE (the Confederation of Laboratories for Artificial Intelligence Research in Europe) recently called for large-scale funding from the EU to counter China’s and America’s rapid progress. In a positive development, the European Commission, in partnership with the European Investment Fund, set up a pan-European Venture Capital Fund-of-Funds programme. This allocates €410m to funds to invest in the European venture capital market. It is expected to raise an additional €2.1 billion from public and private investment. However, it is not only the size of funds that matters, but how the money is spent, too. For instance, between 1958

<sup>22</sup> *The Economist*, “Can the EU become another AI superpower”, 20 September 2018.

<sup>23</sup> Deutsche Bank, Digital economics. How AI and robotics are changing our work and our lives, 14 May 2018.

<sup>24</sup> Charlotte Stix, “A survey of the European Union’s Artificial Intelligence ecosystem”, March 2019, p. 19.

<sup>25</sup> Deutsche Bank, Digital economics. How AI and robotics are changing our work and our lives, 14 May 2018.

and 2018, DARPA (the US Defense Advanced Research Projects Agency) spent \$60 billion on – sometimes deliberately outlandish – research, resulting in inventions such as the internet and GPS. In comparison, the EU’s Horizon 2020 programme amounted to \$85 billion between 2014 and 2020 – \$25 billion more in a time period that was ten times shorter.<sup>26</sup> Projects that explicitly aim to fund “moon-shot projects”, such as the Franco-German JEDI (Joint European Disruptive Initiative), are therefore a step in the right direction. Given its disadvantage in data, Europe should focus on investing in a different kind of AI. There are promising subfields of AI, such as reinforcement learning, which requires fewer data to begin with.

3. **Regulation.** The strengths Europe has as a “regulatory superpower” could help it improve its standing on AI. Because the EU has the world’s largest single market, most multinational companies depend on access to the region – which means complying with EU standards. The EU has made use of this power at various times over the years in the economic realm, such as in blocking the merger of General Electric and Honeywell, and in forcing Microsoft to unbundle its Explorer browser.

If Europe wants to compete in this arena, it should make regulation the fourth key element of AI, alongside talent, data, and hardware. In the digital realm, it already has a headstart: “Europe seems to be in the lead when it comes to setting standards for regulation and privacy protection in the digital age”, comments Deutsche Bank, specifically citing the General Data Protection Regulation as evidence of this strength.<sup>27</sup> Emmanuel Macron has been outspoken on this front too, declaring that: “My goal is to recreate a European sovereignty in AI ... especially on regulation.” “Taking on the US and China will be hard”, *The Economist* notes, nevertheless recommending this course: “Europe has a shot at developing a more decentralised alternative, in which data are traded or shared between firms”. The newspaper proposes an agreement on rights to access data, comparing this to the establishment of property rights in the digital realm. It also suggests steps to codify the types of data that should be made open, on the basis of their social value.

Europe could branch out in AI by, for example, setting rules that cover governance, including on ethics. Several players have adopted this approach already: the European Commission’s AI strategy specifically aims to create an ethical and legal framework for AI “based on the EU’s values”. The “high-level expert group on artificial intelligence” set up by the European Commission published its “ethics guidelines for trustworthy AI” in April 2019. In the same vein, the German government sees “ethical and legal requirements” as an integral part, and future ‘trademark’, of AI made in Germany. In addition to establishing such rules, Europe should aim to enforce them by, for instance, creating a ‘seal’ for ethical AI, which companies can gain by demonstrating good practice. Europe could also look to integrate ethical AI rules into future trade deals, forcing foreign companies to follow European requirements.

It is in this context that the EU could help citizens regain trust both in new technology – by making it safer to use – and in the EU as a political actor that has the best interests of its citizens in mind. Europe should, therefore, not compromise on its principles and see them as disadvantages, but rather aim to turn them into virtues. Europeans’ focus on data privacy, as Kai-Fu Lee notes, “will cause the American giants some amount of trouble and may give local European entrepreneurs the chance to build something that is more consumer and individual-centric ... That would go further than American companies would ever contemplate in protecting privacy.” In this respect, Europe should also look for other likeminded partners among its liberal democratic allies, such as Canada or Australia, to further increase the area in which such rules are applied and thereby increase their impact.

4. **Adopt AI in the military realm (within limits).**

AI provides critical input into military power. Some European countries appear uncomfortable with this – Germany’s AI strategy features just a single sentence on the military applications of AI, for example. Yet ignoring the impact that AI can have on warfare is not a viable long- or even short-term approach. Indeed, there may even be opportunities for European countries that they have not yet acknowledged: the new competitive landscape could, in fact, benefit middle powers, as they will have greater capacity to compete than they did in the creation of the complex – and expensive – military platforms used today, such as precision-guided missiles and nuclear-powered submarines. Political scientist Michael Horowitz argues: “As long as the standard for air warfare is a fifth-generation fighter jet, and as long as aircraft carriers remain critical to projecting naval power, there will be a relatively small number of countries able to manufacture cutting-edge weapons platforms. But with AI, the barriers to entry are lower, meaning that middle powers could leverage algorithms to enhance their training, planning, and, eventually, their weapons systems. That means AI could offer more countries the ability to compete in more arenas alongside the heavy hitters.” Horowitz even goes as far as to say that it is “possible, though unlikely, that AI will propel emerging powers and smaller countries to the forefront of defense innovation while leaving old superpowers behind”. He issues a warning against complacency to the US in particular.

European states can take advantage of this by adopting AI in their military systems – which does not mean that Europe should accept or employ lethal autonomous weapons, as many European states have adopted clear positions against the development and use of such weapons. Beyond lethal autonomous systems, whose possible development and use have become a hotly debated issue and given rise to public protests (for good reason), there are many AI applications in the military realm that are attractive for armed forces, as they can help to lower costs, reduce need for human operatives, and improve planning and foresight. Intelligence analysis is one of the first examples of AI use in military contexts – a fact that became known to the wider public in June 2018, when, following protests from its employees, Google ended ‘Project Maven’, a joint initiative with the US Department of Defense that aimed to

<sup>26</sup> Remarks by a JEDI representative at ECFR’s Flexible Union workshop in January 2019.

<sup>27</sup> Deutsche Bank, “Digital economics. How AI and robotics are changing our work and our lives”, 14 May 2018.

use AI to analyse data collected by drones. Given the greater concern about military applications of technology among Europeans, it is likely that Europe will face even more pushback from firms and researchers on working with the military. In addition, Europe is under pressure because of its ageing population and financial limitations, so it may want to invest in AI for military maintenance and logistics.

**5. Education of the population and policymakers.**

In a world potentially dominated by AI, it is important to adequately train the general population in AI. An educated and informed population may also be more resistant to handing over too much of its data to US (or Chinese) firms and insist on better privacy laws, thereby strengthening Europe's regulatory power. Europe may want to take Finland as an example: the [Finnish AI strategy](#) aims to train 1 percent of the population in AI. Equally, Europe should aim to train policymakers and diplomats in AI, as AI-related provisions are likely to be part of trade agreements and other negotiations in the future.

**Conclusion**

AI is set to influence Europe and the world in many ways. It is crucial that European states and the EU take steps to ben-

efit from AI, while mitigating some of the negative effects on their citizens and their own power.

AI could also provide a chance for the EU to showcase one of its most important strengths: that of the power to set standards, to cooperate, and to benefit from a single market. For Europe to become truly sovereign in AI, it will need to strengthen its access to talent, data, and hardware – the three key elements of successful AI. Europe also needs to add a fourth key element: regulation. Indeed, it is in this element that Europe has a chance to go beyond mere sovereignty to become a norm-setter, embedding its ethics and values into AI governance and development, and serving as an example to fight back against AI nationalism. In doing so, it will need to take significant steps itself, such as rapidly educating its own citizens and policymakers, as well as substantially increasing investment in AI and carefully choosing which subfields of AI to fund. This could involve some tough conversations with European voters, especially on navigating the tricky ethical waters of AI's military applications. But if Europe does not address these difficult questions – and soon – it is liable to find itself surrounded by more powerful rivals that have set the ground rules for AI, leaving it unable to compete or to provide citizens with the protection that they expect and deserve.

## About the author

**Ulrike Franke** is a policy fellow at the European Council on Foreign Relations and part of ECFR's New European Security Initiative. Her areas of focus include German and European security and defence, the future of warfare, and the impact of new technologies such as drones and artificial intelligence. Franke has published widely on these and other topics, among others in *Die Zeit*, *FAZ*, *RUSI Whitehall Papers*, *Comparative Strategy*, *War on the Rocks*, *Zeitschrift für Außen- und Sicherheitspolitik*, and regularly appears as commentator in the media. She co-hosts the *Sicherheitshalber Podcast*, a German-language podcast on security and defence.



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ISBN: 978-1-911544-89-0

Published by the European Council on Foreign Relations (ECFR), Berlin, London, Madrid, Paris, Rome, Sofia, Warsaw