



# (How) will the EU become an AI superstar?

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The competition for global AI leadership is speeding up. But it already seems to be a two-horse race between the US and China. Europe faces an imminent risk of falling far behind if the EU and its members do not act rapidly and boldly. Failure would have broad implications for Europe's competitiveness, future wealth, and political stability.

The European Commission's recently published White Paper on AI and its communication on a European strategy for data are crucial steps to formalise the debate on responding to the AI challenge in Europe. The commission's AI proposals address important aspects regarding funding, regulation, and data availability in Europe. While the strategy goes in the right direction, several points need to be clarified, in particular finding the right balance between regulation and competitiveness of the EU's AI industry.

Substantially more financial firepower is needed both on the EU and national level in order to reach targeted funding levels and to close the AI investment gap towards China and the US. Creating a network of AI research centres around a European AI "lighthouse" is an excellent approach to scale the potential of the EU's AI R&D infrastructure, but targeted support for selected European AI hubs might be further needed to create the aspired "ecosystem of excellence".

The EU still has a competitive edge in AI research based on its top publication record and hosts top AI talent but risks falling behind as it underspends on tech R&D compared with the US and China and struggles to transfer research to business models and applications. The EU should find ways to overcome existing silos for consumer data and give users full sovereignty to commercialize their data in a secure and barrier-free manner.

Further clarification is needed on the distinction between "higher-risk" and "lower-risk" AI systems. "Regulatory arbitrage" regarding AI development must be prevented by putting regulatory requirements clearly on the application/commercialization level for all EU and non-EU providers. Aspects of GDPR that might affect AI development in the EU strictly need to be applied to non-EU developers providing AI-based services in the EU as well – for both higher-risk and lower-risk AI systems.

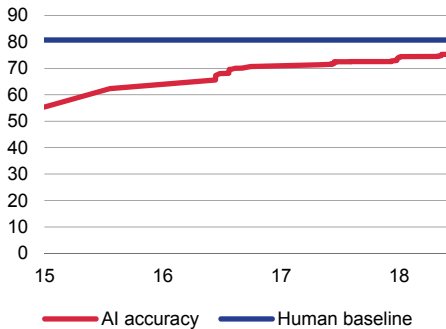


## (How) will the EU become an AI superstar?

AI catches (almost) up with humans in image interpretation

1

Visual Question Answering (VQA) challenge, accuracy, %



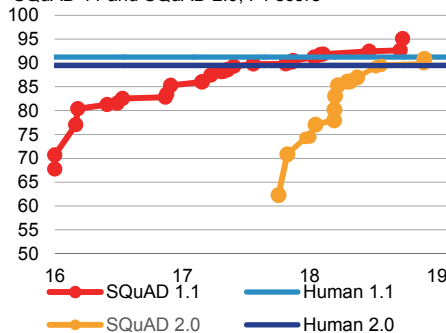
Note: The VQA challenge incorporates both computer vision and natural language understanding. The VQA challenge tests how well computers can jointly reason over these two distinct data distributions. Human performance is measured by having humans answer.

Source: VQA Challenge 2019 accessed through R. Perrault, Y. Shoham, E. Brynjolfsson, J. Clark, J. Etchemendy, B. Grosz, T. Lyons, J. Manyika, S. Mishra, and J. C. Niebles, "The AI Index 2019 Annual Report", AI Index Steering Committee, Human-Centered AI Institute, Stanford University, Stanford, CA, December 2019

AI surpasses humans in Stanford question answering test

2

SQuAD 11 and SQuAD 2.0, F1 score



Note: The Stanford Question Answering Dataset (SQuAD) is a reading comprehension dataset, consisting of questions posed by crowdworkers on a set of Wikipedia articles. The answer to every question is a segment of text, or span, from the corresponding reading passage, or the question might be unanswerable.

Source: CdaLab Worksheets, 2019, accessed through R. Perrault, Y. Shoham, E. Brynjolfsson, J. Clark, J. Etchemendy, B. Grosz, T. Lyons, J. Manyika, S. Mishra, and J. C. Niebles, "The AI Index 2019 Annual Report", AI Index Steering Committee, Human-Centered AI Institute, Stanford University, Stanford, CA, December 2019

## A global race for AI leadership – without Europe?

Artificial intelligence is perhaps the one technology that frequently triggers the highest hopes and deepest fears of our times. Optimists see it as key to a dramatic rise in productivity and economic growth, scientific breakthroughs, improving health care, higher life expectancy, and ever-rising convenience. Critics fear that at some point AI might severely disrupt labour markets around the globe, lead to a further surge in income and wealth inequality, imperil social and political stability, and, if surpassing human intelligence, replace humanity as measure of all things (EU Monitor, May 14, 2018).

AI fears and hopes are fuelled by the dramatic progress in AI over the last years. It seems close to impossible to predict the future trajectory of AI development and its impact on society. But a rapid rise in computing power and data availability already allowed for impressive AI breakthroughs over the last few years, whether in beating human champions in the ancient game of Go or matching or surpassing humans at image and voice recognition, translation, and genome sequencing (Charts 1 and 2).

AI might be a key element in responding to the mounting challenges of the 21st century such as climate change and the risk of pandemics. Tackling climate change has become globally urgent and the European Commission plans to spend a fourth of its future resources on reaching net carbon-neutrality in the EU by 2050. AI/machine learning might help to improve climate and weather predictions, manage the growing energy use of data centers<sup>1</sup>, optimize buildings, reduce transportation, and accelerate research on alternative-energy sources or geoengineering<sup>2</sup>. Societies, economies, and markets around the world are shaken by the rapid spread of Covid-19. According to the World Health Organization<sup>3</sup>, AI and big data were used by the Chinese government to trace the spread of the disease and also US researchers started to use public-health data and machine-learning techniques to track the outbreak.<sup>4</sup> The Canadian health monitoring platform BlueDot even managed to identify the outbreak before official WHO notifications, using AI to scan foreign-language news reports, official proclamations, and public-health data.<sup>5</sup> Drugmakers are using AI techniques to search for vaccines and medication.<sup>6</sup>

High economic hopes. Given the vast scope of applications promised by AI, projections circulate that see the potential impact of AI on the world economy at a staggering USD 13-16 trillion by 2030.<sup>7</sup> Forecasts about the economic effects of AI are highly speculative due to possibly nonlinear interactions with other factors, unknown variables, and lack of historical comparability. But to put these numbers into perspective, this would match the total current size of the Chinese or EU27 economies.

Europe risks falling further back in global race for AI dominance. With a view to the economic potential, it is no surprise that companies and governments around the world have entered a heated race for AI leadership. But even though we might just be at an early stage, it already seems to have become a two-horse race between the US and China (Charts 3 and 4). At the same time the

<sup>1</sup> Training AI algorithms itself is a highly energy-intensive process, though, and data centers and data transmission already today account for around 2% of global electricity demand, according to an IEA report (2019).

<sup>2</sup> Climate Change AI (2019).

<sup>3</sup> WHO (2020).

<sup>4</sup> Wired (February 8, 2020).

<sup>5</sup> Wired (January 25, 2020).

<sup>6</sup> WSJ (March 6, 2020).

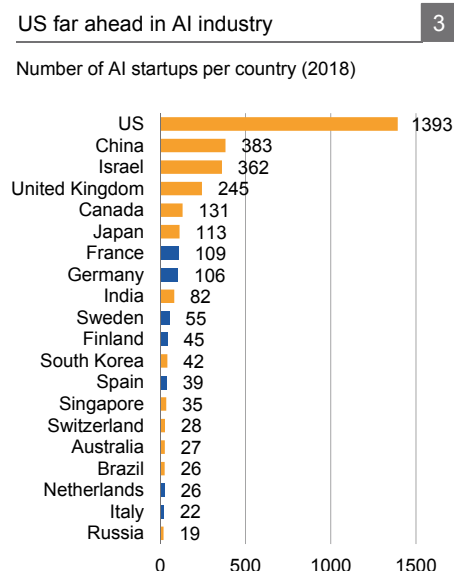
<sup>7</sup> McKinsey (2018) and PwC (2017).



## (How) will the EU become an AI superstar?

EU, still the world's second-largest economy by some metrics, increasingly finds itself sidelined at the risk of losing competitiveness and future wealth.

### A European call for AI sovereignty



Source: Roland Berger (2018), based on Asgard, CB Insights, Crunchbase et. al.

Europe has understood the challenges and opportunities offered by AI both for its economic and geopolitical role as well as the technology's potential impact on society. Together with forming a European "Green Deal" to tackle climate change, making "Europe fit for the digital age" is one of the two top priorities of the von der Leyen Commission.<sup>8</sup> Under the lead of Executive Vice President Vestager, Europe has set course on achieving technology sovereignty and securing its place in the rising "geotech" world order. While the EU's strategy aims at making Europe competitive, in particular regarding key technologies such as AI, blockchain, high-performance and quantum computing, and IoT, it also wants to make sure that the continent's fundamental values and fundamental rights and freedoms are warranted and a potentially disruptive impact on the EU's economy and labour market is mitigated.

The commission's recently published White Paper on Artificial Intelligence and its communication on a European strategy for data are introduced as the first pillars of the EU's digital strategy and indeed are crucial steps in formalising the debate on addressing the AI challenge in Europe.<sup>9</sup>

The White Paper on AI elaborates on the Commission's plan on developing AI in the EU in line with the Union's fundamental rights. It outlines the Commission's proposals on channelling EU investment in AI through the Digital Europe programme, the Connecting Europe Facility 2, and Horizon Europe. It wants to build an "ecosystem of excellence" that should help to integrate research and strengthen collaboration between EU members and help to close the EU's AI funding gap. Proposals for a legal framework that focuses on risks for fundamental rights and safety related to AI should help to create "an ecosystem of trust". Building on the EU's Ethics Guidelines for Trustworthy AI presented in 2019<sup>10</sup>, it focuses on certification and control of "high-risk" AI systems while other AI systems could apply a voluntary labelling.

The European strategy for data aims at creating a "genuine single market for data" both for secure storage of personal and non-personal data as well as providing EU companies access to "huge amounts of high quality data" in order to ensure Europe's "technological sovereignty". Standards and harmonization of datasets should foster data interoperability and improve business-to-business sharing of non-personal (industrial data) that could help both large companies and SMEs remain competitive. Public sector datasets should be opened to increase data availability while access and reuse of sensitive data such as health and social data in line with data protection legislation should be fostered for research purposes including for AI development.

The EU's AI proposals address important aspects regarding funding, regulation, and data availability in Europe. While the strategy goes into the right direction, several points need to be clarified, in particular regarding finding the right balance between regulation and competitiveness of the EU's AI industry.

Proposals to increase the EU's AI investments are highly welcome but substantially more financial firepower is needed both on the EU and

<sup>8</sup> U. von der Leyen (2019).

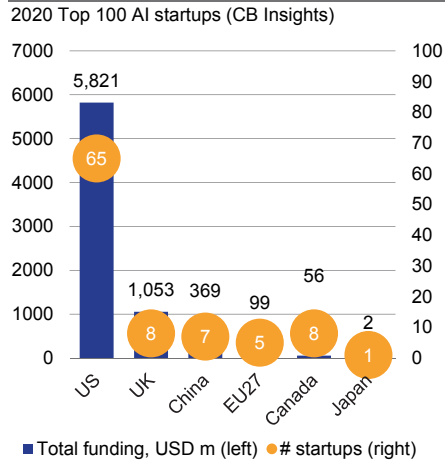
<sup>9</sup> European Commission (2020). White Paper on Artificial Intelligence; European Commission (2020). A European strategy for data.

<sup>10</sup> European Commission (2019). Ethics guidelines for trustworthy AI.



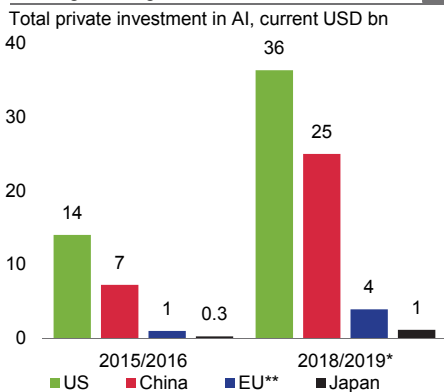
## (How) will the EU become an AI superstar?

Top 100 global AI startups ranking – only five from the EU27



Note: With the AI 100 CB Insights is annually ranking the 100 AI startups that it considers most promising globally.  
Source: CB Insights

China catches up with US private AI funding, EU lags behind



Note: \* January 2018 - October 2019; \*\* based on data availability (ordered by size of funding: France, Germany, Netherlands, Spain, Sweden, Finland, Ireland, Belgium, Denmark, Portugal, Italy, Poland, Austria, Hungary)  
Source: CAPIQ, Crunchbase, Quid, via R. Perrault, Y. Shoham, E. Brynjolfsson, J. Clark, J. Etchemendy, B. Grosz, T. Lyons, J. Manyika, S. Mishra, and J. Carlos Niebles, "The AI Index 2019 Annual Report", AI Index Steering Committee, Human-Centered AI Institute, Stanford University, Stanford,

national level in order to reach targeted AI funding levels and to close the AI investment gap towards China and the US.

Creating a network of AI research centres around an AI "lighthouse" is an excellent approach to scale the potential of the EU's AI R&D infrastructure, but targeted support for selected European AI hubs might be further needed to create the aspired "ecosystem of excellence".

Fostering industrial and government data sharing in the EU is crucial to provide AI researchers with the required "fuel" to train algorithms, but the EU should also find ways to overcome existing silos for consumer data and give users full sovereignty to commercialize their data in a secure and barrier-free manner.

Finding the right balance between AI regulation and competitiveness is key and further disadvantages for EU developers towards competitors must be avoided. Further clarification is needed on the distinction between "higher-risk" and "lower-risk" AI systems. "Regulatory arbitrage" regarding AI development needs to be prevented by putting regulatory requirements clearly on the application/commercialization level for all EU and non-EU providers. Aspects of GDPR that might affect AI development in the EU strictly need to be applied to non-EU developers providing AI-based services in the EU as well – both for high-risk and lower-risk AI systems.

The EU still has a competitive edge in AI research and hosts top AI talent but risks falling behind here as well. Europe should collectively address its underspending on tech R&D relative to its competitors and link its educational focus stronger to market needs and attracting and keeping AI talent. Industry and policymakers should work closely together to improve the transfer of research to business models and applications.

The potential of AI to enable other policy areas such as the "European Green Deal" or defence should be strongly reflected in the EU budget allocation.

### Money: More VC and private and public funding urgently needed

Availability of funding remains a main issue for the European AI industry. Compared with its global peers, Europe still lags with investment in the digital economy, in particular regarding funding for startups and emerging companies. Regarding AI, being at the heart of the digital transformation of the global economy, this is a specifically pressing issue. On the positive side, total private investment in the EU AI industry quadrupled between 2015/2016 and 2018/2019 (data until October) to USD 4 bn, based on estimates published in Stanford's AI Index report (Chart 5). On the negative side, the absolute investment gap towards the US and China has grown further. For 2018/19 the EU's total AI investment remains dwarfed by the US with USD 36 bn as well as China, which managed to push total AI funding to USD 25 bn.

The EU has not been complacent regarding this challenge. In order to close the EU's "digital investment gap" the commission together with the European Investment Fund (EIF) has created a EUR 410 m venture capital fund-of-funds "VentureEU" to spur investment in innovative startups and to help innovative companies to scale up across Europe. The fund aims to raise EUR 2.1 bn of public and private investment and trigger EUR 6.5 bn in fresh investment into startups, in order to double the available venture capital in the EU:  
[https://ec.europa.eu/commission/presscorner/detail/en/IP\\_18\\_2763](https://ec.europa.eu/commission/presscorner/detail/en/IP_18_2763)

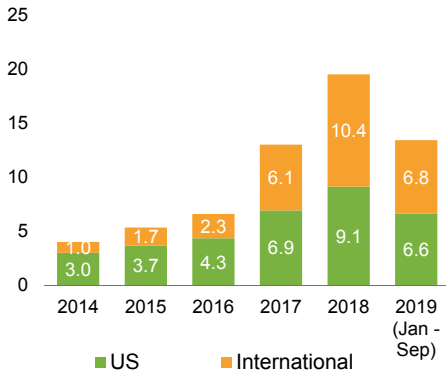




## (How) will the EU become an AI superstar?

### Half of global private AI investment goes to the US 6

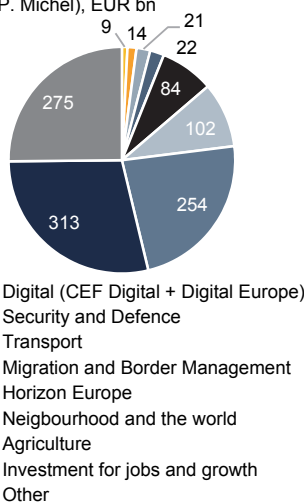
US and international seed and VC volume for AI and machine learning startups, USD bn



Source: Crunchbase

### Digital only a fraction of EU budget proposals 7

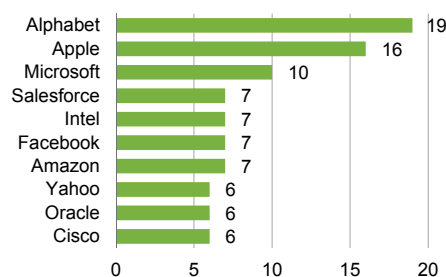
EU budget proposal 2021-2027 (Council P. Michel), EUR bn



Source: European Council

### Top AI takeovers – all from the US 8

Number of AI company acquisitions by acquirers, Jan 2000-May 2019



Source: Crunchbase retrieved from Center For Data Innovation (2019). Who is Winning the AI Race: China, the EU or the United States?

The commission also increased European investment in AI through its research and innovation framework program Horizon 2020 by 70% to EUR 1.5 bn over 2018-2020. Its aim is to trigger total AI investments in the EU, including national governments and private sector of more than EUR 20 bn for the period 2018-2020. Eventually, total private and public AI investment should reach EUR 20 bn per year, including contributions from member states and the Commission. The Commission aims to channel AI investment through the Digital Europe programme, the ConnectingEurope Facility 2, and Horizon Europe and plans to scale up access to finance in AI under InvestEU, the successor of the Juncker Plan.

Still, the investment levels reported for 2018/19 remain far below the EU's target. Also future public funding in the EU is uncertain, in particular as member countries fight about the size and composition of the EU's next seven-year budget (Talking Point, February 25). The risks are that spending on AI and digital innovation in general could be scrutinised for the sake of other traditional spending programs (Chart 7).

AI funding must be scaled up rapidly to prevent the spending gap towards the US and China to grow even further. As China speeds up to compete for the AI leadership position, the US will not remain idle. In the fiscal year 2020, the US government will spend USD 5.9 bn on AI R&D, including USD 1 bn for non-defence and USD 4.9 bn for defence research. The government just announced that for 2021, it seeks to increase federal spending on non-defence AI to USD 2 bn.<sup>11</sup> It is difficult to get reliable numbers for China's AI spending. According to research from the Center for Security and Emerging Technology<sup>12</sup>, the Chinese government's spending on AI R&D is estimated between USD 2 bn and USD 8 bn in 2018. For Europe it is similarly difficult to get aggregate numbers for all 27 member states. France announced in 2018 to spend a total EUR 1.5 bn by 2020 in order catch up with the US and China.<sup>13</sup> Also in 2018, Germany announced in its AI strategy to earmark EUR 3 bn for AI investment until 2025. However, the German AI budget was slashed last year to only EUR 1 bn until 2023 against a more constrained fiscal outlook (Focus Germany, 20 December 2019). For Italy and Spain, the EU's third- and fourth-largest economies, no clear-cut budgetary allocation for AI is available. Comparing these four economies, together accounting for almost two-thirds of the EU27 GDP, with the US and China does not put a positive light on the EU national AI strategies.

EU members should bundle resources on AI funding, outside the EU budget if needed. If EU budget negotiations cannot lead to a sufficient scaling to reach at least the AI investments on the EU level aimed for by the commission, willing members should step in bilaterally to increase national AI spending and consider bundling their resources on a voluntary basis, potentially coordinated on the EU level. In their "Aachen Treaty" of 2019, Germany and France agreed on the creation of a Franco-German research and innovation network for AI, including closer cooperation of the French and German AI industries.<sup>14</sup> This could be a starting point to integrate other EU members.

A competitive and independent European AI landscape. It also has to be made sure that European AI companies continue to serve the long-term European competitiveness and help spread the benefits of the digital transformations across industries and sectors. Public and private EU funding at different stages are a key element of achieving a high level of independence from non-EU investors. Data on global acquisitions have shown that in particular US big techs

<sup>11</sup> <https://www.technologyreview.com/s/614842/china-us-ai-military-spending/>

<sup>12</sup> <http://cset.georgetown.edu/wp-content/uploads/Chinese-Public-AI-RD-Spending-Provisional-Findings-2.pdf>

<sup>13</sup> <https://www.reuters.com/article/us-france-tech/france-to-spend-1-8-billion-on-ai-to-compete-with-u-s-china-idUSKBN1H51XP>

<sup>14</sup> Federal Ministry of Finance (2019).



## (How) will the EU become an AI superstar?

have been active in integrating promising AI companies into their corporate portfolios (Chart 8). When it comes to funding European AI companies with European taxpayer money through different EU and national programs, there should be clear limitations regarding the level of acceptable non-EU funding at later stages, in order to avoid subsidizing a buyout of publicly funded European AI successes from abroad. In addition, whenever a non-EU majority stake in an AI company might be established, this should be assessed through the EU's foreign direct investment screening framework<sup>15</sup> on the grounds of long-term security and public order considerations, given the general purpose and dual-use nature of AI technologies.

### EU definitions of AI

9

"Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications)." (European Commission, 2018)

"Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions." (AI High Level Expert Group, 2019)

"Machine learning denotes the ability of a software/computer to learn from its environment or from a very large set of representative data, enabling systems to adapt their behaviour to changing circumstances or to perform tasks for which they have not been explicitly programmed." (European Commission, 2020)

Source: European Commission (2018): Artificial Intelligence for Europe. European Commission (2019): A definition of Artificial Intelligence: main capabilities and scientific disciplines.

## Concentration: How to build an AI "ecosystem of excellence"

**Fragmentation of EU AI landscape limits scaling potential.** Which factors help to explain the stunning success of US big techs in the digital economy have been discussed at length in recent years. One factor that is frequently quoted is the unique technology infrastructure of the Silicon Valley, where academia, startups, and government are closely integrated in the proximity of Stanford University. Governments around the world have tried to learn from this success in building their own technology hubs, with varying success. In the European case, the fragmentation of the AI industry between member countries is certainly a factor that limits the scaling potential that the US and China can benefit from. Despite bold steps on the EU level to streamline European AI efforts, members still tend to focus on the implementation of their national strategies – if at all.

**EU proposals to build a network of research centres on the right track.** The creation of the European Innovation Council<sup>16</sup> (which is still in its pilot phase) is an important step to improve coordination between European policymakers, researchers, innovators and investors. It will be fully implemented under Horizon Europe in 2021. Beyond its current mandate, it could be a good starting point to build what the Commission has called a European "lighthouse centre of research, innovation and expertise" on artificial intelligence. Building the nexus of a network of research centres across the EU, this would help to align national AI efforts, foster public/private partnerships on AI, and create the required synergies and economies of scale to become globally competitive. The nexus and nodes of this network should be used to build AI research "parks", where startups, incubators, investors, and academia can build a closely integrated infrastructure that allows a rapid transfer from research to business application. Private AI initiatives such as CLAIRE<sup>17</sup>, a European research network connecting more than 350 AI groups and institutions across Europe and is closely aligned with national AI associations across the member states, could be extremely helpful in creating the neural network that connects these centres. With a view to the successes of the US DARPA<sup>18</sup> (Defense Advanced Research Projects Agency), one should not shy away from integrating both defence and civilian AI research in this network, strongly guided by the human-centred and value-based approach to AI envisioned by the EU's AI strategy.

**Geographic AI hubs cannot be substituted by virtual research networks.** In terms of geographic proximity, the specific infrastructure of the Silicon Valley cannot be replicated in the EU without enforcing it through a top-down approach, most likely highly unpopular among many members that might see themselves passed over in the selection of locations. It would also be misaligned with the spirit of cohesion and convergence within the EU that underlies the treaties of the EU. However, by building a European AI infrastructure one should,

<sup>15</sup> EUR-Lex (March 2019).

<sup>16</sup> <https://ec.europa.eu/research/eic/index.cfm>

<sup>17</sup> <https://claire-ai.org/>

<sup>18</sup> <https://www.darpa.mil/>



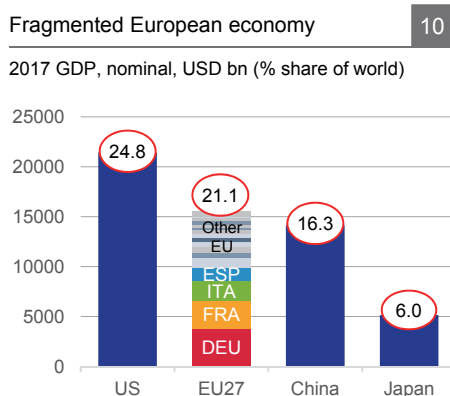
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nevertheless, bear in mind that economies of scale derived from concentration, integration, and proximity of talent cannot be reached if one tries to involve all regions equally. To exploit the joint potential fully, it will be unavoidable at least in the beginning to focus primarily on a few AI hubs, in particular in regions where existing infrastructure and successes can be built upon.<sup>19</sup>

**National subclusters for AI research priorities.** In line with the proposal of the Commission paper for the centres to focus on key areas where Europe could become a "global champion", these hubs could be assigned (maybe through a competition) the proposed research priorities, such as industry, health, transport, finance, agriculture, climate, or energy. This could be co-funded through a new legal instrument suggested by the Commission. In order to involve all 27 EU members and bolster their ownership of this initiative, (neighboring) members could consider teaming up to build subclusters for research priorities and joint centres.

### Size: A fragmented (digital) single market

**The EU cannot fully exploit the potential of the digital single market.** In the digital economy, size matters. This is clearly demonstrated by the success of a handful of tech companies that now dominate their respective markets niches. What they (almost) all have in common is that they started in a huge and strongly integrated domestic market (the US) or in a huge and protected domestic market (China). US companies managed to rapidly scale up by benefiting from network externalities in the integrated US market, providing them with a head start when they went global. Chinese companies benefited from substantially reduced foreign competition in their protected domestic market. While Europe's single market is comparable in size to the US and China (Chart 10), it is fragmented in comparison with the US, and its market-based model excludes replicating the Chinese model.



Source: IMF, Deutsche Bank Research

**European champions not by decree but by success.** Europe is struggling to deal with this dilemma and calls to "create" digital champions have become loud in the recent months. We doubt that a top-down approach of declaring companies as digital or AI champions and allocating funding accordingly is the most-efficient approach of creating a competitive AI landscape, on top of all concerns regarding potential market distortions. Rather promising, from our perspective, are national and EU strategies to create networks of companies that together with public private partnerships can use cooperation on research and development initiatives or data exchange to achieve economies of scale. Cross-border collaboration could be rewarded through prioritized access to EU-funding.

**A crucial step to create a level playing field for EU companies are planned updates to the EU's competitiveness rules.** This should help EU companies in competing with peers from jurisdictions with diverging anti-trust frameworks or different regulation regarding state subsidies and ownership.

### Data: Lacking the fuel that empowers AI

Data is – next to computing power – the key component for training algorithms and developing/improving AI-based tools and business models. Accordingly, companies and countries with vast access to data have a massive competitive advantage when it comes to the development and commercialization of AI-based applications. As the European Commission outlined in its communication on a "European strategy for data", "a small number of Big Tech firms holds a

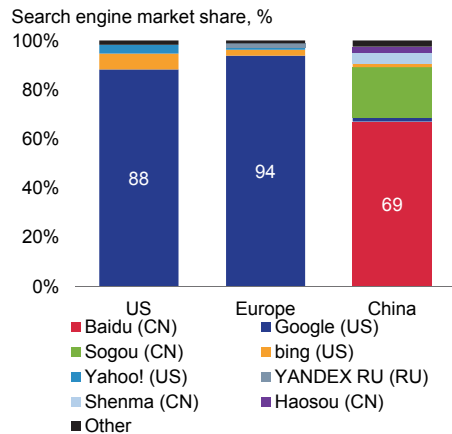
<sup>19</sup> See e.g. Asgard (2017).



## (How) will the EU become an AI superstar?

Data silos – no European providers with noteworthy share in global search engine market

11



Source: Statcounter Global Stats

large part of the world's data". As these companies stem almost entirely from the US and China (Charts 11 and 12), this gives the EU a highly disadvantageous starting position in the race for AI leadership.

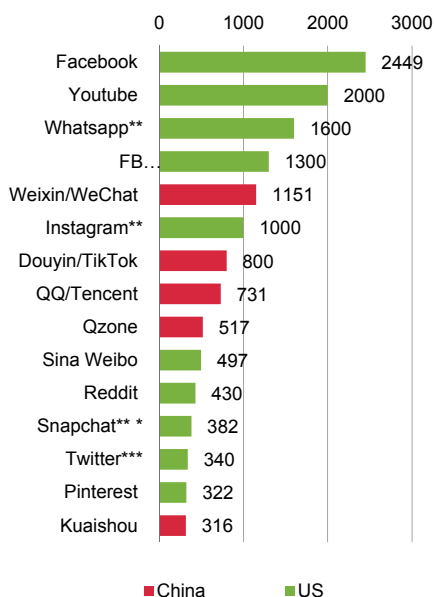
**A single European data space.** In order to address this issue and to build a European data economy, the EU aims at creating a "single European data space". This should warrant Europe's competitiveness and data sovereignty. While European companies lack access to the vast pools of data produced by consumers in the platform economy, the EU hopes that this can be compensated by creating common data spaces in key sectors, such as industrial manufacturing, mobility, health, and climate. Participating actors would be incentivized to share non-personal data business-to-business as well as government-to-business (and vice versa). This should be supported by a regulatory framework for data governance, including interoperability and standardization and compliance with data protection. In addition, public and private efforts should be strengthened to create a competitive European data infrastructure including cloud services (which are currently almost entirely US-dominated). The German "Gaia-X" project might be a starting point for concerted European action on building "federated cloud infrastructures".<sup>20</sup>

**Enforce user data portability warranted in GDPR.** However, for many purposes consumer data might still be the most relevant to build and improve AI-based services. While the General Data Protection Regulation (GDPR) gives users the right, in principle, to ask providers to share their data with others (right to data portability), in practice, it is often highly difficult and time-intensive to enforce this right. Users should be given the possibility to explicitly give consent and request providers to forward their data to third parties with just a few clicks. For this Europe would need a standardized framework and respective APIs for barrier-free and real-time access. The Commission clarifies in its communication that data-sharing between companies in principle should be voluntary. While we agree, it should be made compulsory, if the protection of user rights under GDPR to portability demands it.

Data silos – major social platforms all from the US and China

12

World's most used social platforms, mn contacts\*



Note: \*Contacts are based on monthly active users, active user accounts, advertising audiences, or unique monthly visitors; platforms identified by (\*\*) have not published updated user numbers in the last 12 months; platforms identified by (\*\*\*) do not publish MAU data; figures for Twitter and Snapchat use each platform's latest advertising audience reach, as reported in each platform's self-service advertising tools (January 2020).

Source: Hootsuite & We Are Social (2020). Digital 2020 Global Digital Overview, retrieved from <https://datareportal.com/reports/digital-2020-global-digital-overview>

**Empowering EU users would benefit whole economy.** Users' data sovereignty would be bolstered by giving them the opportunity to commercialise their own data in the data economy rather than leaving it to the providers to earn the full data dividend. This could be linked to above outlined Commission plans for data spaces, i.e., users could agree to provide data (possibly in an anonymized or pseudonymized way) to data pools that can be accessed/purchased by companies. This could help address several issues at once: bolster users' rights on data sovereignty and ownership warranted under GDPR; provide ways to price and value data in the data economy; allow companies with lacking access to data (in particular for AI development) to purchase datasets and thus strengthen their competitiveness. It would address market asymmetries in the platform economy that stem from concentration of data among a few companies.

**A European data market?** The significance of such a step cannot be overestimated. In essence, European user data would become a marketable asset, whereas users themselves would be empowered to decide if and under which conditions to commercialise their data. The implementation of such a framework could be based on the Commission's plans for the adoption of an Implementing act on high-value data sets (Q1 2021) under the Open Data Directive. This foresees making public data available for free in a machine-readable format through standardized APIs. The same framework and standards could be used for consumer-to-business data sharing. Of course, such a framework needs high standards for cybersecurity, data protection (especially in case of highly sensitive information) as well as distinction between

<sup>20</sup> Federal Ministry for Economic Affairs and Energy (2019).





## (How) will the EU become an AI superstar?

raw user data and proprietary information derived and processed by providers. Industry-wide standards for anonymization or pseudonymization should help to address privacy and legal concerns.

EU aims to become a global role model for AI regulation

13

Key requirements for trustworthy AI (European Commission, 2019)

- Human agency and oversight
- Technical robustness and safety
- Privacy and Data Governance
- Transparency
- Diversity, non-discrimination and fairness
- Societal and environmental well-being
- Accountability

Source: European Commission (2019). Building Trust in Human-Centric Artificial Intelligence.

### AI regulation: Finding the right balance

**A cautionary and prudent approach to AI should be warranted, not only in Europe but globally.** This is particularly the case, as we have witnessed the potentially highly distortive impact of certain aspects of technologies such as AI already, e.g., regarding the public dialogue, elections, and growing knowledge and wealth asymmetries (see EU Monitor, August 2019). Additionally, increasing use of AI in "high-risk" areas such as transportation, healthcare, or policing requires clear rules regarding safety, legal liability, and protection of rights.

**EU is a frontrunner on AI regulation.** The EU is one of the first jurisdictions to address the issue of AI regulation in such depth and the fact that it has become a front-runner (and international role model) regarding technology regulation is a remarkable success. The necessity to find a legal framework for this game-changing technology cannot be questioned. Regarding the fragmentation of the EU's digital single market, it is also crucial to have common European standards to avoid cross-border uncertainties for AI researchers and companies.

**AI regulation and competitiveness need to be balanced.** However, the EU faces a fundamental dilemma in its AI strategy: how to catch up in the global AI race and particularly in commercializing AI, while at the same time regulating potential risks and enforcing the protection of user rights and fundamental values? How can it be made sure that the EU will keep up if other economies do not follow suit regarding the high legal standards for AI development?

**Further disadvantages for the EU AI landscape should be avoided.** Regarding privacy rights and data ownership, the absence of any (strict) regulation over many years might be a crucial factor in explaining the success of digital behemoths around the globe. The European General Data Protection Regulation (GDPR), at least in principle, already substantially strengthened users' data rights also with respect to transparency of AI-based decision making (see Talking Point, 2018). When AI regulation is further tightened in the EU but remains more lax elsewhere, the EU could unintentionally create disadvantages for its own AI industry. This does not mean at all that the concerns regarding high-risk application and use of data should be left unaddressed, but the potential costs must be recognized, in particular when one is already far behind in the race.

**The European Commission's "risk-based approach" to AI requires further clarification.** The Commission proposes a risk-based approach to determine the scope of applicable AI regulation and restrictions. According to the Commission, the risk level of applications would need to be assessed both regarding the sectors and the intended use. "High-risk" sectors would include healthcare, transport, and energy while the risk level would also need to be determined with view to protection of safety, consumer rights, and fundamental rights. In general, using a risk-based approach certainly makes sense and should help to avoid a regulatory overburden for AI developers and service providers. In practice, however, it might be difficult to set clear borders for what should be considered higher or lower risks, in particular when it comes to fundamental rights. The requirement of non-discrimination could potentially put all applications prone to algorithmic bias at high risk, whether, e.g., used in recruiting processes or loan applications.

One of the most-sensitive topics regarding current AI developments and regulation is the use of biometric data for remote identification, e.g., facial recognition in public places. The Commission clarifies in its White Paper, that



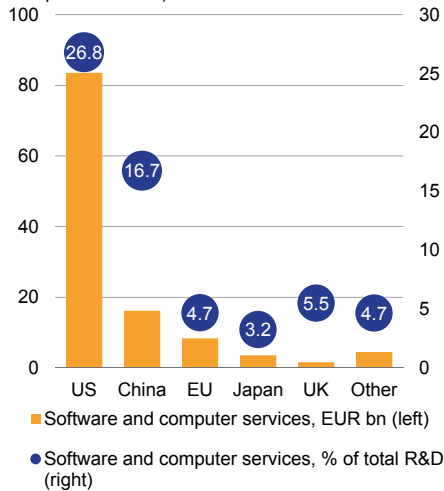
## (How) will the EU become an AI superstar?

this carries "in principle" risks for fundamental rights and that under EU data protection regulation such as the GDPR the "processing of biometric data for the purpose of uniquely identifying a natural person" is in principle prohibited, unless "such use is duly justified, proportionate and subject to adequate safeguards." Given that European governments such as Germany are already planning widespread use of facial recognition technology, e.g. at railway stations and airports<sup>21</sup>, clarification on the EU level is urgently needed under which specific circumstances this is justified.

**AI regulation must take effect at business level.** If European AI regulation will be stricter than elsewhere, it is crucial that regulation will be implemented at the commercialization/business level to create a level playing field. Otherwise, EU AI companies and startups would be put at a severe disadvantage and the current AI gap could widen further. This must indeed mean that applications will need to be restricted or prohibited if these are based on algorithms that are trained (outside the EU) in a way or with data that do not comply with EU regulation, e.g., regarding fundamental rights such as non-discrimination, privacy protection and consumer rights.<sup>22</sup> Third countries might otherwise exploit tougher regulation in the EU in a beggar-thy-neighbour manner. For example, the UK, with London already hosting the largest technology hub in Europe, indicated that because it has left the EU, it will develop its own data protection regulation. Also, the question of future data exchange between the EU and UK with respect to GPDR has already become a contentious issue.

Europe underspends on tech R&D 14

Global 2500 R&D spending 2018/19 (software and computer services)



Note: R&D spending of software and computer services can serve only as a very rough proxy for R&D spending on key technologies such as AI; for example, in many EU countries or Japan, a bulk of R&D spending comes from the automotive sector, which includes major players on technology R&D.

Source: European Commission (2019). The 2019 EU Industrial R&D Investment Scoreboard.

### AI research and skills: Europe's got talent but underspends on tech R&D

**Europe still competitive in AI R&D and skills.** When it comes to AI academic research and talent, Europe is still in a relatively competitive position compared with the US and China. While the US does have a significant lead regarding top AI publications, research institutions, and researchers, Europe and China are in a close race for second place. However, China's bold AI strategy, huge domestic (data) market, and global spread of tech giants suggest that China could quickly leave Europe behind and compete with the US for global leadership. It is thus imperative for Europe to increase rapidly its AI and tech talent pool and provide the academic and professional environment to keep and retrieve top talent.

**Europe underspends on tech R&D.** Europe's global share in R&D spending decreased over the last years. This primarily reflects the rise of China, which according to EIB calculations already spent more on R&D in 2016 than the entire EU.<sup>23</sup> Importantly, the share of R&D spending of the business sector is lower in the EU (66%) compared to the US (72%) or China (almost 80%).<sup>24</sup> Europe dedicates much less to tech than both the US and China (Chart 14). This partly reflects the dominance of the automobile and pharmaceutical sector in several European countries but also shows the growing discrepancy regarding the creation of tech giants compared with the US and China.

<sup>21</sup> Euractiv (Jan 10, 2020).

<sup>22</sup> In its White Paper on AI, the commission calls for applying the regulatory requirements to "all relevant economic operators providing AI-enabled products and services in the EU, regardless of whether they are established in the EU or not".

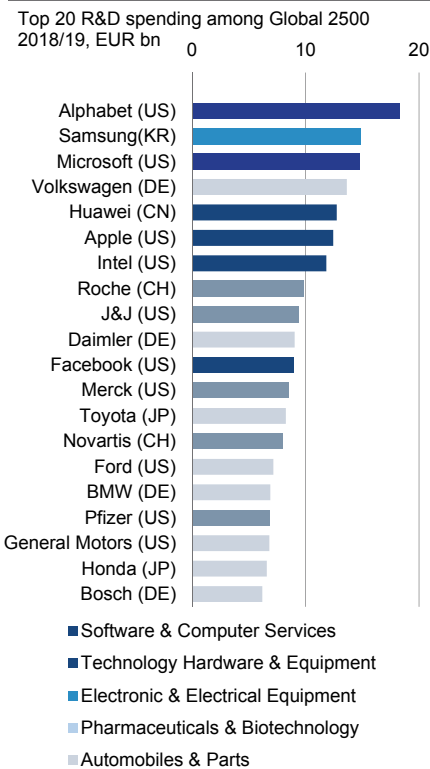
<sup>23</sup> EIB (2019). Investment Report 2019/2020, page 110.

<sup>24</sup> Even though in China many large companies are controlled by the state.



## (How) will the EU become an AI superstar?

### Technology companies lead top R&D spenders 15

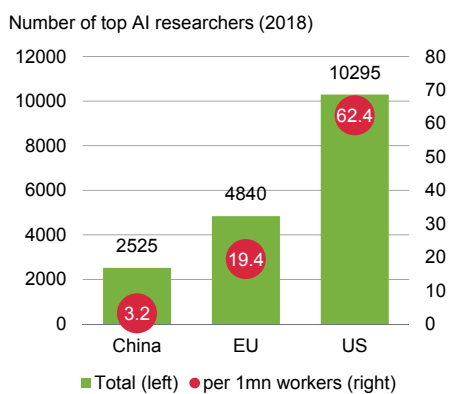


Source: European Commission (2019): The 2019 EU Industrial R&D Investment Scoreboard.

**Big techs spend big on R&D.** Big techs from the US and China have ranked up to the top R&D spenders globally (Chart 15). These companies also tend to concentrate top AI talent and research capacities as they acquired top AI companies both to further establish their position in traditional market segments and spread their business portfolio to new ones. This concentration of tech and AI R&D spending and talent among US and Chinese companies risks leaving Europe further behind also regarding the creation of the next generation of tech champions. It needs to be emphasized that AI is not a separate industry or narrow niche of the economy. As a general purpose technology, it cross-feeds into all sectors of the industry and particularly lies at the core of the platform economy. Underspending on AI therefore means risking a severe loss of competitiveness, whether it is in automotive, the service sector or manufacturing.

**AI educational focus should be linked to market needs and attracting/keeping talent.** Europe is still in the game when it comes to top AI research, reflected, for example, in the high number of European AI researchers that hand in publications at leading AI conferences (Chart 16). However, with view to the rapidly rising number of AI publications from Chinese academia and the educational focus on key technologies, Europe also risks falling behind on the talent side. For top talent, both research funding and compensation are often more attractive outside Europe, in particular in the US. The focus of the Commission's Digital Education Action plan on AI skills is of the highest importance to fill competence shortages. However, priority should be first given to train AI experts at the university level to bolster the AI industry rather than allocating resources broadly to upskill the workforce (which will increasingly be necessary over time as well). The intention to increase AI awareness to help EU citizens to handle technology and its implication in an informed manner is highly important and meets our own call for a digitally literate and enlightened society (EU Monitor, August 2019).

### US leads with top AI talent, Europe still in the game 16



Note: Number of authors publishing at leading AI academic conferences around the world.

Source: Center For Data Innovation (2019). Who Is Winning the AI Race: China, the EU or the United States?; based on JF Gagne, Grace Kiser, and Yoan Mantha., Global AI Talent Report 2019 (Element AI, April 2019), and World Bank Open Data (labor force, total; accessed June 26, 2019).

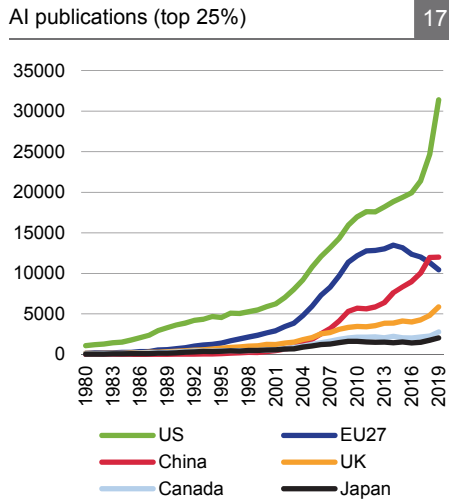
**Shortcomings in transfer from research to business application.** While Europe still has a competitive edge in AI research, it struggles to translate its excellent academic research into business models and commercialise its talent and skills compared with peers from the US and China. In the context of building European research networks of excellence outlined further above and strengthen public private partnerships on AI, priority should be given to coordinate research projects in a targeted market- and application-oriented manner. Fostering and improving funding for the European startup culture here also plays a key role.

### Dual use and economies of scope: AI is a key enabler across policy fields

**Leverage AI research through other EU policy priorities.** Public funding is scarce and needs to be distributed between competing policy priorities. But in the case of AI as a general purpose technology with an almost unlimited scope of applications this is not necessarily the case. This means from an EU perspective that investment and research efforts in AI can be efficiently linked and integrated with other policy priorities such as defence and climate policy. In particular, regarding the EU's upcoming decision on its next seven-year budget and policy priorities such as the European Green Deal, AI could become a key element across spending programs. Combining it with other priorities could lead to a substantial leverage to AI spending. For example, the EU aims to reserve 25% of its 2021-2027 budget for climate action, i.e. around EUR 250 bn over seven years.



## (How) will the EU become an AI superstar?



17

Source: OECD.AI(2020), visualisations powered by JSI from MAG, accessed on 2/3/2020, www.oecd.ai.

**Making full use of AI's dual use potential.** Almost any AI applications can be used both for civilian and defence purposes, making it almost by definition a dual-use technology. This potential to create strong synergies between civilian and defence research could not only help Europe to bolster its efforts to increase defence spending (and in particular defence R&D), but also to further integrate its defence capacities, e.g., through tapping the European Defence Fund, which earmarked a share of its funding for disruptive technologies and most prominently for AI research.<sup>25</sup>

### Top priority: Becoming an AI superstar

The Commission's White Papers on AI and strategy for data are a courageous step in bringing more structure and political coordination to the complex interactions and huge uncertainties related to AI. In its holistic approach, the Commission tries to address the questions of competitiveness, regulation, ethical guidelines, and socioeconomic considerations simultaneously. All these are crucial and equally important facets of the challenge posed by AI. However, in terms of timing and urgency one needs to allow for some discrimination.

**Priority: Gaining AI competitiveness.** Europe faces an imminent threat of falling far behind in the global competition for AI leadership if the EU and its members do not react rapidly and boldly. Given the broad economic and geopolitical implications this should be the number-one priority right now. It should thus be reflected not only in full-hearted commitments to digital sovereignty but in substantial public and private funding. The EU members' national AI strategies and what EU programs currently reserve for AI fall clearly short of that. The next EU budget, InvestEU, Horizon Europe, and other EU programs as well as the Commission's proposals on how to coordinate research efforts and exchange data provide a unique window of opportunity to confront this challenge. It needs to be addressed immediately, and any further postponement will translate into further losses of global competitiveness, influence, and future wealth.

**Priority: Setting the AI playing field.** The EU is right not to aim at achieving AI leadership at all costs. It needs a clear and Union-wide regulatory framework that gives legal certainty, embodies the Union's fundamental values and sets the playing field on which AI should thrive. However, it is clear that AI regulation must be adjusted and updated over time, either to react to further technological changes, to close regulatory loopholes, or to drive back regulation where one might find it too restrictive. As regulation could be added and removed in building blocks over time, there is no need to find a wholesale regulatory solution right from the start. First of all, from past experience, this will make it much lengthier – and time right now is of the essence. Secondly, if there is risk of overregulation that might overly harm the European AI industry at an early stage, starting with a less-restrictive approach is an option.

<sup>25</sup> European Commission (2019).

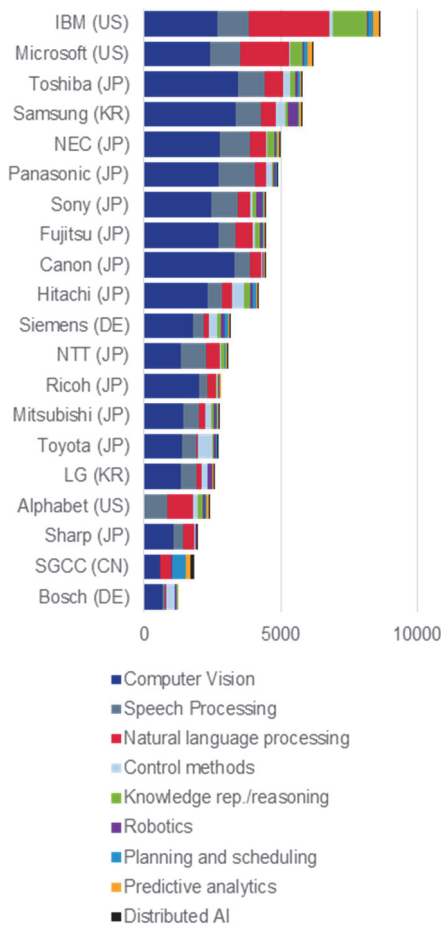




(How) will the EU become an AI superstar?

US and Japanese companies lead among AI patent applications

18



**Priority: A human-centric approach to AI.** To be sure: keeping AI in line with the EU's fundamental values and ethical norms as well as making sure that AI will benefit all citizens and not just a narrow technological elite should be the number-one priority of any AI strategy. The EU's ethical guidelines and legal considerations will be translated into its regulatory framework. But if we look beyond regulation and towards the future socioeconomic impact of AI, we need to be clear this is about the medium-to-long term. AI is not just yet disrupting EU labour markets (where unemployment is at historical lows) even though it might as some point. AI is currently not posing a threat to the welfare system even though in the future it might become one. AI is not at a level yet where it makes human intelligence and creativity obsolete, but no one knows when (if at all) this might be the case. All these considerations must be addressed at some point in the future but right now they should not be the EU's policy priority, in particular when it comes to the allocation of scarce financial resources.

Right now, the top priority for the EU should be to become an AI superstar, or more generally, a technology superstar in line with its values, legal order, and other key priorities such as climate policy and protecting its democratic order. Only by remaining a key innovator, commanding state-of-the-art technologies, and harvesting the productivity gains implied by AI in combination with other key technologies such as robotics, high-performance computing and IoT, will Europe be able to maintain its economic strength and competitiveness. By falling behind, Europe would not only lose prosperity and risk falling support for the democratic political order among its electorate but it would also lose financial room for manoeuvre to address the challenges posed by the digital transformation in a human-centric and value-based way.

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Source: World Intellectual Property Organization (2019). WIPO Technology Trends 2019 Artificial Intelligence.



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