

Section III

Global AI Race

Artificial Intelligence in UK Landscape Overview Q3/ 2018

Table of Contents

Section III: Global AI Race

Key Highlights.....	179
2017-2018: Transformation of Global AI Landscape.....	180
China vs US: Economic or Technological Standoff?.....	181
The Rise of China Tech Giants.....	183
AI and Economic Development.....	195
AI Nationalism.....	200
Innovation Ecosystem Development Can Create New International AI Leaders.....	201
The Global Race for AI Talent.....	202
National AI Strategies.....	203
UK as World Leader of “Good Trusted AI”	220

Key Highlights

- China now actively competing with US as top contender of the global AI race, with Chinese president Xi Jinping having committed \$150 billion in government funding in order to make China the undisputed global leader in the AI race by 2030.
- UK AI Industry growth rate increase at an accelerating pace and now outperforming most other countries. Countries with active AI hubs and aspirations to participate in the global AI market include Germany, Switzerland, Canada, Hong Kong, Singapore, South Korea, France, United Arab Emirates, Japan, Russia, Israel.
- The UK has now achieved the #3 position in the global AI race, and is actively supporting the development of its AI industry on the national level to ensure that this position is maintained and enhanced in the years to come. This is a result of many synergetic efforts including the UK Government's £1 billion AI Sector Deal commitment to grow the nation's AI industry, and the fact that the UK has created a highly attractive ecosystem for business development through the combination of favorable investment landscapes, high density of tech hubs and the scientific prowess of the London-Oxford-Cambridge triangle.
- The UK has several additional strategic contributing factors:
 - The UK now has an AI industry of a critical scale in the global economy, with investment in UK AI businesses has now exceeding \$5bn (£3.8bn) and growing.
 - London is now both a leading global financial hub and an AI hub, home to more AI startups than any other European country.
 - The scientific prowess and intellectual excellence emanating from AI-savvy UK universities.
 - The UK's reputation for developing strong ethical traditions relating to governance and business.
- There is room for many other countries to rise to top positions within the Global AI landscape by focusing on dominance in specific AI verticals rather than in AI as a horizontal technology, leading in specific AI use-cases and the application of AI to specific industries.
- While the UK's capacities to supercede China or the US as the leader of the global AI race are limited, the nation does have the potential to become the world leader in the specific niches of AI in FinTech and Healthcare, and to set the gold standard for "Good Trusted AI" and to develop international laws for the prevention of oppression, discrimination and biases resulting from the unethical use of AI.

2017-2018: Transformation of Global AI Landscape

There has been a stable balance with the US as the unquestioned leader in the global IT-market for nearly the past 20 years, and by extension the international AI-industry as well, which has evolved from the data science and big data analysis sector to become the engine of the 4th industrial revolution, global economic growth and social progress that it is today.

During recent years the European Union (Germany, France and the UK in particular) along with Canada also secured a stable secondary position in the global AI race, with other competing countries falling well behind the US and EU.

But the past two years can be reasonably considered as the Cambrian Explosion of the AI market, achieving a clearly exponential rate of development, and it is obvious that the next few years will bring an even greater level of accelerated development for the global AI market.

The past two years have brought in drastic changes to the global AI market and landscape. One of the most striking shifts to have occurred in 2017-2018 is that the US has now lost its exclusive #1 position as the frontrunner of the international AI and China rapidly reaching equality with the US. More of it, according to recent assessments and estimations of multiple AI experts, China might already even exceed the US by some parameters in terms of dominance in the AI industry.

The Chinese government has cemented AI as a core part of their national agenda, with Chinese president Xi Jinping having committed \$150 billion in government funding in order to make China the undisputed global leader in the AI race by 2030. Meanwhile, no such high-level governmental strategy has come forth in the US.

While we saw some steps in this direction during the Obama Administration, such as the release of the White House Reports "[Preparing for the Future of Artificial Intelligence](#)" and "[National Artificial Intelligence Research and Development Strategic Plan](#)", the Trump administration has failed to carry that torch forward.

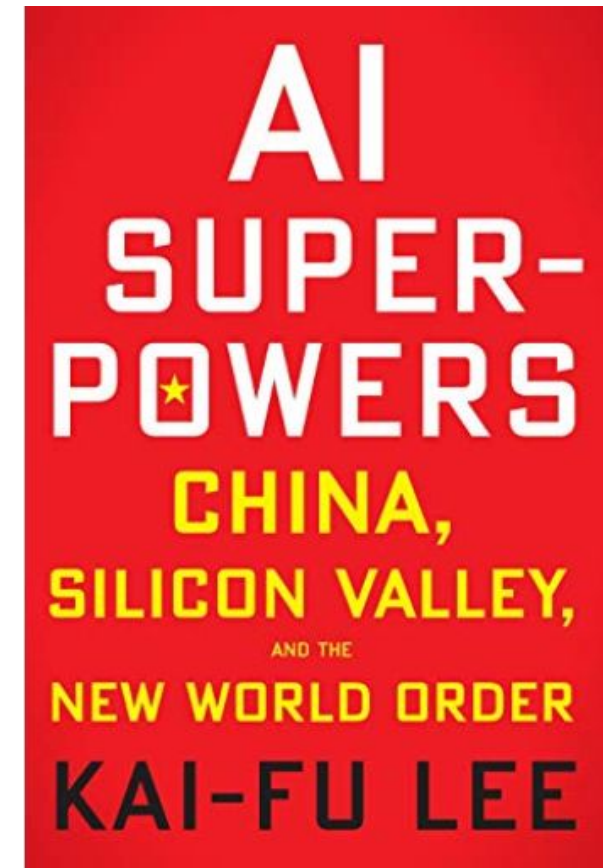
A large portion of developments in the US AI-industry is driven by the activities of US IT-giants (Google, Facebook, Amazon, etc) and private initiatives, such as recent announcement of [MIT to invest \\$1 Billion in its AI college](#) and [DARPA's Announcement to Launch a \\$2 Billion Campaign to Develop Next Wave of AI Technologies](#).

China vs US: Economic or Technological Standoff?

China's success in quickly dismantling the US' exclusive leadership position as the current global AI leader is in large part due to the government's realization of the national strategic importance of AI, and the commitment of tens of billions of dollars to the issue. Another factor biasing China toward success is the sheer size of their population, which gives them greater potentials to create and train a large number of AI specialists (one of the foremost bottlenecks on the pace of AI advancements in the EU and other regions). China's large population, combined with its more relaxed data privacy laws and the large amount of data produced by citizens (assisted by their high level of public surveillance), also allows for the nation to generate more data to train their AI, putting them at an additional competitive advantage over the US.

Some studies conducted in 2016-2017 found that up to 25% of the AI researchers working in the US originated in China. Recently, however, the Trump administration has stated its intentions to ban visas for Chinese individuals, which may in part be a masked attempt to decrease the proportion of AI, IT and technology workers coming from the nation. Now, whether independently of these actions or partly as a result, the US is facing a brain drain of AI talent (mentioned elsewhere in this report), with many top researchers leaving in order to work in China.

It is possible that the current economic sanctions and start of financial war between the US and China derive not from a matter of economic necessity, but as a belated US reaction to China's extreme rapid growth in technological development and AI sector in particular over the past few years, and an artificial attempt to slow down China's technological progress and in this way to secure their own position as the #1 leader of the global AI race. The trade war being launched between the US and China may be an attempt by the US to sever business ties between the two nations in order to separate them into isolated economical camps. This would create less flow of IP and intellectual assets between the countries, prevent new technology developments in one nation from inevitably trickling into the R&D labs of the other, and create a scenario where only one of the two nations could come out on top in the global AI race.



Deciphering China's AI Dream



Deciphering China's AI Dream: The context, components, capabilities, and consequences of China's strategy to lead the world in AI

Marked by the State Council's release of a national strategy for AI development in July 2017, China's pursuit of AI has, arguably, been "the story" of the past year. Deciphering this story requires an understanding of the messy combination of two subjects, China and AI, both of which are already difficult enough to comprehend on their own. Toward that end, I outline the key features of China's strategy to lead the world in AI and attempt to address a few misconceptions about China's AI dream. Building off of the excellent reporting and analysis of others on China's AI development, this report also draws on my translations of Chinese texts on AI policy, a compilation of metrics on China's AI capabilities vis-à-vis other countries, and conversations with those who have consulted with Chinese companies and institutions involved in shaping the AI scene.

The report is organized in four parts: (1) Context - I place China's AI strategy in the context of its past science and technology plans, as well as other countries' AI plans; (2) Components - I relate the key features of China's AI strategy to the drivers of AI development (e.g. data, talented scientists); (3) Capabilities - I assess China's current AI capabilities by constructing a novel index to measure a country's AI potential; (4) Consequences - I highlight the potential implications of China's AI dream for issues of AI safety, national security, economic development, and social governance. In each of these four parts, I dispel a common misconception about China's approach to AI (Table 1). Then, using the deconstruction of these myths as a starting point, I derive my own findings. What follows is a summary of the key findings in each section.



The Rise of China's Tech Giants - BAT

Baidu, Alibaba, and Tencent (BAT) are now valued at a combined \$1 trillion USD. As of March 2018, China had skyrocketed to 164 unicorns, worth a combined \$628 billion USD. Roughly 50 percent are controlled or backed by BAT. Worldwide, BAT invests in over 150 companies, spanning the gamut from AI to biotech.

In November 2017, China's Ministry of Science and Technology announced a new wave of "open innovation platforms," relying on Baidu for rollout of autonomous vehicles, Alibaba Cloud (Aliyun) for smart cities, and Tencent for medical imaging and diagnostics. But while BAT are increasingly embroiled in China's state agenda, they are also expanding their control to other APAC countries and consumers, recruiting US talent, investing in startups from Canada to Israel, and forming global partnerships in everything from predictive healthcare to conversational AI.

Of all the BAT giants, Baidu was the first to pioneer and apply deep learning, scoring a big win in 2014 with the hire of Andrew Ng to head Baidu's Silicon Valley AI lab. By 2015, Baidu's AI algorithms had already surpassed humans in Chinese speech recognition, a full year before Microsoft achieved the same feat in English. Fast forward to 2017, and China's dominant search engine now heads up national initiatives in AI R&D, driverless vehicles, and international open-source platforms.

And as of June 2018, Baidu is putting driverless cars on the road. Launching tests on an unused expressway in China's industrial city of Tianjin, Baidu has already signed agreements with the local government of Xiong'an New Area to build an AI city, decked out with autonomous cars, smart traffic systems, facial recognition, and sensor-loaded cement. Already heading China's National Engineering Lab for Deep Learning Technologies, Baidu is also working on brain-inspired neural chips and intelligent robotics under China's state-run umbrella. With voice patents in both the US and Japan, Baidu most recently launched Aladdin—a 3-in-1 smart speaker, smart lamp, and projector for the Japanese market—showcasing its product at CES 2018 (the Consumer Electronics Show). Built on Baidu's conversational AI platform, DuerOS, Aladdin is only the first of many Baidu consumer products that will rival the likes of Amazon's Alexa and Google Assistant. Hinted at by a patent published with the US, China, Europe, South Korea, and Japan, Baidu may soon be rolling out a consumer robot equipped with both voice and facial recognition.

The Rise of China's Tech Giants - Alibaba

China's leading e-commerce behemoth, **Alibaba** has made an unbelievable dent in the Chinese retail and financial sectors. Witnessing a 62 percent rise in sales from core commerce in Q1 of 2018, Alibaba has built far more than a digital marketplace.

Leading the world in fintech disruption, Alibaba's Ant Financial Services Group controls the world's largest money market fund, has made loans to tens of millions, and handled more payments in 2017 than Mastercard. Already geared with facial recognition for user sign-in, Alibaba's Alipay has more than half a billion users worldwide.

But Alibaba is setting its sights far further afield than just online retail and mobile payments. Working with several local governments, including that of Macau and Hangzhou, Alibaba is at the forefront of smart cities. Alibaba's AI cloud platform "ET City Brain" uses AI algorithms to predict outcomes across traffic management, healthcare and urban planning, crunching data from cameras, sensors, social media, and government data.

Aiming to revolutionize urban management, Alibaba has partnered with Nvidia for its deep-learning-based video platform for smart city services. Alibaba also led a financing round for Chinese computer vision startup SenseTime, now the highest valued AI startup in the world.

And just in 2018, Alibaba backed AI-based vehicle-to-vehicle network developer Nexar, and has even partnered with the Malaysian government to launch the country's first City Brain initiative. Targeting traffic, City Brain can optimize urban traffic flow, getting emergency vehicles to the scene at record speeds.

Already with operations in over 200 countries, Alibaba is now launching a global \$15 billion R&D initiative in AI, quantum computing, and emerging new tech-driven markets. Scoring top local talent, Alibaba's R&D center, DAMO Academy, is set to launch in Tel Aviv's thriving tech hub, among six other cities.

Source: <https://singularityhub.com/2018/08/17/baidu-alibaba-and-tencent-the-rise-of-chinas-tech-giants/#sm.001pi0m6c94ld7810nr1h6kta2rmc>

The Rise of China's Tech Giants - Tencent

Briefly surpassing Facebook's market cap in November of 2017, **Tencent** was the first Chinese company to top \$500 billion. Combining the functionality of Facebook, iMessage, PayPal, UberEats, Instagram, Expedia, Skype, WebMD, eVite, GroupMe and many others, WeChat is an ecosystem of epic proportions. To solidify its loyal consumer base, Tencent has also become a leader in mobile gaming, owning the wildly popular League of Legends, played by over 100 million people every month.

Also Tencent is making extraordinary new inroads in AI-based healthcare disruption under Chinese government leadership. Hiring scores of researchers and opening an outpost in Seattle, Tencent is massively ramping up AI capabilities. Aiming at world-class status in genomics and personalized medicine, the company further invests in and partners with global startups to bring AI healthcare tech to China.

In April 2017, Tencent partnered with UK's Babylon Health, a virtual healthcare assistant startup, whose app now allows Chinese users to message their symptoms and receive immediate medical feedback. In addition to Tencent's own Miying healthcare AI platform—aimed at assisting healthcare institutions in AI-driven cancer diagnostics—Tencent is quickly expanding into the drug discovery space, participating in two multimillion-dollar, US-based AI drug discovery deals just in 2018.

China's tech behemoths are disrupting everything from intelligent urban infrastructure to personalized medicine. They're bringing enormous sums of capital and cutting edge technology to startups and markets across the globe.

Source: <https://singularityhub.com/2018/08/17/baidu-alibaba-and-tencent-the-rise-of-chinas-tech-giants/#sm.001pi0m6c94ld7810nr1h6kta2rmc>

The Rise of China's Tech Giants - Baidu

Baidu was the first among all three Chinese tech giants to become a pioneer in the area of deep learning, beginning with the 2014 acquisition of Andrew Ng to head Baidu's Silicon Valley AI lab.

Baidu's algorithms have already surpassed humans in the task of Chinese speech recognition, a feat that was accomplished one year before Microsoft was able to do the same for English speech recognition.

Baidu continues to excel economically, with total revenue increasing by 31% year over year. By 2017, Baidu was leading national initiatives in AI R&D. And in June 2018, Baidu used its AI algorithms to succeed in putting driverless cars on the market.

More recently, Baidu has signed agreements with Xiong'an New Area to build an AI city featuring driverless cars, smart traffic systems, facial recognition systems and cement with embedded sensors.

Baidu also recently released Aladdin - a smart speaker, smart lamp and projector, with speech recognition capabilities, as a competitor to Amazon's Alexa and Google Assistant. Additionally, Baidu recently filed patents in US, China, Europe, South Korea and Japan for consumer robotics featuring combined voice and facial recognition.

Baidu is also working on neural chips and intelligent robotics for the Chinese state via China's National Engineering Lab for Deep Learning Technologies.

Baidu was also the first Chinese company to join the US-led alliance on artificial intelligence, titled The Partnership on AI, among US tech giants Facebook, Amazon, Google, Microsoft and IBM. The alliance seeks to ease fears regarding the unsafe and unethical use of AI, and to formulate best practices for AI regulation and governance, in coordination with academics and ethicists.

This is a particularly surprising development given the increasing technological and economic tensions forming between China and the US, with the Trump administration accusing Beijing of stealing technology trade secrets from US companies.

How China became an AI leader

A new research conducted by Accenture has found that many large businesses do not fully appreciate the value of AI. The same cannot be said for entrepreneurs and startups, who are in the vanguard of this revolution. Many of them are based in China, which has become a powerhouse of innovation in deep learning, sensors, predictive maintenance, and intelligent robotics.

Funding for AI startups worldwide has grown at a compound annual growth rate of nearly 60% since 2010. China has filed more than 8,000 AI patents in the five years to 2015, a 190% growth rate that outpaces other leading markets significantly. Growth is driven partly by the largest digital user base in the world. China is generating new data, particularly from mobile users, faster than any other country.

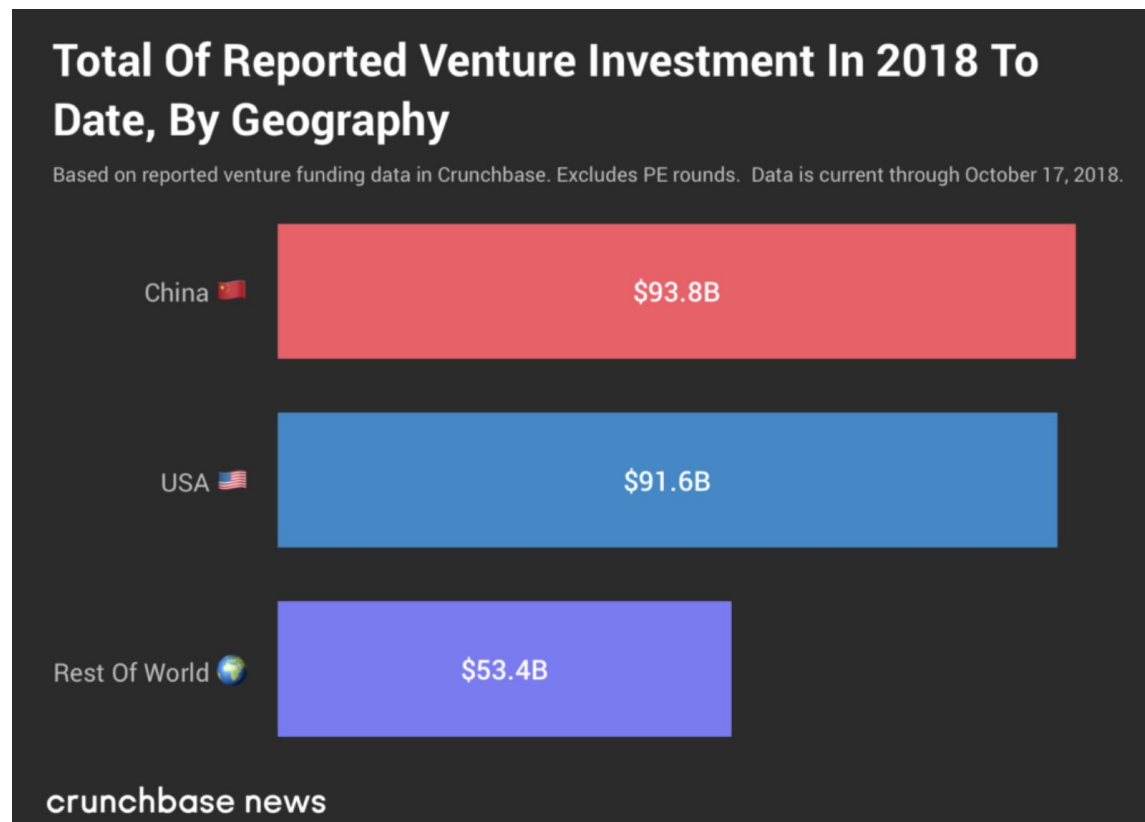
Accenture analysis shows that AI could boost China's productivity by 27% by 2035. But AI has a far greater opportunity to create entirely new categories of products and services. It will establish new markets and drive growth. AI's boost of the top line is reflected in its estimate that annual economic growth rates in China could increase from 6.3% to 7.9% in 2035 if companies harness AI to transform their entire business models. That would generate additional economic output of more than \$7,000 billion at that time.

To achieve this growth potential means going beyond using AI to do things differently and, instead, using it to do different things. For example, JD.com, the online retailer, is exploring AI to improve internal operations through unmanned warehouses and drone delivery, but is also applying it to personalize the shopping experience and develop new products and services. Alibaba partners with SAIC to connect their cars to the internet and is introducing new cloud-based AI services targeting the health care and manufacturing sectors. Tencent, the provider of WeChat, is developing virtual assistants and autonomous driving among other applications.

China also has many successful AI startups. For example, Malong Technologies' product recognition AI uses deep learning, which among other uses, it applies to analyze worldwide fashion colour trends to help thousands of textile makers predict global fabric demand.

2018 Venture Investment in China surpassed US for the first time

It is notable that in 2018, for the first time, Chinese venture investments have surpassed the US volume of investments (even if only slightly). This provides some evidence that the AI goldrush is a part of a larger global megatrend. We are witness the moment when the US is losing its exclusive leadership not only on the front of AI, but in technology development generally. Private technology companies in China have led their U.S. counterparts in venture capital fundraising throughout the surpassing majority of 2018. Aggregated venture funding data from Crunchbase, current as of this morning, suggests that Chinese startups raised more venture capital than American startups to date in 2018. At roughly \$2.2 billion, the gap in funding is nonetheless notable.



Much of the difference is attributable to just a few supergiant venture rounds of \$100 million or more. It's a phenomenon Crunchbase News has covered in depth, and it's a trend that's still very much at play in recent months. In the context of rounds of that scale, a \$2.2 billion gap in funding doesn't seem like much. Just a few big rounds here or there could tip the balance in a big way. Indeed, the current \$2.2 billion difference is much narrower than at other times of the year. But the change from a U.S.-led startup ecosystem to one that China drives is a notable shift. Doubly so if China holds the crown through the year's end.

China and US mastering military AI

This year's focus of the Aspen Strategy Group, which annually brings together top-level current and former national security officials, along with a few journalists, to discuss defense and foreign policy, was on "Maintaining America's Edge" in the dawning era of high-tech combat, and the big takeaway was this: The future of warfare is now, and China is poised to dominate it.

Speakers at the conference described a new generation of combat systems, powered by artificial intelligence, cyberweapons and robots that can operate on land, sea and air. But America is still largely wedded to legacy weapons of the past — superbly engineered (but super-expensive) aircraft carriers, bombers, fighter jets and submarines. The Pentagon needs a large number of inexpensive, unmanned, expendable, autonomous systems that can survive in the new electronic battlespace and overwhelm any potential adversary.

Christian Brose, staff director of the Senate Armed Services Committee, calculates that in the Pentagon's initial request for \$74 billion in new defense spending in fiscal 2019, only 0.006 percent was targeted for science and technology. The National Science Foundation estimates that in fiscal 2015, only 18 percent of the Pentagon's research and development budget went to basic, applied and advanced research. Major systems claimed 81 percent.

China appears determined to seize this AI "high ground" of future conflict. For the past two years, Chinese companies have won an AI competition for detecting objects. The Chinese are happy for the United States to keep building carriers and bombers, so long as they deploy the more advanced technologies that can disable these systems.

America's vulnerability to information warfare was a special topic of concern. One participant recalled a conversation several years ago with a Russian general who taunted him: "You have a cybercommand but no information operations. Don't you know that information operations are how you take countries down?" As the gathering concluded, Republicans and Democrats were equally passionate about spreading the message that this is a Sputnik moment for modernizing our military. Competing with a rising China begins at home, with a more nimble Pentagon and a country that's more united to face the big problems ahead.

Source:

https://www.washingtonpost.com/opinions/the-chinese-threat-that-an-aircraft-carrier-cant-stop/2018/08/07/0d3426d4-9a58-11e8-b60b-1c897f17e185_story.html?noredirect=on&utm_term=.bb4bbcd1e5b

US Defense Department pledges billions toward artificial intelligence research

In September 2018 the military's research arm said it will invest up to \$2 billion over the next five years toward new programs advancing artificial intelligence, stepping up both a technological arms race with China and an ideological clash with Silicon Valley over the future of powerful machines.

The Defense Advanced Research Projects Agency, part of the Defense Department, said it will fund dozens of new research efforts as part of a "Third Wave" campaign aimed at developing machines that can learn and adapt to changing environments.

DARPA director Steven Walker announced the effort to an audience from American academia, private industry and the military at a symposium outside Washington, saying the agency wants to explore "how machines can acquire human-like communication and reasoning capabilities." DARPA's expansion comes at a time of tension between government agencies and the tech giants who employ some of the world's most in-demand AI talent. In June, Google announced it would not renew its Defense Department contract to help develop AI that could analyze drone footage, known as Project Maven, following a worker uprising against what some inside the company called the "business of war." The agency said the new money would fund projects on top of the more than 20 active programs exploring cutting-edge applications of AI, including in cybersecurity; the detection of AI-created fake audio or video; and in "human-computer symbiosis" programs targeting the interaction between people and machines.

One of Silicon Valley's most competitive arenas, it's also of increasing prominence for Washington policymaking: The White House said in July that American leadership in AI was the federal government's second-highest budget priority for research and development, above American manufacturing, space exploration and medical innovation. But military officials say AI could also revolutionize espionage, national security and the battlefield. In a June letter announcing the launch of the Joint Artificial Intelligence Center, a Pentagon hub for overseeing AI research across the military, Defense Department leaders said the technology "will change society and, ultimately, the character of war."

Source:

https://www.washingtonpost.com/technology/2018/09/07/defense-department-pledges-billions-toward-artificial-intelligence-research/?noredirect=on&utm_term=.cecd03d735a

The Global Military Simulation and Virtual Training Market 2018-2028

The global military simulation and virtual training market is primarily driven by military platform procurement programs undertaken by several armed forces across the globe. Also, militaries are incorporating simulation based training techniques to ensure safety, cut down operating costs and wear and tear of machinery associated with real time training.

With a number of defense ministries across the globe looking to improve the cost effectiveness of operations, the need for low-cost simulators with advanced artificial intelligence is expected to surge over the forecast period. Moreover, the technology to develop military training simulators has become more affordable, which in turn resulted in the growth of homeland security and border patrol simulators.

The Global Military Simulation and Virtual Training Market 2018-2028 report offers a detailed analysis of the industry, with market size forecasts covering the next ten years. This report will also analyze factors that influence demand for military simulation and training equipment, key market trends, and challenges faced by industry participants.

- The Global Military Simulation and Virtual Training Market is projected to value US\$10.2 billion in 2018 and is expected to grow at a CAGR of 3.12% during the forecast period.
- The cumulative market for global expenditure on military simulation and virtual training will reach US\$128.5 billion over the forecast period.
- In terms of segments, the military simulation and virtual training market is split into three segments: combat, flight, and maritime.
- During the forecast period, flight simulators will lead the global military simulation and virtual training market, with a share of 53.8%, followed by the maritime segment and combat simulators segments over the forecast period.

How AI Changes National Security

The US and China are actively exploring military applications of AI, from the control of drones and other autonomous vehicles to the use of AI as engines of advanced cyber-warfare and surveillance systems.

The number of voices and initiatives wishing to prevent the further application of data science and AI for nefarious purposes is ever-growing and has reached a critical level in recent years (See Section IV: Ethics of AI).

The issue of data privacy is now a very hot topic making political waves in the US in particular, with large IT-giants like Google and Facebook coming under fire for allowing corporate and governmental entities to benefit from user data.

Oxford University's Future of Humanity Institute and Cambridge University's Centre for the Study of Existential Risk have recently released a report detailing four high-level recommendations for governments and policymakers in order to deter AI-driven threats to national security.

They include:

- 1. Policymakers should collaborate closely with technical researchers to investigate, prevent, and mitigate potential malicious uses of AI.*
- 2. Researchers and engineers in artificial intelligence should take the dual-use nature of their work seriously, allowing misuse-related considerations to influence research priorities and norms, and proactively reaching out to relevant actors when harmful applications are foreseeable.*
- 3. Best practices should be identified in research areas with more mature methods for addressing dual-use concerns, such as computer security, and imported where applicable to the case of AI.*
- 4. Actively seek to expand the range of stakeholders and domain experts involved in discussions of these challenges.*

Source: <https://arxiv.org/ftp/arxiv/papers/1802/1802.07228.pdf>

Global Governance of AI

With an increasing number of national AI strategies being put forward by many nations, we can also expect to see increasing international efforts to come to common agreements on the global governance of AI.

The April 2018 [UK House of Lords Report](#) has recommended that the UK government hold a global summit by the end of 2019 to develop “a common framework on the ethical development and deployment of AI.” While the UK seems to lead the global governance of ethical AI, similar ambitions have been made public by the EU, China, and France.

At the G7 Summit in 2018, world leaders announced the launch of the [Charlevoix Common Vision for the Future of Artificial Intelligence](#), outlining a set of principles and commitments that all G7 leaders committed to:

- *Endeavour to promote human-centric AI and commercial adoption of AI, and continue to advance appropriate technical, ethical and technologically neutral approaches by: safeguarding privacy including through the development of appropriate legal regimes; investing in cybersecurity, the appropriate enforcement of applicable privacy legislation and communication of enforcement decisions; informing individuals about existing national bodies of law, including in relation to how their personal data may be used by AI systems; promoting research and development by industry in safety, assurance, data quality, and data security; and exploring the use of other transformative technologies to protect personal privacy and transparency.*
- *Promote investment in research and development in AI that generates public trust in new technologies, and encourage industry to invest in developing and deploying AI that supports economic growth and women’s economic empowerment while addressing issues related to accountability, assurance, liability, security, safety, gender and other biases and potential misuse.*
- *Support lifelong learning, education, training and reskilling, and exchange information on workforce development for AI skills, including apprenticeships, computer science and STEM (science, technology, engineering and mathematics) education, especially for women, girls and those at risk of being left behind.*

Global Governance of AI

- *Support and involve women, underrepresented populations and marginalized individuals as creators, stakeholders, leaders and decision-makers at all stages of the development and implementation of AI applications.*
- *Facilitate multistakeholder dialogue on how to advance AI innovation to increase trust and adoption and to inform future policy discussions.*
- *Support efforts to promote trust in the development and adoption of AI systems with particular attention to countering harmful stereotypes and fostering gender equality. Foster initiatives that promote safety and transparency, and provide guidance on human intervention in AI decision-making processes.*
- *Promote the use of AI applications by companies, in particular small and medium-sized enterprises and companies from non-tech sectors.*
- *Promote active labour market policies, workforce development and reskilling programs to develop the skills needed for new jobs and for those at risk of being left out, including policies specifically targeting the needs of women and underrepresented populations in order to increase labour participation rates for those groups.*
- *Encourage investment in AI technology and innovation to create new opportunities for all people, especially to give greater support and options for unpaid caregivers, the majority of whom today are women.*
- *Encourage initiatives, including those led by industry, to improve digital security in AI and developing technologies, such as the Internet of Things and cloud services, as well as through the development of voluntary codes of conduct, standards or guidelines and the sharing of best practices.*
- *Ensure AI design and implementation respect and promote applicable frameworks for privacy and personal data protection.*
- *Support an open and fair market environment including the free flow of information, while respecting applicable frameworks for privacy and data protection for AI innovation by addressing discriminatory trade practices, such as forced technology transfer, unjustified data localization requirements and source code disclosure, and recognizing the need for effective protection and enforcement of intellectual property rights.*

AI and Economic Development

According to “*Artificial intelligence and human development: : toward a research agenda*” by Matthew L. Smith and Sujaya Neupane, the potential benefits of AI in developing countries are the following:

- **Health care:** AI can play a crucial role in augmenting health care capacity by filling gaps in human expertise, improving productivity, and enhancing disease surveillance. For example, an NGO in Brazil has partnered with an AI start-up to develop a system to predict upcoming incidences of disease.
- **Delivery of government services and information:** Groups around the world are exploring ways to use AI to help countries improve their e-government efforts by automating complex assessments that take account of a range of technical, organizational, and social factors. For example, a machine learning system has been developed to help predict mass grave locations of Mexican drug cartel victims.
- **Agriculture:** AI is being employed to address the various threats that can compromise a successful harvest. For example, AI systems are being used to support water management in Palestine and drought monitoring in Uganda.
- **Education:** AI can move educational offerings beyond an industrial, one-size-fits-all delivery model toward quality personalized learning opportunities at scale. For example, efforts in India are employing AI to develop intelligent tutoring systems.
- **Economy and business:** AI offers the potential for higher productivity and offers a means of growth in the form of new business development, innovation, and optimization of economic building blocks. For example, several companies are working to extend access to standard financial services to the hundreds of millions of Africans who either do not use them or do not currently have access.

Like most new technologies, Artificial Intelligence has the potential to exacerbate existing problems, reinforce structural inequalities, and superimpose biases. The paper proposes a proactive research agenda for the ethical and equitable application of AI in the Global South, drawn from a broad overview of technologies associated with AI capabilities, and the opportunities and challenges they present. Three areas are identified in which action can be taken: policies and regulations; inclusive and ethical AI applications; and infrastructure and skills.

AI as the Engine for the Digital Augmented Economy 2.0

Every cent invested into AI brings about much more than a simple return on investment because advances in AI fuel synergetic complimentary effects on the many other industries that can benefit from the use or integration of AI, effectively compounding its effects on the economy as a whole.

Some of the sectors set to reap the largest near-term benefits of advancements in AI include healthcare, biotech, FinTech, InsurTech, LegalTech, GovTech, InvestTech and IoT.

In slightly longer timeframes, AI also has the power to transform entire economies through fundamental shifts in the finance sector, specifically through the creation of what we referred to in previous reports as the transition from the Digital Economy to the Digital Economy 2.0 or "Augmented Economy", which we have defined previously as a state in which entirely novel outcomes and values not obvious or projectable by current standards will emerge as a natural product of the evolution of the digital ecosystem.

This transition is marked by the digitalization and mathematization-enabled full integration and unification of FinTech, RegTech, LegalTech and InvestTech, housed by a blockchain backend, and advanced IT and AI technologies, throughout its evolution from the Crypto Economy of today, toward the Augmented Digital Economy 2.0 of the future.

Some hallmarks of the Augmented Economy include geographical interconnectivity, accelerated speed of transactions, reduced cost of transactions, enhanced cybersecurity, enhanced liquidity and enhanced interoperability.

It is in use-cases like this that we can see significant potentials for specific countries to advance into leadership positions.

Global financial epicenters like Singapore and Switzerland have very good potentials to leverage both their existing financial prowess, as well as their technocratic tendencies (i.e. their history of strategically guiding technological developments for the purpose of economic and geopolitical gains), to excel in the application of AI to finance and commerce.

AI and International Trade

Every day, large amounts of data flows course through the internet, over borders and between individuals, firms and governments to power the internet and associated technologies. A growing portion of these data flows are used to fuel AI applications such as Siri, Waze and Google searches. Because many of these data flows are directly or indirectly associated with a commercial transaction, they are essentially traded.

Although the World Trade Organization (WTO) says nothing about data, data flows related to AI are governed by WTO rules drafted before the invention of the internet. Today, trade policy makers in Europe and North America are working to link AI to trade with explicit language in bilateral and regional trade agreements. They hope this union will yield three outputs: the free flow of information across borders to facilitate AI; access to large markets to help train AI systems; and the ability to limit cross-border data flows to protect citizens from potential harm consistent with the exceptions delineated under the General Agreement on Trade in Services. These exceptions allow policy makers to breach the rules governing trade in cross-border data to protect public health, public morals, privacy, national security or intellectual property, if such restrictions are necessary and proportionate and do not discriminate among WTO member states.

Some states and regions are developing very clear and deliberate policies to advance AI both within and beyond their borders. China's free trade agreements do not contain binding rules on data flows or language on algorithms. But the country uses the lure of its large population, relatively low and poorly enforced privacy regulations, and subsidies to encourage foreign companies to carry out AI research in China. At the same time, the United States seems to be using trade agreements to build beyond its 318 million people to achieve economies of scale and scope in data. However, the European Union seems to be taking the most balanced approach, recognizing that it cannot encourage AI without maintaining online trust among netizens that their personal data will be protected. Countries are just beginning to figure out how best to use and to protect various types of data that could be used in AI, whether proprietary, personal, public or metadata. Most countries, especially developing countries, do not have significant expertise in AI. These states may be suppliers of personal data, but they do not control or process data.

AI and International Relations

At present, the focus of scholarship, investment and political debate about AI is on markets and weapons. In a welcome turn, there is also a growing sector of research and advocacy with respect to AI, public policy, and basic ethical question about how societies should evaluate and manage the consequences of a world driven by automated decisions. By contrast, research and analysis at the intersection of AI and foreign policy is quite underdeveloped. Commentary on the role of diplomacy and statecraft is scarce. And yet, clearly there are major implications for policy development and programmatic work for the foreign service. “*Artificial Intelligence and Foreign Policy*” by Ben Scott, Stefan Heumann and Philippe Lorenz offered an outline of the foreign policy challenges implicit in three areas where AI will have a powerful impact: global economics, international security, and democratic ethics.

A Chatham House report: “*Artificial Intelligence and International Affairs Disruption Anticipated*” states that discussions around AI should not lose sight of the fundamental ways in which it may change the nature of international politics and power structures, and should aim to build up ethical and legal frameworks to manage those changes. While no one can predict the exact trajectory that AI will take over the coming decades, it is clear that it will have an increasing and profound impact on society. To prepare for this transformation, the report made a number of recommendations for policymakers:

- AI expertise must not reside in only a small number of countries – or solely within narrow segments of the population.
- Corporations, governments and foundations alike should allocate funding to develop and deploy AI systems with humanitarian goals.
- Understanding of the capacities and limitations of artificially intelligent systems must not be the exclusive preserve of technical experts.
- Developing strong working relationships, particularly in the defence sector, between public and private AI developers is critical, as much of the innovation is taking place in the commercial sector.
- Given the broad applicability of the technology, clear codes of practice are necessary to ensure that the benefits of AI can be shared widely while its concurrent risks are well managed.
- Particular attention must be paid by developers and regulators to the question of human–machine interfaces.

Source: https://www.stiftung-nv.de/sites/default/files/ai_foreign_policy.pdf
<https://www.chathamhouse.org/sites/default/files/publications/research/2018-06-14-artificial-intelligence-international-affairs-cummings-roff-cukier-parakilas-bryce.pdf>

Space for New Players Through Focus on Specific AI Niches & Sectors

While very few countries have the available budgets or existing industrial infrastructure required to seriously compete with China and US as top leaders of the global AI industry, there is still space for many nations just emerging onto the international AI scene to carve valuable positions for themselves in the AI race if they focus on fostering the development of specific AI verticals rather than AI as a horizontal technology, i.e., by committing to very specific AI subsectors or industry applications.

A good example of this might be the problem of extreme demographic aging in Japan. It is already suffering the significant negative economic effects of the large portion of their population being over the age of 65. If they can leverage the application of AI to preventive medicine and AgeTech, they could potentially save much more than they spend on the accelerated development of these AI-relevant subsectors, which gives them enormous economic incentive to do so. Similarly, it is possible for Japan to be united among other countries in an international, cross-nation effort led by the UK to apply various countries' specific areas of skill, experience and socioeconomic need in order to apply AI to the advancement of preventive medicine and AgeTech, especially given that among the UK's four grand challenges and industrial strategy priorities, AI was listed as #1, with Aging Population being listed as #2. These factors make Japan a very natural strategic partner for the UK, which has 20% of their own population aged 65+, for a national development of AI in healthcare program with a focus on preventive medicine and the extension of healthy longevity.

Besides the potential for smaller players to achieve top positions by becoming leaders in specific AI use-cases, subsectors and the application of AI to particular industries, what possibilities exist for the emergence of new superpowers to rival China and the US? Russia, for instance, had excellent potentials to become an AI superpower several years ago, but lack of Government commitment caused them to fail to seize the opportunity, and current political and economic issues now preclude that possibility almost entirely, despite the fact that Russia still remains as one of the global data science leaders as measured by its quantity of data science and IT specialists. Saudi Arabia and the UAE, for instance, are nations to keep an eye on in this regard, as their recent entry into AI industry development is proof of their interest, and their large GDP puts them in a good position to climb the AI ladder if they prove their commitment to join the AI race. They are already funneling significant financial resources from their oil economy into post-oil era technologies and into their efforts at digital reformation.

If they continue to commit financial resources to the development of a robust AI industry, and define AI as a core part of their national geopolitical agenda, it is possible that they could rise to the status of an AI superpower in the years to come as well.

AI Nationalism

The science and business of AI has come to be recognized by several nations as critical - and, indeed, perhaps the most impactful factor above all others - to the strategic development of a given country's economic, geopolitical and military future. These governments believe that AI is the strongest driver of the entire national economy and further GDP growth, enabling the accelerated synergetic development of many other industries that either use or are enhanced by AI, such as Healthcare, IoT, FinTech and advanced digital economy in general - subsectors that the UK is currently at the forefront of.

This trend has recently reached new heights with the advent of the term "[AI Nationalism](#)" to specifically denote those countries that make AI a core element of their national economic and geopolitical agenda. While other countries do have ambitions to apply AI for militaristic purposes, none of them have the same degree of potential to do so compared to the US and China, and most other countries are focusing instead on the application of AI to specific subsectors, and aim to excel in particular practical AI applications and verticals, rather than becoming a global superpower and leader of AI as a horizontal, all-encompassing technology capable of boosting many other more specific industries and use-cases that can benefit greatly from the integration of AI. Such countries include Canada, Switzerland, Germany, Singapore, the UEA and others.

One nation with some of the strongest potentials in this area is the UK. During 2016, 2017, and the beginning of 2018, there were a number of countries equally positioned to take the #3 leadership spot including Canada, South Korea, Israel, Germany and France.

But the UK, being a global hub for science, technology, finance, investments and startup communities, and also taking in account support of AI-sphere by multiple UK Government and Parliamentary initiatives, naturally evolved to position #3 in 2018, and now home to 1000 AI companies, 600 firms and individuals investing in AI in the UK, as well as 35 AI tech hubs and research institutes based in the UK. We can expect the current significant growth rates of the AI-industries in China and US to stay at the same pace in coming years, and for the UK's industry-specific growth rate to increase in an accelerated mode above other countries due to its natural predisposition to maximize its presence within the global AI-industry, such that over the coming years the UK will capture an increasing of the international AI-market share.

Innovation Ecosystem Development Can Create New International AI Leaders

Many experts and analysts would argue that the fate of the coming global AI race will be almost entirely determined largely by levels of monetary investment, and that those countries with the largest budgets will inevitably come out on top. While success in developing an internationally-competitive AI industry does require the commitment of large quantities of funds - now on the order of tens of billions of dollars - it is not the sole, or even most critical, determining factor.

Rather, it is the scarce elements of the industry -- i.e., those resources in necessarily limited quantity that serve as bottlenecks for industry progress -- that wield the most power to change the fate of a country's position in this race. Resources like manpower. There are not enough AI specialists to meet the needs and demands of industry growth. Both the US and the UK are facing the problem of “brain drain” in the AI industry. While the UK continues to acquire AI talent from the EU, it is losing many such talent to the US, who in turn is losing many of its own AI specialists to China.

What can truly put a country ahead is the cultivation of an ecosystem that attracts the best talent through both monetary and non-monetary resources. Take the UK for example. It combines the intellectual prowess of the London-Oxford-Cambridge triangle, home to some of the best universities in the world, with with a highly progressive startup and investment landscape (London having more AI start-ups than any country in Europe) and a constellation of technology hubs. Furthermore, the nation's emphasis on developing safe, ethical and well-governed AI also fosters an attractive psychological ecosystem, where researchers can feel confident that their work will not be put to unethical or non-peaceful purposes.

These factors, when partnered with other nation-wide initiatives like the Government's commitment to strategically invest in AI growth, as well as its commitment to aggressively acquire more AI PhD students, make it a highly attractive ecosystem for AI experts and specialists in industry and academia alike. Being capable of providing competitive salaries is necessary, but not enough. It is the combination of monetary and non-monetary incentives that will determine who comes out on top of the race for AI talent. This means that it is possible for countries not yet recognized as leaders in the global AI industry to rapidly climb the international AI ladder through strategic investment into factors that increase the interoperability of industry, academic, investment and technology entities and institutions.

The Global Race for AI Talent

Everyone agrees that the competition to hire people who know how to build artificial intelligence systems is intense. It's turned once-staid academic conferences into frenzied meet markets for corporate recruiters and driven the salaries of the top researchers to seven-figures.

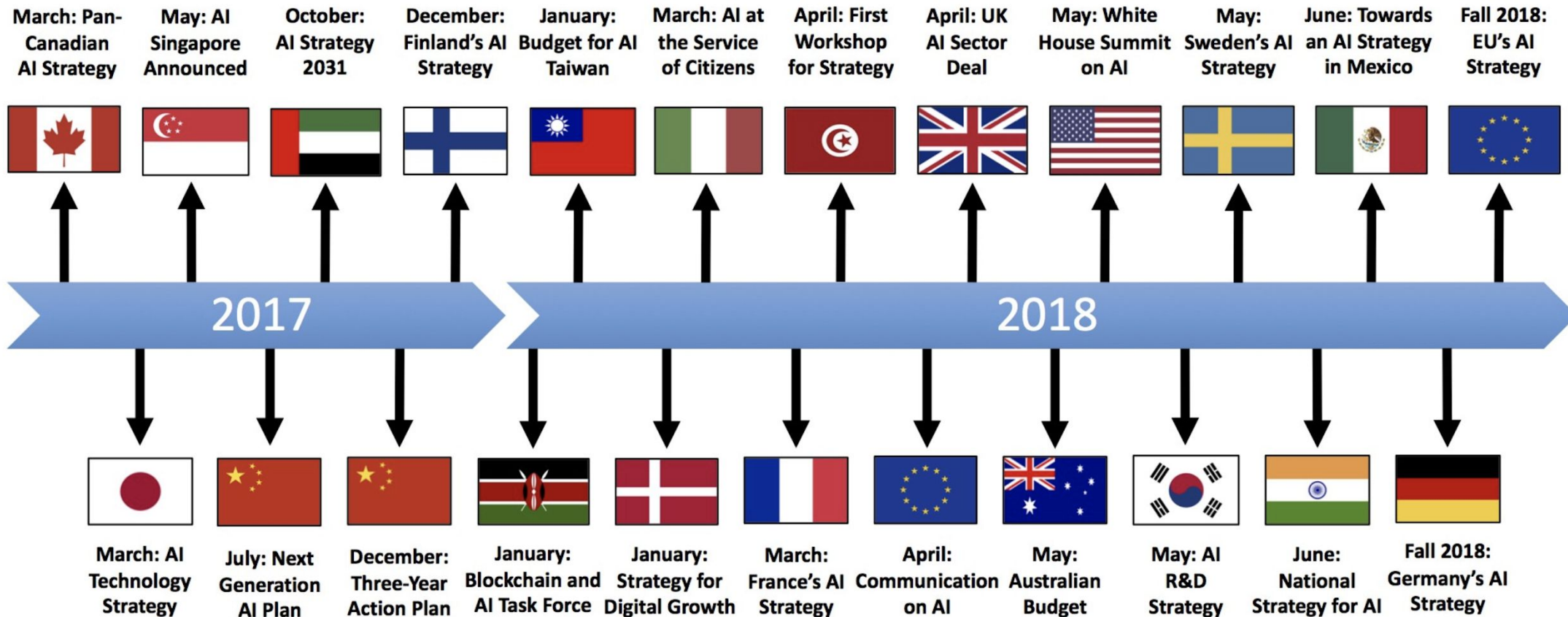
Last year Element AI Inc., a Montreal-based startup, estimated that there were fewer than 10,000 people in the world with the expertise needed to create machine learning systems. The figure was widely cited in media stories and among recruiting firms, although it wasn't clear how Element AI arrived at it. In December, Tencent Holdings Ltd., the Chinese internet giant, published its own estimate of global AI talent, putting the figure at a far higher 200,000 to 300,000 people who were either AI researchers or industry practitioners. Which is correct? The answer matters to companies trying to decide whether to build their own AI and data science teams or contract with consulting firms and third parties to create AI-based solutions for them. It also has an impact on the salaries those AI experts can command.

Element AI has rejoined the debate with a new estimate – and some transparency about its methodology. According to a report published Wednesday, there are about 22,000 PhD-educated researchers working on AI, of which about 3,000 are currently seeking work. Element AI said it scoured LinkedIn for people who earned PhDs since 2015 and whose profiles also mentioned technical terms such as deep learning, artificial neural networks, computer vision, natural language processing or robotics. In addition, to make the cut, people needed coding skills in programming languages such as Python, TensorFlow or Theano.

There's another subset of about 5,000 people at the cutting edge of AI research who are publishing papers and presenting at academic conferences, the report said. By removing the restriction that the person's PhD must have been awarded since 2015, Element AI said there were at most 90,000 people in the world with the right skill set – a figure that was much larger than their other estimates but still well below Tencent's. The company said its earlier rough estimate of “fewer than 10,000 people” had been based only a search of people who had been active at academic AI conferences in the past seven years.

National AI Strategies

Artificial Intelligence Strategies



Source: <https://medium.com/politics-ai>

A Proliferation of AI-Centered National Strategies

Since the beginning of 2018, Denmark, France, the UK, the EU, South Korea, and India have all released national strategies to promote the use and development of AI.

They join Canada, Japan, Singapore, China, the UAE, and Finland, who all released similar strategies in 2017.

According to a study by Element AI, there are only 22,000 PhD-educated AI researchers in the world—40% of whom are concentrated in the US.

As a result, to train domestic talent and attract international talent, countries are rushing to develop AI Master and PhD programs, short-term training initiatives, massive open online courses, and scholarships and fellowships.

Almost every recent national strategy includes some combination of these initiatives to attract, retain, and develop AI talent.

In April 2018, the British government announced a number of new initiatives to establish the UK as a leader in the AI revolution, including a new R&D tax credit, a national retraining scheme, additional funding for STEM education, a national centre for data ethics, and improvements to public digital infrastructure.

France's strategy included a multi-million dollar commitment to AI startups and industrial projects, while China announced a \$2 billion AI research park to house up to 400 companies.

South Korea

Asia is aggressively pursuing artificial intelligence. Across the whole region, companies with an AI-focus are raising more money than ever before. In particular, while China has been making waves with some of the most eyebrow-raising investments in AI, South Korea is becoming increasingly visible and bullish on its own investments in AI as well. Both governments are heavily investing in AI. A little over a year ago, China released a three step program outlining their plan on how it will become a world leader in A.I. by 2030. South Korea's government also released an AI strategy and wants to be a top 4 contender in AI by 2022. China's plan includes pushing for greater use of and heavy investment of AI in a number of areas such as the military and smart cities. The Chinese government plans to spend \$2.1 Billion for an AI-focused technology research park. South Korean government agencies and major tech companies have pledged similarly large-sized investments in their AI industry.

In 2016 South Korea famously hosted the match where DeepMind's AlphaGo defeated Go's world champion Lee Sedol, a Korean-native. They are also known throughout the world for their strong semiconductor, automotive, and electronics industry, as well as their use of industrial robotics technology. The country is home to many large well established tech companies such as Samsung, LG, and Hyundai, that have each shown significant appetite to invest in AI.

In response to a shortage of AI engineers in the country, the Korean government plans to create at least six new AI schools by 2020, and educate more than 5,000 high quality Korean engineers. It also plans to invest in AI on a national level. An R&D challenge similar to those developed by the US Defense Advanced Research Projects Agency (DARPA) as well as funding AI projects related to areas such as public safety, medicine, national defense are also in the plans. Many in the country see the creation and development of AI startups and businesses is also vital to building a strong AI ecosystem, and as a result the government is supporting the creation of an AI-oriented startup incubator to help develop emerging AI businesses and funding for the creation of AI semiconductors by 2029.

Despite this intense investment in AI, South Korea faces some sizable challenges to long term growth of the local AI ecosystem. The country doesn't have a well-developed venture capital ecosystem and has a small number of significant AI focused startups, an engineering talent gap for experienced, skilled AI talent.



South Korea's Ministry of Science and ICT has recently announced a 2.2 trillion won budget for research and development in artificial intelligence (AI) and expansion of AI-related infrastructure as part of the nation's bid to transform the country into an AI heavyweight by 2022. The announcement comes as South Korea seeks to provide assistance to local technological development to gain parity with regional counterparts and gradually reduce foreign dependence. According to a memorandum released by South Korea's Ministry of Science and ICT on 15th May 2018, artificial intelligence forms part of the Data-Network-AI (DNA) framework for South Korea's approach to the 4th Industrial Revolution.

The 2.2 trillion won budget will be allocated to a number of large-scale projects in national defence, medicine and public safety, establishing six AI graduate schools with the aim of cultivating 5000 AI specialists, as well as strengthen public-private partnerships in artificial intelligence research and development. The proposed 5000 AI specialists comprise 1400 AI researchers and 3600 data management specialists, all providing the backbone which South Korea's drive towards AI development will depend upon.

By fostering the growth of AI, South Korea hopes to catch up with the likes of China and Japan and eventually emerge as a global AI powerhouse by 2022.

The Ministry of Science and ICT's allocation of 2.2 trillion won to establish the country as a leading player in global AI R&D comes as a response to the disproportionate amount of investment regional and international competitors are receiving. In addition, the Ministry for Science and ICT also acknowledges that the country's progress in artificial intelligence trails significantly behind that of China and the US, but possesses "good conditions" for artificial intelligence development due to the "accumulation of significant data". In addition to funding AI research and development and expansion of AI-related infrastructure, part of the budget will also fund the creation of South Korea's Supercomputer No.5. Startups and small-and-medium enterprises in the country will be able to utilise the supercomputer upon full operation.



The federal government's 2018-19 budget earmarks \$29.9 million over four years to strengthen Australia's capability in artificial intelligence and machine learning. The funding will be split between programs at the Department of Industry, Innovation and Science, which will receive the lion's share of the funding, the CSIRO and the Department of Education and Training.

This measure supports business innovation in sectors such as digital health, digital agriculture, energy, mining and cybersecurity. Measures to be funded include additional funding for the Cooperative Research Centres Program to back AI projects and funding PhD scholarships and school-related learning to address AI and ML skill gaps.

The government said it would fund the development of a "technology roadmap" and "standards framework" for AI as well as a national AI Ethics Framework. Together they will "help identify opportunities in AI and machine learning for Australia and support the responsible development of these technologies." The budget funding for AI forms part of the government's broader Australian Technology and Science Growth Plan.

Gartner research is forecasting that global business value derived from AI will total US\$1.2 trillion in 2018, which it says is an increase of 70 per cent from 2017. AI-derived business value is forecast to reach \$3.9 trillion in 2022, according to figures released last month by the analyst firm. One of the biggest aggregate sources for AI-enhanced products and services acquired by enterprises between 2017 and 2022 will be niche solutions that address one need very well. Business executives will drive investment in these products, sourced from thousands of narrowly focused, specialist suppliers with specific AI-enhanced applications.

By 2022, the analyst John-David Lovelock is predicting that AI focused on supported or augmenting decision making will have other types of AI initiatives to account for 44 per cent of global AI-derived business value.



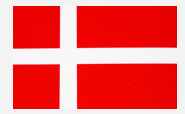
CIFAR is leading the Government of Canada's \$125 million Pan-Canadian Artificial Intelligence Strategy, working in partnership with three newly established AI institutes – the Alberta Machine Intelligence Institute (Amii) in Edmonton, Mila in Montreal and the Vector Institute in Toronto. The strategy funds three centres of excellence in AI research and innovation in Canada's three major centres for deep learning and reinforcement learning research – in Edmonton, Montreal and Toronto. These three AI Institutes provide a critical mass of research and innovation excellence, and work with researchers, industry and other stakeholders across Canada.

Announced in the 2017 federal budget, the Strategy has four major goals:

- To increase the number of outstanding artificial intelligence researchers and skilled graduates in Canada.
- To establish interconnected nodes of scientific excellence in Canada's three major centres for artificial intelligence in Edmonton, Montreal and Toronto.
- To develop global thought leadership on the economic, ethical, policy and legal implications of advances in artificial intelligence.
- To support a national research community on artificial intelligence.

Over the next five years, CIFAR will collaborate with the Canadian research community to:

- enhance Canada's international profile in AI research and training;
- increase the productivity in AI academic research and enhanced capacity to generate world-class research and innovation;
- increase collaboration across geographic areas of excellence in AI research and strengthen relationships with receptors of innovation;
- attract and retain outstanding AI talent in Canadian universities and industry;
- and translate AI research discoveries in the private and public sectors leading to socio-economic benefits for Canada.



With The Strategy for Denmark's Digital Growth, the government will create the best foundation for Danish companies to exploit new technologies to generate growth and more wealth for all Danes.

Companies ought to have the best possibilities for utilizing new technologies, and all Danes must have the competencies to successfully commit themselves to the digital future. To accomplish this, the Danish Government has launched the Strategy for Denmark's Digital Growth, consisting of 38 initiatives. The strategy aims at bringing Denmark in the front of the digital development and creating growth and wealth for all Danish people.

The strategy consists of seven main initiatives:

- Digital Hub Denmark
- SME:Digital
- The Technology Pact
- Strengthened Computational Thinking in Elementary School
- Data as a Driver of Growth
- Agile Regulation for New Business Models
- Strengthened Cyber Security in Companies

With the strategy the Danish Government will also host an annual digital summit, where businesses, organizations etc. focus on the digital transformation. Strategy for Denmark's Digital Growth is based on recommendations from the Digital Growth Panel from May 2017 and the Danish Government's Disruption Committee. The strategy allocates 1 billion DKK for initiatives running to 2025, according to a political agreement with the Danish People's Party and the Danish Social-Liberal Party to strengthen Danish Businesses. The deposited allocation should be seen as seed capital as there also will be private funding for several of the initiatives.



European leaders have put AI at the top of their agendas. On 10 April 2018, 24 Member States and Norway committed to working together on AI.

In May 2017, the Commission published its mid-term review of the Digital Single Market strategy . It highlighted the importance of building on Europe's scientific and industrial strengths, as well as on its innovative startups, to be in a leading position in the development of AI technologies, platforms, and applications. The European Council of October 2017 stated that the EU needs a sense of urgency to address emerging trends such as AI "while at the same time ensuring a high level of data protection, digital rights and ethical standards" and invited "the Commission to put forward a European approach to artificial intelligence". The European Parliament made wideranging recommendations on civil law rules on robotics and the European Economic and Social Committee has also issued an opinion on the topic.

This Communication sets out a European initiative on AI, which aims to:

- Boost the EU's technological and industrial capacity and AI uptake across the economy, both by the private and public sectors. This includes investments in research and innovation and better access to data.
- Prepare for socio-economic changes brought about by AI by encouraging the modernisation of education and training systems, nurturing talent, anticipating changes in the labour market, supporting labour market transitions and adaptation of social protection systems.
- Ensure an appropriate ethical and legal framework, based on the Union's values and in line with the Charter of Fundamental Rights of the EU. This includes forthcoming guidance on existing product liability rules, a detailed analysis of emerging challenges, and cooperation with stakeholders, through a European AI Alliance, for the development of AI ethics guidelines.

The EU has a strong scientific and industrial base to build on, with leading research labs and universities, recognised leadership in robotics as well as innovative startups. It has a comprehensive legal framework which protects consumers while promoting innovation and it is making progress in creating a Digital Single Market.



The Artificial Intelligence report is part of the intelligence program set by the Minister of Economy Mika Lintilä, chaired by Pekka Ala-Pietilä. The report was produced by the Work and Society Transformation working group under the program, chaired by VTL Osmo Soininvaara.

The report consists of four main articles dealing with (1) the effects of artificial intelligence on general economic and employment development; (2) labor change and the labor market; (3) education and skills management; and (4) ethics. Artificial Intelligence is a general purpose technology that broadly transforms working life and society.

An international hub for artificial intelligence must be established in Finland. The hub must have adequate resources as well as effective processes for cooperation with both national stakeholders (companies and the public sector) and international stakeholders (research partners and customers). The hub will become internationally prominent in areas in which Finland has clear strengths and which have international appeal.

A virtual university that is specialised in artificial intelligence and the digital revolution must be established within a Centre of Excellence, which will help Finland emerge as an interesting destination for top experts. In order for Finland to establish itself as a leading country in the application of artificial intelligence, the public and private sectors must have good access to international top expertise and result results. Application alone is not enough – the objective will also require Finland to produce world-class research as a close-knit part of the international network. Finland's research resources are limited, and for this reason resources will have to be gathered both virtually and physically in order for us to achieve a leading position.

Finland's competitive advantages include a high standard of education and tech-friendly attitudes, which have contributed to the development of business as well as of society. The high standard and impact of the Finnish education system have clearly made Finnish education stand out in international comparisons.



On the occasion of the “AI for Humanity” conference at the Collège de France, the President of the Republic presented France’s ambitions and strategy with regard to artificial intelligence. AI is one of the keys to tomorrow’s world, it is “not only a technological but also an economic, social, ethical and [therefore] political revolution”, Emmanuel Macron explained.

France has no lack of advantages to position itself as leader, including acknowledged excellence in mathematics and computer science. Many of the biggest digital companies’ heads of AI research are currently French. In order to take full advantage of such assets, the strategy presented by the President focuses on 4 major challenges:

1. Reinforcing the AI ecosystem in order to attract the very best talents.
2. Developing an open data policy, above all in sectors where France already has the potential for excellence, such as healthcare.
3. Creating a regulatory and financial framework favouring emergence of “AI champions”, through provision of special support to AI research projects and startups.
4. Giving thought to AI regulation and ethics, to ensure its development in line with the very best standards of acceptability for citizens.

Alongside the conference, a number of companies made announcements regarding location of AI research centres in France: IBM (400 positions within the next two years), Samsung (100 positions), Fujitsu, and DeepMind. These are in addition to announcements already made by Facebook and Google during last February’s Choose France! summit: Facebook announced planned investment of €10 million to double the size of its French AI laboratory, making it the largest in the world along with the New York laboratory, and Google announced it was going to invest in AI research in France with the opening of a fundamental research centre.



In March 2018 the members of Germany's Social Democratic Party (SPD) voted in favor of the coalition agreement that will see Angela Merkel remain Chancellor for the next four years. Although digital and cyber issues were recurring themes during the election, the agreement leaves many questions unaddressed.

The coalition sets a goal of bringing gigabit internet speeds to every part of the country by 2025, and wants to enshrine a right to "fast internet" in the constitution within the next four years. To bring fiber to "every region and every county," the government will support the private sector's roll out with up to €12 billion in subsidies it hopes to raise through an auction of 5G frequencies. Linked to its broader infrastructure efforts, the federal government will give Germany's states €3.5 billion to connect schools and universities to the internet under an initiative it is calling "Digitalpakt#D." As part of its efforts to shape "digital work 4.0," the coalition will launch a national strategy for continued training and attempt to remove barriers to remote work.

Concerned about the growing market power of tech giants, the coalition will launch a "Competition Law 4.0" commission to examine how existing anti-trust regulation could be adapted to take new business models into account. In a similar vein, the government will support efforts to collect taxes from "internet companies," a term that is not clearly defined. There is a similar lack of detail when it comes to the coalition's plans of establishing "strong German and European actors in the platform economy."

The coalition further aims to take a closer look at algorithms and artificial intelligence (AI). A commission on data ethics will be tasked to provide recommendations on the use and regulation of such technologies. Germany will further develop a "Masterplan for AI" and establish a joint AI research center with France to compete with the United States, Canada, and China.

To address emerging cyber threats, the coalition seeks to strengthen Germany's federal information security agency, the BSI. The BSI will be expected to improve its security advice and offerings to citizens, civil society and small- and medium-sized companies, adding to its current responsibility of advising government and industry.



“National Strategy for Artificial Intelligence” report published in June 2018 stated that India, being the fastest growing economy with the second largest population in the world, has a significant stake in the AI revolution.

Recognising AI’s potential to transform economies and the need for India to strategise its approach, Hon’ble Finance Minister, in his budget speech for 2018 – 2019, mandated NITI Aayog to establish the National Program on AI, with a view to guiding the research and development in new and emerging technologies. In pursuance of the above, NITI Aayog has adopted a three-pronged approach – undertaking exploratory proof-of-concept AI projects in various areas, crafting a national strategy for building a vibrant AI ecosystem in India and collaborating with various experts and stakeholders. Since the start of 2018, NITI Aayog has partnered with several leading AI technology players to implement AI projects in critical areas such as agriculture and health.

While evolving the national strategy for AI, the underlying thrust was to identify applications with maximum social impact, a willingness to learn from the best of the world when it comes to the recent technology advancements in AI, and leveraging approaches that democratize access to and further development of AI. Acknowledging that India is some distance away from consistently delivering home grown pioneering technology solutions in AI, adapting and innovating the technology for India’s unique needs and opportunities would help it in leap frogging, while simultaneously building the foundational R&D capability aimed at ensuring competitiveness in the long run.

A national AI strategy needs to be premised on a framework which is adapted to India’s unique needs and aspirations, while at the same time, is capable of achieving the country’s full potential of leveraging AI developments. Such a framework could be seen as an aggregation of the following three distinct, yet inter-related components:

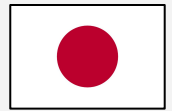
- a) Opportunity: the economic impact of AI for India
- b) AI for Greater Good: social development and inclusive growth
- c) AI Garage for 40% of the world: solution provider of choice for the emerging and developing economies (ex-China) across the globe

Italy released a white paper on AI in March 2018. Unlike other strategies, which focus on research and development or private sector uptake, the white paper exclusively focuses on how the government can facilitate the adoption of AI technologies in the public administration.

The white paper, “*Artificial Intelligence: At The Service of Citizens*”, was created by a task force for the Agency for Digital Italy. Given its focus, the paper devotes a significant amount of time to the challenges of integrating AI into government services. This includes concerns over ethics, the availability of skilled employees, the role of data, and legal implications. Taking these challenges into account, the paper concludes with a set of 10 recommendations for the government to consider. Recommendations included the creation of a National Competence Centre and a Trans-disciplinary Centre on AI, a national platform to promote the collection of annotated data, and measures to disseminate AI-related skills through the public administration. It is unclear whether Italy’s new government will implement and fund these recommendations.

The 2014-2020 strategy of the Digital Agenda has become a veritable tool to pursue the great objectives of growth, employment, quality of life and democratic participation. But the challenges of digital transformation have changed quickly: Internet of Things (IoT), big data analytics, Artificial Intelligence and Blockchain are the vectors through which the new digital economy moves. The Plan contains operating indications (actions, times and objectives) for the development of four pillars: digital ecosystems or policy areas (health, school, justice, etc.), intangible infrastructures (including enabling platforms and PA data), physical infrastructures and cybersecurity.

In July 2018, a consortium of universities and research centres in Italy united to create a new national laboratory for AI. CINI-AIIS Lab (Artificial Intelligence and Intelligent Systems Lab) aims to strengthen Italy’s basic and applied research in AI, support the country’s ICT industry by promoting technology transfer from research to entrepreneurship, and promote the adoption of AI solutions in the public administration.



Japan was the second country to develop a national AI strategy. Based on instructions from Prime Minister Abe during the Public-Private Dialogue towards Investment for the Future in April 2016, the Strategic Council for AI Technology was established to develop “research and development goals and a roadmap for the industrialization of artificial intelligence.” The 11-member council had representatives from academia, industry, and government, including the President of Japan’s Society for the Promotion of Science, the President of the University of Tokyo, and the Chairman of Toyota.

The plan, the Artificial Intelligence Technology Strategy, was released in March 2017. The strategy is notable for its Industrialization Roadmap, which envisions AI as a service and organizes the development of AI into three phases: (1) the utilization and application of data-driven AI developed in various domains, (2) the public use of AI and data developed across various domains, and (3) the creation of ecosystems built by connecting multiplying domains. The strategy applies this framework to three priority areas of Japan’s Society 5.0 initiative— productivity, health, and mobility—and outlines policies to realize the industrialization roadmap. These policies include new investments in R&D, talent, public data, and start-ups. Follow-up of Artificial Intelligence Technology Strategies:

- The Strategic Council for AI Technology will conduct regular follow-ups on the approaches described in these strategies.
- It is necessary for relevant ministries to make continuous approaches from a medium and long-term perspective, without stopping during temporary booms, taking into consideration the Industrialization Roadmap. Utilization and application of AI technology have been progressing rapidly, and relevant ministries and research institutions should move forward with approaches that take the latest trends into consideration.
- For matters that require institutional examinations in implementing these strategies, information will be provided to investigatory organs, such as the Council on Investments for the Future, and timely examinations will be promoted.
- Dialogues with relevant economic organizations and academic societies will be held with regard to these strategies, and approaches by private corporations and universities will be promoted.



New Zealand's Minister of Broadcasting, Communications and Digital Media Clare Curran announced that her government is exploring the development of an AI action plan after a major third-party group called upon the government to develop one.

AI Forum of New Zealand is an independent organization that brings together people from academia, industry, and government to advance New Zealand's AI ecosystem. In May 2018, the organization released a report titled, *"Artificial Intelligence: Shaping a Future New Zealand."*

The report surveys the global AI landscape, examines the potential impact of AI on New Zealand's economy and society, and concludes with a set of recommendations for policymakers.

With the goal of "fostering an environment where AI delivers inclusive benefits for the entire country," the organization recommends that the government should focus on:

1. developing a coordinated national AI strategy,
2. creating awareness and understanding of AI in the public,
3. assisting the public and private sectors adopt AI technologies,
4. increasing access to trusted data,
5. growing the local AI talent pool, and
6. examining how AI affects laws and ethics.

AI Forum NZ has also started two working groups to advance these goals: one focuses on fairness, transparency, and accountability in AI, while the other focuses on AI's economic and labour impact.



Launched in May 2017, AI Singapore is a five-year, S\$150 million national program to enhance Singapore's capabilities in AI. It is a government-wide partnership involving six different organizations. Its goals are to invest in the next wave of AI research, address major societal and economic challenges, and broaden adoption and use of AI within industry.

The program consists of four key initiatives:

- First, Fundamental AI Research funds scientific research that will contribute to the other pillars of AI Singapore.
- Second, Grand Challenges supports the work of multi-disciplinary teams that provide innovative solutions to major challenges Singapore and the world faces. Currently the program focuses on health, urban solutions, and finance.
- Third, 100 Experiments funds scalable AI solutions to industry-identified problems.
- Finally, AI Apprenticeship is a 9-month structured program to foster a new cohort of AI talent in Singapore.

In June 2018, the government announced three new initiatives on AI governance and ethics. Principally, the new Advisory Council on the Ethical Use of AI and Data will help the Government develop standards and governance frameworks for the ethics of AI.

The two programmes AI for Everyone (AI4E) and AI for Industry (AI4I) were officially unveiled by Mr S Iswaran, Minister for Communications and Information, at AI Singapore's first anniversary event on 30 August 2018. The two initiatives aim to educate Singaporeans about AI – showing them how technology can help in their daily lives, and to prepare industry professionals to be ready and competitive, and work productively with AI. The new programmes are part of the TeSA initiative, which aims to develop a pipeline of skilled tech professionals to drive Singapore's local tech ecosystem, especially in the AI space.

In October 2017, the UAE Government launched 'UAE Strategy for Artificial Intelligence (AI)'. This marks the post-mobile government phase which will rely on various future services, sectors and infrastructure projects. The AI strategy has five themes: (1) the formation of the UAE AI Council; (2) workshops, programmes, initiatives and field visits to government bodies; (3) develop capabilities and skills of all staff operating in the field of technology and organise training courses for government officials; (4) provide all services via AI and the full integration of AI into medical and security services; (5) launch leadership strategy and issue a government law on the safe use of AI.

The strategy is first of its kind in the region and the world and it aims to:

- achieve the objectives of UAE Centennial 2071
- boost government performance at all levels
- use an integrated smart digital system that can overcome challenges and provide quick efficient solutions
- make the UAE the first in the field of AI investments in various sectors
- create new vital market with high economic value.

The strategy will cover the following sectors:

- transport – to reduce accidents and cut operational costs
- health – to minimise chronic and dangerous diseases
- space – to help conduct accurate experiments, reduce rate of costly mistakes
- renewable energy – to manage facilities
- water – to conduct analysis and studies to provide water sources
- technology – to increase productivity and help with general spending
- education – to cut costs and enhance desire for education
- environment – to increase reforestation rate
- traffic – to reduce accidents and traffic jams and draw more effective traffic policies.

Source:

<https://government.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/uae-strategy-for-artificial-intelligence>

UK as World Leader of “Good Trusted AI”

The fact that the UK has already committed significant portions of their GDP toward investment into AI development also puts them in a good position relative to other countries. Being able to excel in the AI race requires not hundreds of millions of committed government dollars, but tens of billions, which is not as realistic a prospect as other competing countries with lesser GDPs.

Another factor favouring the UK's position to overtake other countries in the development of their AI industry is their geographical interconnectedness and interoperability. London, already home to more AI startups than any other city in Europe, is the epicenter of not only the UK's financial sphere, but also its scientific sphere, with leading academic institutions and universities clustered very close together in the Oxford-London-Cambridge triangle.

This is one of the factors behind the recent increase of investments into UK tech startups, as well as the recent trend of international tech specialists flocking to the UK, namely, because this interconnectedness and the synergy between financial hubs, tech hubs and scientific development hubs in the UK creates a highly favourable ecosystem for convergent technology development.

The US is comparatively disadvantaged in this specific sense. In the US, financial centers of gravity like Wall Street are far-removed from BioTech epicenters like Boston and technology innovation hubs like Silicon Valley.

While the UK's prospects for overtaking the US for the second position or China for the first position in the international AI race is not as strong, ***the nation does has considerable prospects of becoming the #1 leader in some specific niches including Healthcare and FinTech, and in the development of AI ethics, governance and safety frameworks on a global scale. In particular, it has substantial potential to set the gold standard for “Good Trusted AI” and to develop international laws for the prevention of oppression, discrimination and biases resulting from the unethical use of AI.***

How the UK can win the AI race

Keeping up with this change is not going to be easy, it never is. But we need to protect the UK's position today. Three areas are essential to help AI flourish in Britain: Bringing order to disruption To give our smallest AI start-ups the best chance, the government has to provide a level playing field.

The UK has the best system of laws in the world, so playing to these strengths and creating a world leading regulatory environment for AI should be a priority. The public are open to technology improving their lives, but are wary of poor safeguards that will lead to their data being compromised. A strong regulatory framework is an important step in reassuring the public that proper safeguards are not a nice to have, but a precursor for growing public trust. Future-proofing skills Our world-leading position in the AI race may be lost unless we urgently address the digital skills gap facing the UK. The public recognise that they need to digitally upskill, with over 60% of survey respondents believing they will need to learn new skills as technology and AI advances.

Modern jobs need modern skills. By investing in the skills— from schools to adult learning – the UK will secure the workforce it needs. Inclusive economic growth will be catalysed by narrowing the skills gap, avoiding the potential social inequality that AI could bring if people can't adapt to change. The NHS: A shot in the arm for AI Growth? The quantity of data that the NHS holds is a national asset. This data is the UK's key to unlocking a world leading healthcare AI industry.

There are however barriers to harnessing this potential. Concern amongst the public on sharing health data with third parties is high. We found only 15% of respondents are willing to share their data with pharmaceutical firms. Yet 56% are willing to share more personal data with the NHS to improve its service and 53% agreed AI will have a positive impact on the NHS, only 10% thinking that the impact would be negative. We know people are cautious about who they share their data with. But we found that one organisation is seen as trusted above all else: the NHS. However, we need to address the lack of trust in those companies equipped to kick-start a UK healthcare AI industry. We found respondents know what AI is, but are less sure on the positive impacts it can have on society. To grow our nation's AI prowess the public need to be on board. We hope to kick-start that conversation. James Stewart Vice-Chair Head of Brexit and Industrial Strategy KPMG.

Source: <https://assets.kpmg.com/content/dam/kpmg/uk/pdf/2018/09/how-the-uk-can-win-the-artificial-intelligence-ai-race.pdf>

How the UK can Win the AI Race

Part of KPMG's Industrial Strategy series states that:

“What we know, what the public think and where we go from here Global governments recognise the potential of artificial intelligence (AI) as an accelerator for growth. The UK is a global leader in AI, but needs to act now to protect its position. What we know The government and UK business must take action to keep the UK at the frontier of AI advancement.”

“The UK is an AI academic powerhouse, publishing nearly 25,000 research papers on the topic in the past ten years. This puts the UK fourth in the world when it comes to AI research. Our experts give their take on the opportunities we can grasp as a nation, and the hurdles we need to clear to keep Britain in contention. What the public think We know new ideas that disrupt the status quo don't have the luxury of public support from the off. Especially ones that require the input of our personal data.”

“So we asked 2,000 people from across the UK exactly what they think about AI. AI touches nearly every part of our day-to-day lives. In work, entertainment, socialising, government and more. The UK population already has a relationship with this nascent technology. But when it comes to AI, we found one organisation British people have the most faith in: the NHS. A majority (53%) of respondents think that AI will have a positive impact on the NHS.”

“Probing further, 56% approve of their data being used to improve the NHS. The contrast with media companies (8%), internet companies (8%), charities (11%) or pharmaceutical companies (15 %) is stark. Where we go from here The exponential pace of technological change in the next ten years will far outstrip the linear progress of the previous ten. The speed of current breakthroughs has no historical precedent. It is starting to blur the lines between the physical, digital and biological spheres. This chapter of change is termed ‘The Fourth Industrial Revolution’ and will be a story that shapes our lives for decades to come.”

The UK's AI Industry Specific Growth Rate Set to Exceed US & China

The UK Government has proven itself as one of the most proactive and progressive countries in its national AI-strategy, which is internationally recognized among the most pragmatic and balanced strategies put forward by any nation. This state of affairs is the synergetic result of numerous supplementing factors, including the fact that London is a leading financial global hub, the substantial scientific prowess and intellectual excellence emanating from constellation world-class universities, including Oxford and Cambridge, and the unparalleled reputation that the UK has cultivated for the development of strong ethical traditions relating to industry, finance and governance.

What makes areas like the London-Oxford-Cambridge triangle so attractive to industry players is not any single factor in isolation, but the combination of several factors equally contributing to the creation of an industry ecosystem uniquely optimized for coordinated technology and business development, including its intellectual and academic prowess, highly developed science and technology hubs, and favourable investment landscapes. Silicon Valley, for instance, is quickly losing its reputation as the exclusive leading hub for Tech innovation and AI in particular. Meanwhile, other nexuses for industry development are actively developing elsewhere.

Singapore and Hong Kong, conversely, have been attracting many AI startups due to their more flexible regulatory frameworks, and while start-ups might have an easier time finding investors in places like Silicon Valley, this is offset by greater access to government grants and investment-matching programs, and by the rise of Chinese AI investors, who are quickly coming to match if not outpace US AI investors in terms of both overall quantity and total funds invested.

We can expect the current significant growth rates of the AI-industries in China and US to stay at the same pace in coming years, and for the UK's industry-specific growth rate will increase in accelerated mode above other countries due to its natural predisposition to maximize its presence within the global AI industry, such that over the coming years the UK will capture an increasing of the global AI-industry market share.

The UK has several additional strategic contributing factors:

- The UK now has an AI industry of a critical scale in the global economy, with investment in UK AI businesses has now exceeding \$5bn (£3.8bn) and growing.
- London is now both a leading global financial hub and an AI hub, home to more AI startups than any other European country.
- The scientific prowess and intellectual excellence emanating from AI-savvy UK universities.
- The UK's reputation for developing strong ethical traditions relating to governance and business.

AI Industry in the UK - Global Engine of the 4th industrial Revolution

The UK has now reached the inflection point whereby all of the activities mentioned above, taken together, can be reasonably described as the Cambrian Explosion of AI in the UK. A number of analytical reports published during 2018 have highlighted the fact that the AI Industry in the UK highlighted the nation's very strong potentials to become a global leader in AI, provided that sufficient commitments from the UK Government were made in order to prioritize it as a matter of national strategic importance.

Given the substantial surge of activities on the part of the UK Government throughout the past several months, ranging from Governmental reports, new AI offices and committees, and the announcement of well-funded Government and private sector partnerships and initiatives, it is clear that the Government has very strongly confirmed its commitment to prioritize the further development of the AI industry as a core part of its national agenda.

While the UK will not be able to compete with the US and China as the dominant AI leader globally, but it is absolutely clear that it can become an AI leader in a different mode: being the obvious #3 in the global AI race, it can become the #1 leader in international AI-cooperation, AI-governance, and global AI-guidance on the matters of AI ethics, transparency and safety, issues which are becoming more and more pressing.

Meanwhile, the UK has a long history of productive intercontinental collaboration, and is in the best position to become the leader of international AI cooperation with such countries as Singapore, Hong Kong, South Korea, Israel, Switzerland, Saudi Arabia and UAE. While US and China are too focused on their isolated growth and industry dominance, the UK has all elements necessary to become an unbiased frontrunner in international AI collaboration and to set the gold standard for "Good Trusted AI" and to develop international laws for the prevention of oppression, discrimination and biases resulting from the unethical use of AI. If the UK will proceed in the same direction as it was doing throughout 2017-2018, it has great potentials to become the new global leader of the 4th Industrial Revolution, driven by the further evolution of the UK AI Industry.

**AI
SUPER-
POWERS**

**CHINA,
SILICON VALLEY,
NEW WORLD ORDER**

**United Kingdom
Global Hub
Trusted AI
2020**