

A way forward for the D9 in the age of AI:

An industry view

Digital Future for Europe coalition



This paper is the result of workshops and interviews with a wide range of startups, unicorns, and associations in countries across the D9, following a request from economy ministers in D9 nations for industry input into the future of digital policy. Their quotes – anonymised – are presented in this document. The policy recommendations in here represent the combined result of the interviews and discussions we had rather than a manifesto for any individual organisation.

This paper is a follow up to the work that was presented to the D9 at the meeting hosted by the Estonian government in 2018. That paper asked for a focus in Europe on:

- Completing the single market, and recognising that there was no such thing as a ‘digital single market’ but rather a ‘digitised’ single market that represented all industries.
- Reinforcing the SME ecosystem on which Europe relies by:
- A focus on interventions that positively impacted jobs and growth, and stimulated the adoption and use of digital technologies throughout the economy;
- In part through the contribution of AI to productivity throughout the economy;
- Providing the underpinning infrastructure and environment to support this.

This paper provides a deep dive into AI specifically and also provides more detailed policy recommendations for D9 governments as well as the EU. It finds – unsurprisingly – that many of the underlying drivers of success in tech are the same as those in AI. The findings of this paper therefore entirely support the previous one.

Participants



Confederation of Danish Industry



THE STARTUP VOICE



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About Us

The Digital Future for Europe coalition is made up of successful tech startups, scaleups, unicorns, think tanks and trade associations from digital frontrunner countries. Digital Future for Europe formed to help our countries learn from best practices on tech policy, and to support policymakers at national and European level in developing policies that will help European tech companies grow.

www.digitalfutureforeruoep.com

A short summary

The AI transformation

- In previous centuries new pervasive technologies – the printing press (Alsace); the steam engine (the UK); the stock market (the Netherlands); or the internal combustion engine (Belgium) transformed every aspect of our economy and society. Because Europe both invented and capitalised on these ideas, its people gained previously unimaginable levels of wealth. We are now at a pivotal moment in the development of the next all-pervasive technology – AI. It will change every industry.
- The Digital 9 (D9)¹ stand to gain particularly from AI. Their pre-existing success in technology – including an over-representation in successful scaleups and unicorns – alongside a highly educated population puts them in a good position.
- AI is likely to transform the fortunes of companies in every sector – from pharmaceuticals and energy to the automotive industry. Countries that seize the opportunity from AI will see increased productivity and wealth for their citizens. Those that do not are likely to suffer from job losses and a large relative decline in economic power. The public sector – such as health and transport – is also going to be majorly affected by AI.

Where do the D9 stand?

This paper presents a view of how the D9 countries - as digital frontrunners with an unusual record in investment and success in technology - can take advantage of AI and propel the rest of Europe. It is the result of research and of workshops and interviews with 18 startups, scaleups, unicorns and trade associations across the D9 countries.

The collective view of those we interviewed can be summarised as:

- **The general tech and SME ecosystem will determine the success of AI.** Many of those we interviewed were at pains to point out that the same structural conditions – talent, capital, size of market, and regulation and infrastructure – that affected the EU’s ability to grow successful companies of any type also impacted AI. The D9’s approach should therefore be predominantly an innovation and startup friendly approach.
- **Europe needs to play to its strengths. That is not only regulation.** While most participants were approving, in general, of the EU’s leadership in ethical AI and regulation, they did not want this to be the sole focus. If Europe is to play to its strengths it needs to maximise the impact of its talent; of its potential scale; and of the areas where it is already strong, which includes the public sector. There are opportunities and challenges in each of these areas.
- **While public trust can be strengthened through government regulatory action, it will be *most* strengthened by practical benefits.** In particular, if governments demonstrate real benefits to citizens’ lives through the health system, transport, and clean low-cost energy the trust battle will be won.

¹ The D9 consists of Sweden, Denmark, Finland, Estonia, Belgium, the Netherlands, Luxembourg, Ireland, and the UK

- **The D9 could be the frontrunners in more than name, and develop a true ‘fast lane’ for AI in Europe.**
The collective view of those we talked to was that while the EU needed to strengthen its single market, it continued to be a slow process. Given the similarities between many D9 countries and the relatively high level of public comfort between D9 countries, there was a major opportunity for D9 governments and leading organisations in these countries to launch programmes which practically demonstrated the gains that could be achieved through market harmonisation and scale. This could include trials and pilots of greater harmonisation and data-sharing between the D9 nations, as an example for all of Europe to follow.

What does this mean for policy?

Our participants want AI policy to reflect:

- A general desire to strengthen the tech and SME ecosystem;
- A deliberate focus on the EU’s strengths without attempting to do everything;
- An approach to public trust that is as focused on demonstrating practical benefits as pre-empting concerns.

How D9 member states can collaborate and propel the public sector

Perhaps most importantly, the people we interviewed thought the D9 did not need to wait for formal EU policy to demonstrate the benefits that a harmonised multi-state approach could achieve. They see the D9 as the genuine frontrunners and want them to influence EU policy, act domestically *and* work together. These primary recommendations are therefore for D9 governments, however they could also be implemented by D9 nations individually, bilaterally, or at an EU-level. They will support the development of AI – and also benefit the wider tech sector.

Recommendation 1: replicate each others’ work on automating government processes and opening up public sector datasets with a prioritised list of areas where some D9 states have made progress and others have yet to catch up

Recommendation 2: create common commitments to open data and move to data interoperability including the adoption of shared open data standards between nations

Recommendation 3: develop agreements for the movement of data – including personal data in specific areas – across national borders with trials on priority areas in the D9

Recommendation 4: work to deliver 5G across states: shared infrastructure programmes will give a basis for AI development in the next decade

Recommendation 5: there should be a shared approach to simplifying and harmonising regulation for different sectors across D9 states

Recommendation 6: nations to work together to identify hubs and develop the D9 ecosystem so that Europe can benefit from spillover effects and scale

Recommendation 7: the D9 can lead the way on public sector procurement including adopting scaleup targets and increasing investment in very early stage high-risk projects

A renewed focus on skills systems and how they need to adapt

If AI is to be a truly inclusive technology, creating greater prosperity for all, it is essential that we improve our system of education and training – ensuring that workers can gain the skills they need to take full advantage of the productivity enhancements from automation. As AI increasingly replaces old forms of routine and predictable work, new types of skills are likely to become important. These recommendations are aimed at the EU and domestic governments.

Recommendation 8: *the EU or D9 should establish a What Works centre to synthesise and commission evidence*

Recommendation 9: *the EU or D9 should make it easier to recognise people's training outside university through joint accreditation schemes*

Recommendation 10: *the EU or D9 should change the incentives for retraining including lifelong accounts; the ability to use savings such as retirement funds; and incentivising universities and other education institutions to develop shorter degrees with the option for later retraining*

Recommendation 11: *incentivise retraining in 'soft' tech skills including marketing, problem-solving and management*

Recommendation 12: *change and increase incentives to diversify the tech workforce including scholarships and bursaries; incentives for female returners; and reporting*

Recommendation 13: *educate citizens in AI following Finland's example and develop an EU wide MOOC to educate at least 1% of the European population on AI skills and principles*

A magnet for talent

Participants agreed that access to talent was the greatest block – by far – to success in AI and tech more broadly. They wanted to see moves not only to increase the skill of EU citizens but encourage the best from around the world to come into the EU and grow companies there.

Recommendation 14: *supporting people taking a high risk move into startups by allowing them to keep employment rights for a fixed period if that startup fails*

Recommendation 15: *make rules around startup visas consistent and favourable across the EU and expanding to founder teams.*

Recommendation 16: *make it easier for startups to offer stock and other non-monetary forms of compensation in a tax-efficient manner by replicating the best performing D9 systems such as Estonia*

Making the EU AI-ready

Many of our proposals are designed to fast-track developments we would like to see across the entire EU. However there are two specific recommendations that have been made by other organisations that are essential in preventing AI from moving backwards.

Recommendation 17: the EU should do an 'AI refit' of existing proposals and legislation to ensure no adverse effects

Recommendation 18: the D9 and EU should adopt the principle of de minimis exceptions for small companies

Where next for the D9?

The D9 nations can play an important role in shaping the digital agenda in the European Union. These proposals suggest two complementary courses of action. The D9 nations can combine their diplomatic and economic clout to shape the political agenda in Europe, and use their positions in traditional channels to affect the sort of policy change and desired outcomes we have outlined above.

But the D9 nations can also forge ahead with the policies proposed here. Instead of lobbying for policy change at the highest level, they can demonstrate how effective these policies can be in practice, and encourage other nations to join them.

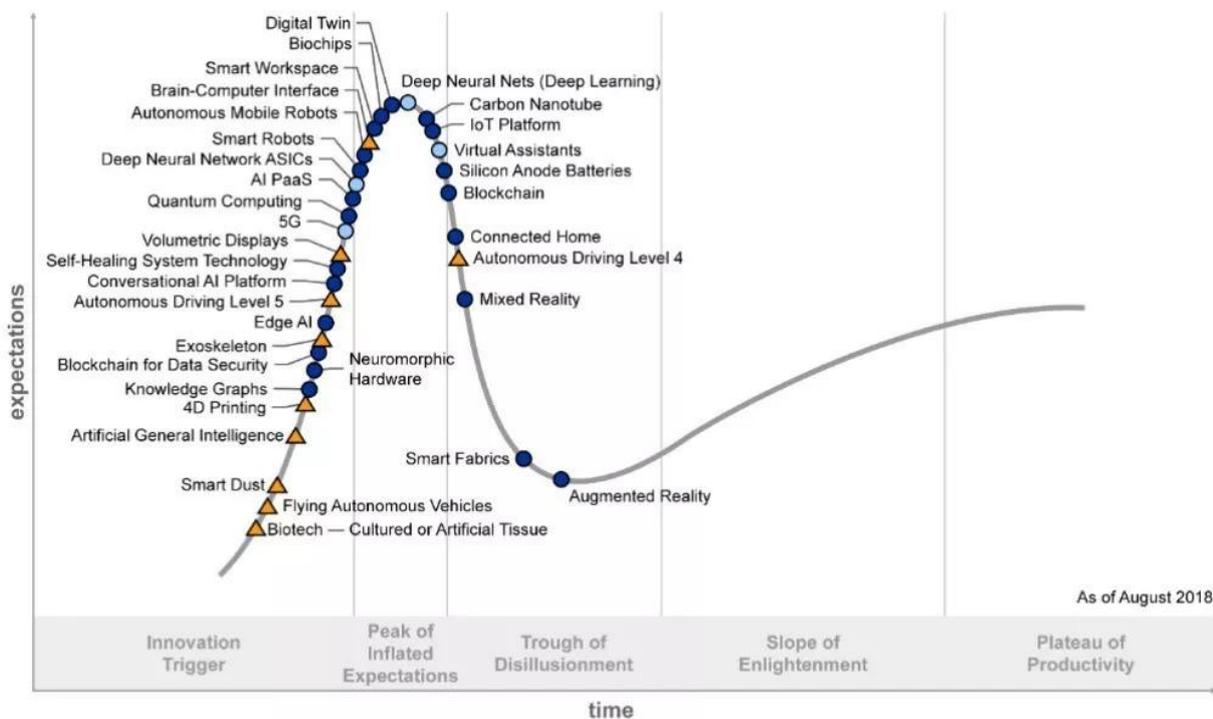
Chapter 1 - The AI transformation

A. Why are we writing about AI?

*“The business plans of the next 10,000 startups are easy to forecast: take X and add AI”
(Kevin Kelly, Founding Executive Editor of Wired)*

In previous centuries new pervasive technologies – the printing press (Alsace); the steam engine (the UK); the stock market (the Netherlands); or the internal combustion engine (Belgium) – transformed every aspect of our economy and society. Because Europe both invented and capitalised on these ideas, its people gained previously unimaginable levels of wealth.

We are now at a pivotal moment in the development of the next all-pervasive technology – AI. It will change every industry. It is also moving fast. In Gartner’s annual ‘hype cycle’ AI related technologies were simultaneously at the most over-inflated part of the cycle and just 2-5 years off the ‘plateau of productivity’. Classic models of innovation, where traditional research in universities slowly moves to commercial application, don’t apply: companies like DeepMind are simultaneously publishing cutting edge research in Nature², beating world champions of games like Go and Starcraft³, and reducing the cooling bill of data centres by 30% through practical optimisation⁴. Industries that don’t adapt may die.



Europe – like the rest of the world – wants to capitalise on the opportunities of AI and minimise the disruption. It is well understood by policy makers that AI will determine the relative and absolute success of countries and companies in the coming century, and therefore the level of prosperity and safety our citizens can enjoy. If Europe falls behind other countries in creating the AI powering companies of the future, its citizens will be subjected to the job losses rather than the job and productivity gains AI could offer.

² Solving Intelligence through research, [DeepMind](#)

³ AlphaStar: Mastering the Real-Time Strategy Game StarCraft II, [DeepMind](#)

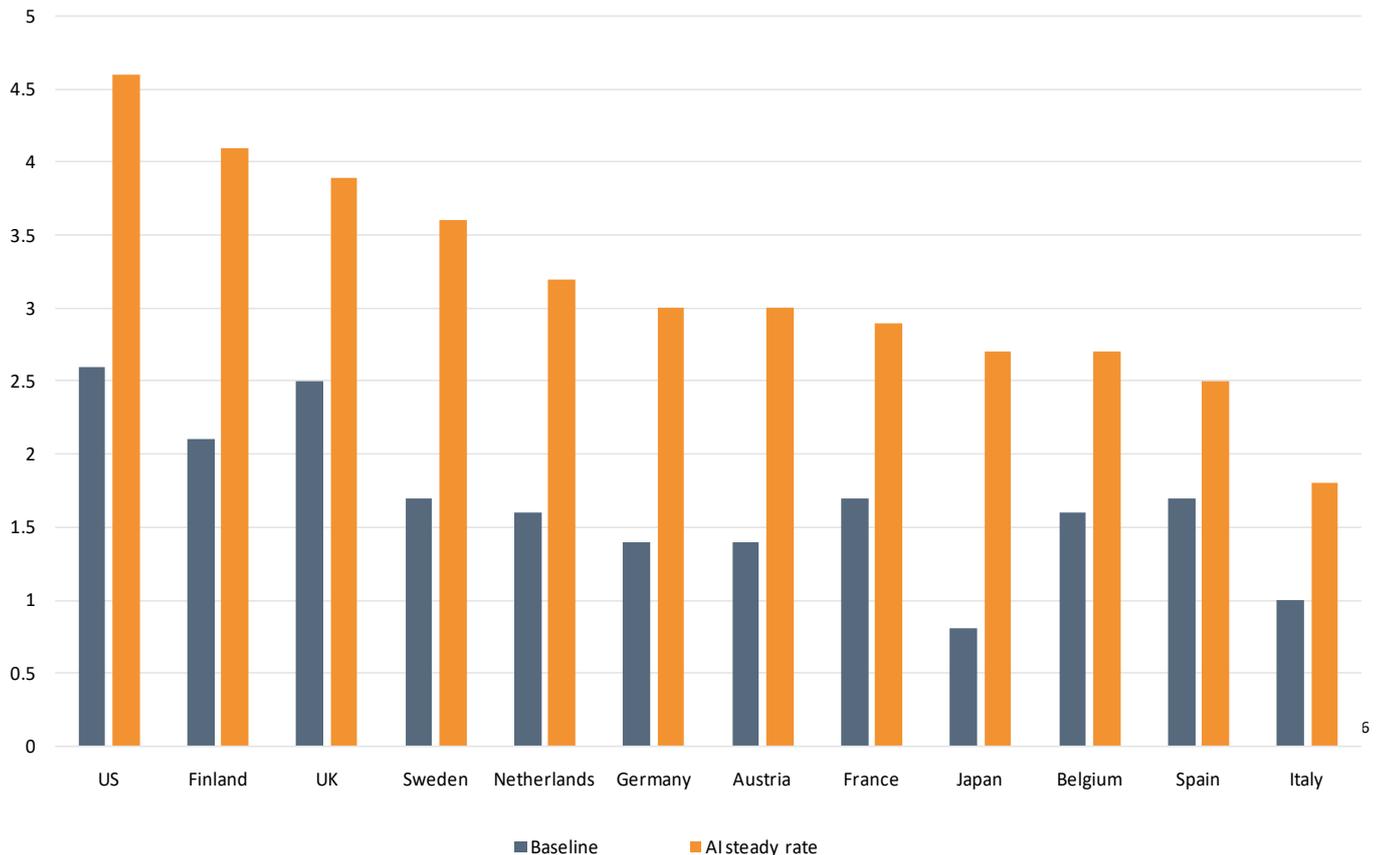
⁴ Safety-first AI for autonomous data-center cooling and industrial control, [Google](#)

B. The D9 in particular stand to gain enormously from AI

“You can see that there is general optimism about AI in the Nordic and other D9 countries”

In 2017 McKinsey identified the D9 as the ‘digital frontrunners’ who stand to gain the most from AI. Successful adoption of AI by the D9 could see an annual increase of 1.2% to their GDP between 2016 and 2020, and an additional 4.5 million jobs.⁵

AI as driver of growth

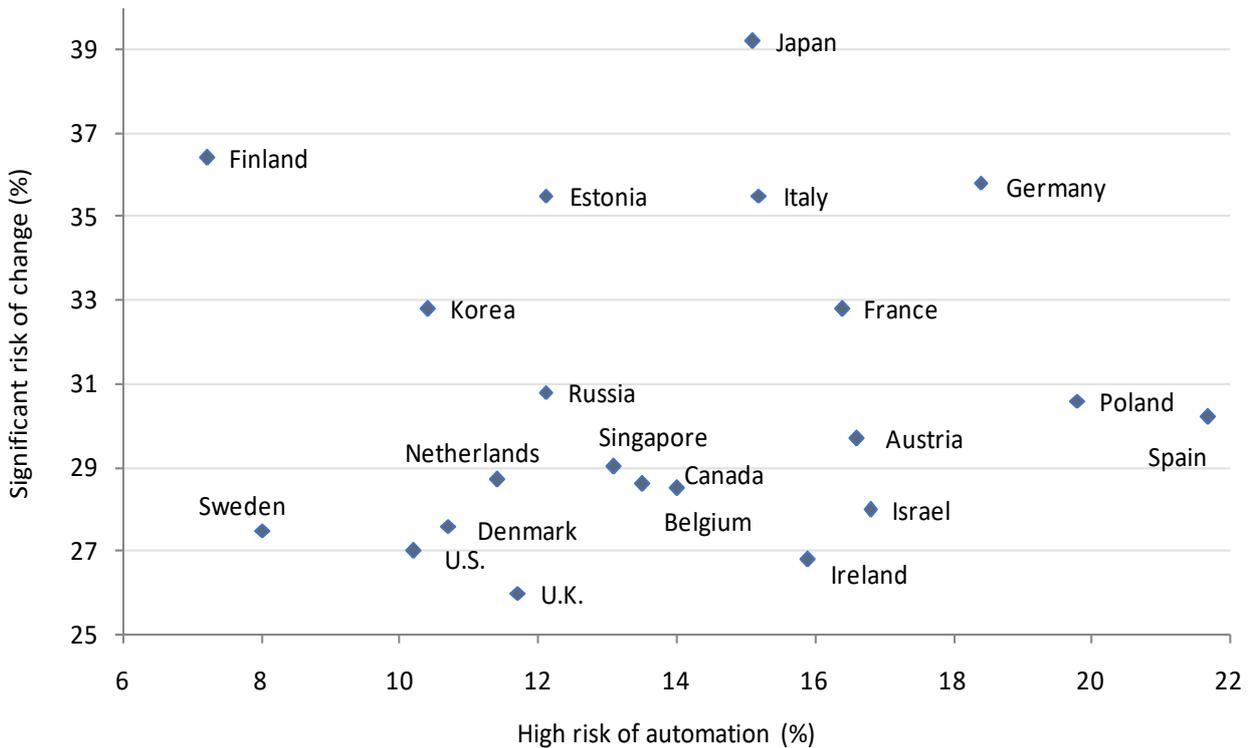


⁵ Digitally-enabled automation and artificial intelligence: Shaping the future of work in Europe’s digital front-runners, McKinsey, [2017](#)

⁶ Artificial Intelligence is the Future of Growth: Doubling Down on Growth, Accenture [2016](#)

Most of the countries in the D9 are also – because of the structure of their labour market – *relatively* protected from job losses.

% of jobs in selected OECD countries at high risk of automation ⁷



This potential is in part because of a pre-existing strength in tech (and the underlying conditions that led to that strength). There is no question that nations in the D9 punch above their weight. Estonia, with a population of 1.3 million, has roughly \$300 million is invested in startups, scaleups, and tech unicorns every year⁸. It has also practically benefited from technology – saving the state the equivalent of 2% of GDP every year following the development of its secure digital government in 2001.⁹

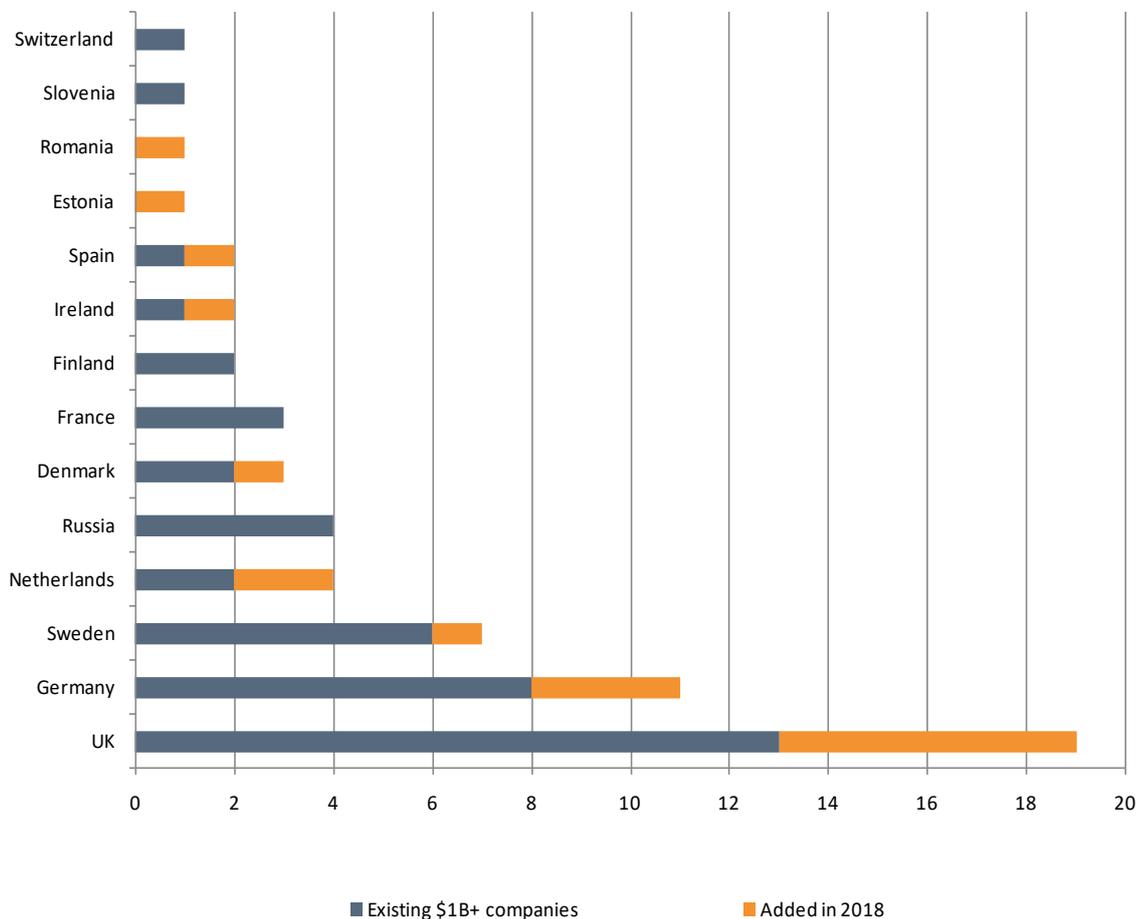
⁷ The Future of Work, OECD [link](#)

⁸ Invest in Estonia, [2018](#)

⁹ Nesta, digital frontrunners country spotlight, [Estonia](#)

There are now 19 unicorns – privately-held companies valued at over \$1 billion – in the D9, over 60% of the European total. In 2018, 5 new ones emerged in the D9 out of a total of 119 globally.¹⁰

Tech unicorns in different European nations ¹¹



C. AI will have a profound impact on wealth-producing sectors and the public sector within the D9 economies

“The challenge is how to convince the mainstream companies to adopt AI”

Of course the distinction between ‘tech companies’ and the rest is becoming increasingly blurred. There is no longer such a thing as the ‘digital sector’. Instead we have an increasingly digitised economy which affects all sectors and companies. The same is true for AI – it is a technology which can be deployed by the public and private sector, and in every industry. For our participants – who tend to come from tech companies and trade associations – it is the level of adoption of AI in traditional sectors which will determine how much European economies benefit – not the development of ‘AI companies’ per se.

¹⁰ The Global Unicorn Club, CB Insights, [January 2019](#)

¹¹ State of European Tech Report, 2018

Table 1: How will AI affect the largest companies in the D9?

Example D9 company	AI applications
<p>Automotive</p> <p>Volvo (Swe)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - Voice-activated commands, in-car assistants, safety features to assist driving - Volvo developing AI in partnership with Swedish AI company NVIDIA <p>Future applications:</p> <ul style="list-style-type: none"> - NVIDIA-powered AI in Volvo cars will use ML technology to adapt each Volvo car to each driver's style and approach - Fully automated, driverless vehicles for commercial and personal use
<p>Chemicals</p> <p>Solvay (Bel)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - Include machine learning tools for process control systems to predict and design safer chemicals and compounds, making R&D more efficient; improving worker safety around dangerous chemicals <p>Future applications:</p> <ul style="list-style-type: none"> - Solvay has partnered with Noble.ai in Silicon Valley to utilise data from the company's 150 year history to make intelligent recommendations for the creation of new chemicals, formulations, and advanced materials
<p>Consumer goods</p> <p>Unilever (NL)</p> <p>AB InBev (Bel)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - Unilever currently using an AI application to assist with recruiting thousands of staff in around 190 countries, as well as using Unabot, an AI system to manage a range of HR functions and provide unique service to different employees. - AB InBev has introduced an AI system to monitor the health of their breweries in their global supply chain, which will track operation quality and make supply-chain adjustments accordingly <p>Future applications:</p> <ul style="list-style-type: none"> - Fast-moving consumer goods will benefit from greater use of big data and machine learning applications to analyse large amounts of customer data. This will improve supply chain management, demand management, autonomous vehicles in logistics, staff management, and intelligent systems to automatically recommend products
<p>Financial services</p> <p>ING (NL)</p> <p>Prudential (UK)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - AI is already in use in financial services, using big data analysis to improve risk management and fraud detection, as well as managing personal finance portfolios and trading decisions <p>Future applications:</p> <ul style="list-style-type: none"> - Prudential is investing in a raft of AI applications and measures to improve their products and staff productivity, including using machine learning and augmented data science to better identify the right insurance and investment products for customers
<p>Oil and Gas</p> <p>Shell (NL)</p> <p>Eesti Energia AS (Est)</p> <p>BP (UK)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - Using AI in surveying, planning and forecasting, improving efficiency and worker safety in oil and gas - Shell has been an early adopter of AI, investing in AI-enabled horizontal drills, which make automatic adjustments on the basis of real-time data which improves efficiency and reduces wear and tear <p>Future applications:</p> <ul style="list-style-type: none"> - AI applications and big data will further improve the efficiency and safety of oil and gas, thanks to robotic technologies to assist with marine exploration. BP is investing in a new AI technology called Sandy to reduce the time it takes to collect and analyse data on new projects by 90%

<p>Professional Services</p> <p>Accenture (Ire)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - Professional services firms are already benefiting from AI. Using big data to improve decision-making and the quality of advice offered to clients, as AI applications will use past data to predict future outcomes and recommend the most effective solutions more efficiently <p>Future applications:</p> <ul style="list-style-type: none"> - Using AI and machine learning applications to interpret vast quantities of client data – across different languages and locations – beyond the speed and ability of human team, to recommend new strategies - Professional services are arguably under severe threat from AI development, as smaller AI firms move into consulting. It is likely that legacy consultancies will invest in and buy up AI SMEs
<p>Retail</p> <p>Tesco (UK)</p> <p>H&M (Swe)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - AI is already being used in retail in such forms as automatic checkouts, and analysing customer transaction data to better understand customer behaviour, seasonal trends, and how to improve customer experience - Tesco's R&D division is integrating its online shopping with Google Home, which is enabling greater personalisation of customer service <p>Future applications:</p> <ul style="list-style-type: none"> - IBM identified six ways for the retail industry to utilise AI, which were supply chain planning, demand forecasting, customer intelligence, marketing, store operations, pricing and promotion. Some of these are already being implemented, and will enjoy significant improvement
<p>Shipping</p> <p>Maersk (Den)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - Maersk has invested in a New York-based AI startup called Loadsmart, which provides shippers with real-time data about capacity and prices at different locations in the US, to massively improve logistics around the world <p>Future applications:</p> <ul style="list-style-type: none"> - In the future, automated processes could better identify and predict forthcoming problems or conflicts which may occur in shipping routes, as well as optimise the performance of ports and container terminals - Maersk is trailing a scheme to improve at-sea situational awareness, which will help ship crew better identify threats and dangers at sea
<p>Telecommunications</p> <p>Ericsson (Swe)</p> <p>Nokia (Fin)</p>	<p>Current applications:</p> <ul style="list-style-type: none"> - Telecoms firms are harnessing vast amounts of data from networks, devices, and customer behaviour. It is improving customer service by developing more sophisticated chatbots to understand customer concerns, and making billing and customer communications more efficient <p>Future applications:</p> <ul style="list-style-type: none"> - Ericsson is investing in AI and machine learning applications in preparation for 5G. 5G will enable these applications to combine machine learning with reasoning, share real-time data between fast moving devices like drones and cars, which will catalyse innovation way beyond the telecoms sphere

Table 2: How will AI affect the public sector?

Sector	AI applications
Health	<p>Size of sector:</p> <ul style="list-style-type: none">- Healthcare spending is worth 9.4% of the EU's total GDP- As of 2012, the European pharmaceutical industry was worth over €220 billion, and was responsible for nearly 2% of European jobs <p>Current applications:</p> <ul style="list-style-type: none">- AI is being used to improve detection and diagnosis, including improving quality and speed of identification of mammograms- The growth of wearable tech is providing data to monitor heart disease <p>Future applications:</p> <ul style="list-style-type: none">- There is huge potential for AI in healthcare, including the use of big data and machine learning applications to manage demand and logistics; improve drug discovery; increase productivity in pharmaceutical R&D; improvements in diagnosis and prognosis; and in the future there is potential for automation in surgery- Benevolent.ai is using machine learning an AI to discover new drugs on from data from previous clinical trials
Transport	<p>Size of sector:</p> <ul style="list-style-type: none">- Around 2% of EU GDP is spent on transport- Transport is worth 9% of the EU's Gross Value Added, and 9% of total EU employment <p>Current applications:</p> <ul style="list-style-type: none">- The majority of public transport providers already use AI applications- AI is being used in transport to predict and manage demand and allocate resources accordingly. Customer data can be used to understand patterns of behaviour, which can be utilised in urban planning and infrastructure building. In the future, there will be greater use of autonomous vehicles for public and private transport <p>Future applications:</p> <ul style="list-style-type: none">- European innovations like My-Trac will use vast quantities of users' data to develop seamless public transport services, linking together different providers like rail, buses, trams and metros, which operate in line with user demand and with greater appreciation of mobility

Defence

Size of sector:

- The European defence industry had a [turnover](#) of around €100 billion in 2015
- [Combined European defence](#) spending is over \$200 billion per year, around 1.5% of EU GDP

Current applications:

- [There is already significant military investment](#) in cloud-based technologies, which are enabling the more sophisticated use of AI in defence technology
- The defence industry has developed many AI applications such as GPS navigation, as well as missile defence systems and cybersecurity defence technology. AI will have extensive use in improving the efficiency of logistics and transport in the military, as well as assisting security forces with target recognition to improve accuracy and eliminate civilian casualties. AI and machine learning technologies may also be able to better assist commanding officers with decision-making in the future, with an enhanced ability to recognise threatening behaviour

Future applications:

- AI will prove increasingly important [in cyber-defence technologies](#), enhancing defence systems' abilities to track bugs and system breaches, as AI applications are able to collect and understand data on a far greater scale than ever before

Clean energy

Size of sector:

- In [2017](#), renewable energy sources generated over 17% of energy in the EU
- The EU aims to reach 20% by 2020

Current applications:

- AI is being used to improve buildings' [energy efficiency](#) to reduce overall energy consumption
- The [combination](#) of AI with the internet of things is developing intelligent smart meters which are able to reduce household energy consumption, and make energy networks more responsive to demand

Future applications:

- AI will be central to the development of the [Smart Grid](#), where energy is distributed more closely according to customer demand, thanks to the use of data from smart meters. This has the potential to create a truly global energy market
- AI applications [to improve the storage](#) of renewable energy are being developed. This will enable households with renewable energy generators like solar panels to store energy and sell it onto the grid when prices increase, improving the flow of energy in the grid and reducing spikes in supply and demand

Chapter 2 – How does the D9 stand? An industry view

This paper presents a view of how the D9 countries – as digital frontrunners with an unusual record in investment and success in technology – can take advantage of AI and propel the rest of Europe. It is the result of research and of workshops and interviews with 18 startups, scaleups, unicorns and trade associations across the D9 countries.

The collective view of those we interviewed can be summarised as:

- 1. The general tech and SME ecosystem will determine the success of AI.** Many of those we interviewed were at pains to point out that the same structural conditions – talent, capital, size of market, and regulation and infrastructure – that affected the EU's ability to grow successful companies of any type also impacted AI. The D9's approach should therefore be predominantly an innovation and startup friendly approach.
- 2. Europe needs to play to its strengths. That is not only regulation.** While participants were approving, in general, of the EU's leadership in ethical AI and regulation, they did not want this to be the sole focus. If Europe is to play to its strengths it needs to maximise the impact of its talent; of its potential scale; and of the areas where it is already strong, which includes the public sector. There are opportunities and challenges in each of these areas.
- 3. While public trust can be strengthened through government regulatory action, it will be *most* strengthened by practical benefits.** In particular, if governments demonstrate real benefits to citizens' lives through the health system, transport, and clean low-cost energy the trust battle will be won.
- 4. The D9 could be the frontrunners in more than name, and develop a true 'fast lane' for AI in Europe.** The collective view of those we talked to was that, while the EU needed to strengthen its single market, it continued to be a slow process. Given the similarities between many D9 countries and the relatively high level of public comfort between D9 countries, there was a major opportunity to launch programmes which practically demonstrated the gains that could be achieved through market harmonization and scale. This could include trials and pilots of greater harmonisation and data-sharing between the D9 nations, as an example for all of Europe to follow.

A. The general tech and SME ecosystem will determine the success of AI.

“I wish policy makers didn’t think AI was this magical thing different from all other technologies. The same policies that affect them will affect AI”

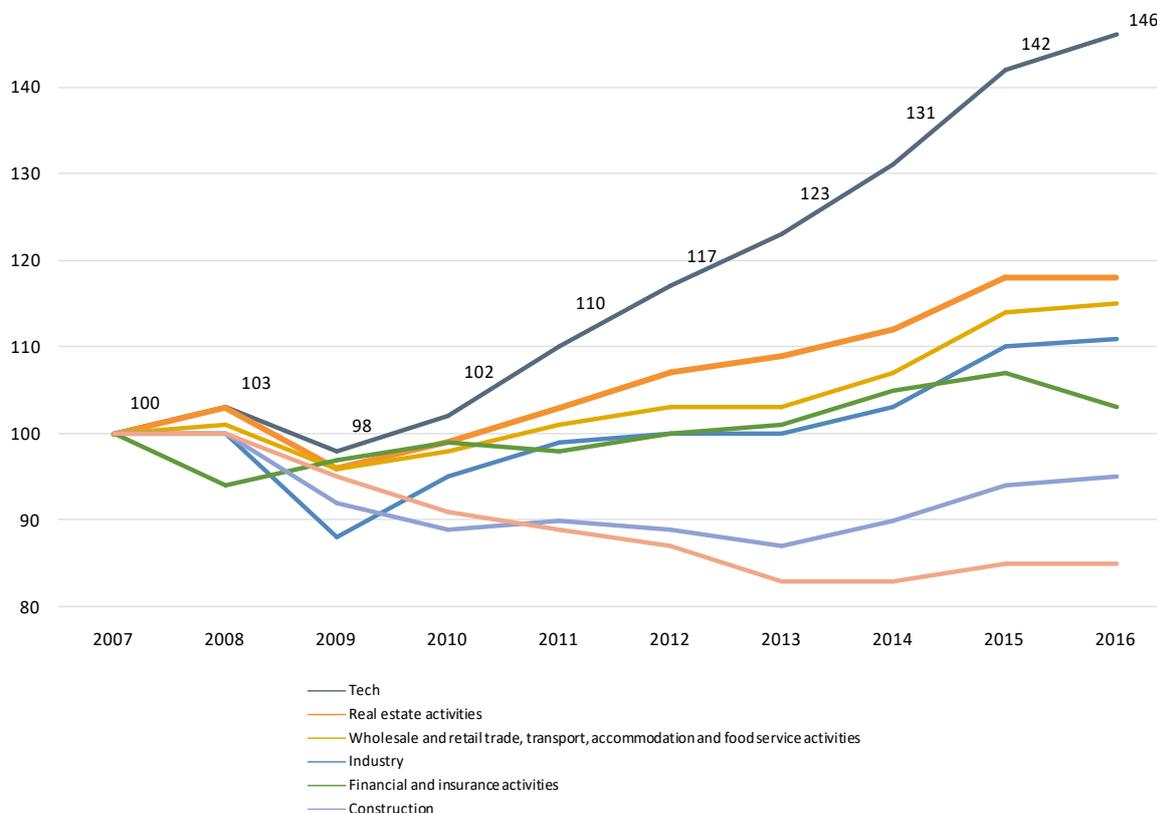
Many of those we interviewed were at pains to point out that the same structural conditions – capital, talent size and harmonisation of market, and infrastructure – that affected the EU’s ability to grow successful companies of any type also impacted AI. The D9’s approach should therefore be predominantly an innovation and startup friendly approach.

In our previous report, we argued for a number of policies to boost the SME ecosystem in Europe. These included altering public procurement rules to enable more innovative startups to bid for public contracts, and using the power of the public purse in Europe to make investments in a pan-European AI strategy, and consider the establishment of a high-risk innovation centre in Europe. These policies, in the specific context of AI, were also considered desirable.

We are starting from a relatively good place. Productivity growth is high for European tech, and so is optimism for the future

Between 2007 and 2016, the GVA of the European tech industry has increased by half, while traditional sectors like construction and telecommunications are yet to reach their pre-crisis value.¹²

Chain linked volumes of tech and selected traditional industries GVA (indexed 2007-2016)

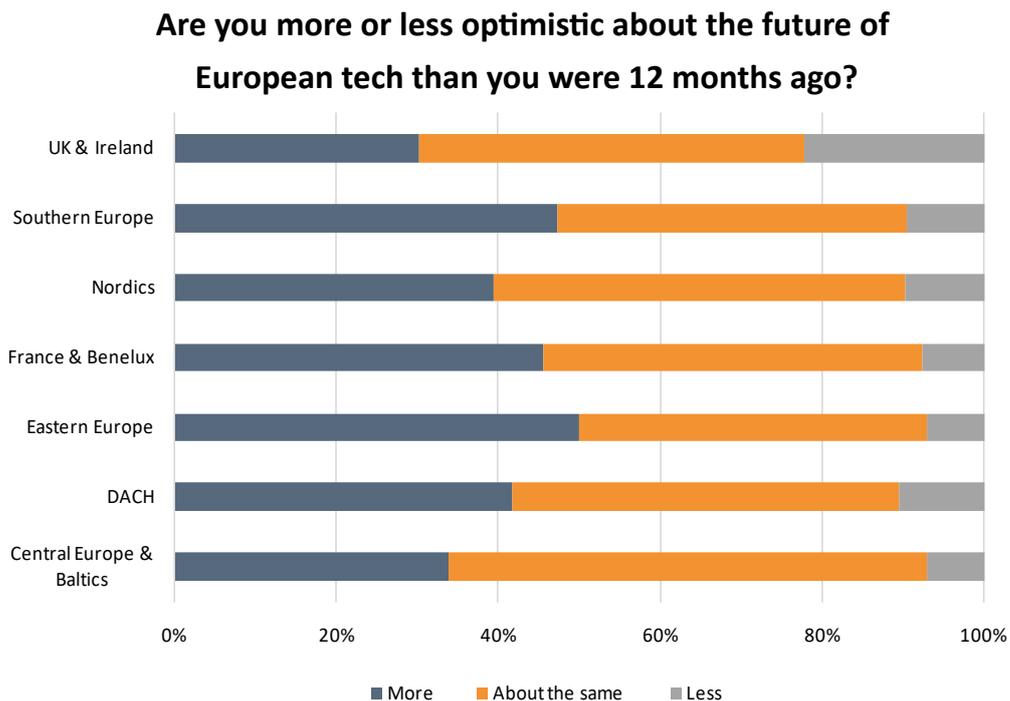


12 The State of European Tec 2018, tech as the motor of European growth, Atomico [2018](#)

Optimism on technology in the D9 also remains high, although it has been slightly dented in the UK and Ireland somewhat because of Brexit.

Throughout our interviews and workshops, participants repeatedly stated that they thought there was a great atmosphere for startups and business creation in Europe. As the surveys from Atomico's comprehensive report on the state of European tech in 2018 show, European founders are generally positive and optimistic about the future.¹³

This is not without reason. In recent years Europe has been home to more tech IPOs than the US, and many regulators – particularly the UK's Financial Conduct Authority – have cultivated exciting ecosystems around regulatory sandboxes.¹⁴



Capital and investment shows an improved landscape...

“On access to finance, things have improved a lot in the last five to ten years, especially at pre-seed stage and there has been a lot of support for angel investors. Once startups with the scaleup stage it is difficult, but lots of companies have started attracting 50 and 80 million dollars.”

2018 was an exciting year for the European tech industry. \$23 billion was invested in the EU tech ecosystem in 2018, up from just \$5 billion in 2013. A long-term increase in investment is also bearing fruit: there were four tech IPOs in 2018 that reached valuations of more than \$5 billion on opening day, including Europe's largest ever venture-backed publicly-listed tech company, Spotify, from Sweden. In total, Europe contributed three of the top 10 largest tech IPOs globally of 2018.¹⁵

Investment has also moved into AI. Billions of dollars have been invested in AI across the continent (the UK and France have received the largest investments).

¹³ The State of European Tech 2018, Atomico, [2018](#)

¹⁴ Europe's stock options muddle is handing America a big advantage, Wired, [November 2018](#)

¹⁵ Dataconomy, What is driving Europe's tech grow? [January 2019](#)

Table 3 – investment in different categories (\$m) of tech¹⁶

Category	2013	2014	2015	2016	2017	2018
Artificial Intelligence	234	582	1086	1382	2306	1965
Internet of Things	62	223	555	837	677	684
Blockchain	45	133	66	171	223	651
Big data	146	317	455	358	516	452
Deep learning	19	31	89	63	196	71
Hardware	408	376	1197	1674	943	1282
Drones	7	3	70	75	29	112
Nanotech	23	13	101	182	49	145
Virtual reality	7	32	160	304	652	244
Search	96	441	458	575	328	299
Robotics	10	35	94	187	243	368

In the last year, company investment in the D9 has increased substantially.

Company Investment in AI in 2018 ¹⁷	Total	Per Capita
Ireland	39	8.1
UK	7262	110
Belgium	110	9.64
Netherlands	43	2.5
Denmark	330	57.9
Sweden	254	25.4
Finland	24	4.36

¹⁶ The State of European Tech 2018, Research and Development, Atomico [2018](#)

¹⁷ Microsoft Ireland, *Artificial Intelligence in Europe: Ireland. Outlook for 2019 and Beyond*, EY 2018

...but where Europe needs to play smart to compete with the US and China

“If you look at how much is being invested in AI, Europe is way behind, obviously different countries have different national goals but as a whole Europe is really lagging behind”

“Of course US and China will be the first in this game, it is really difficult to do something about that”

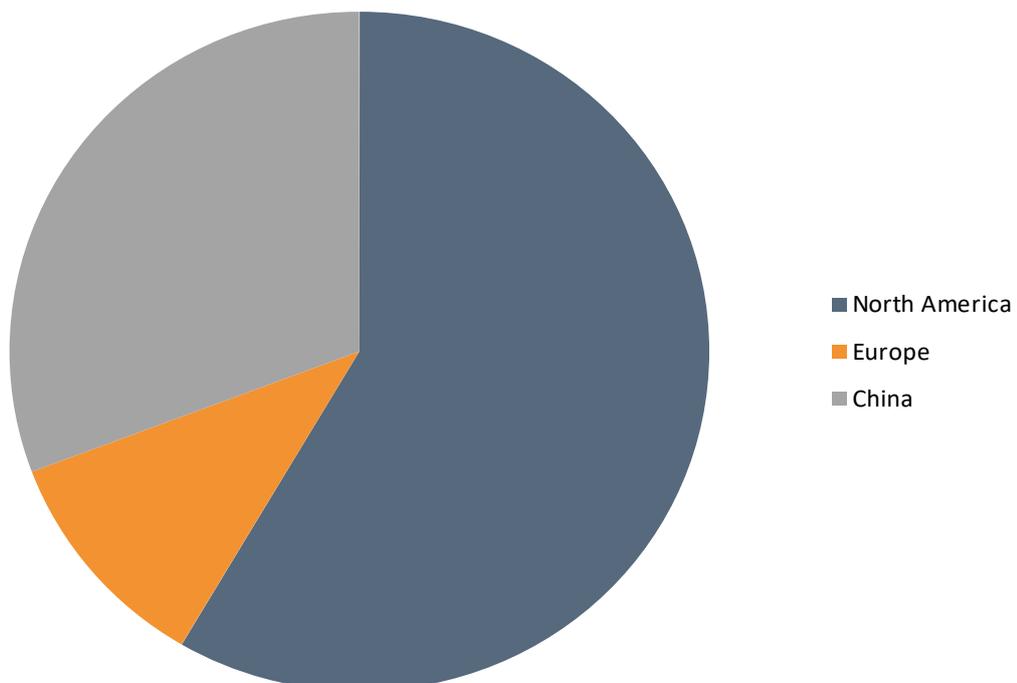
“That doesn’t mean we should be pessimistic...but Europe does need to play smart”

“Something that worries me is that Europe is trying to do too much, Europe is going to lead on investment, Europe is going to lead on adoption in all our sector and we are going to set all the rules. Europe can be successful but not if it spreads itself too thin”

Nevertheless, we cannot pretend that the European landscape is close to that of America or China. In 2016, \$6.67 billion of funds were raised by Europe and UK-based venture firms, compared with \$39.5 billion in the US. Investment in AI in Europe stands at just 18% of the level in the US, and 33% of the Asia’s investment level.

According to the EU Commission, for example, \$38 billion worth of investments were made into AI-specific technologies in North America in 2016. This compares with roughly \$20 billion investment from China, and only \$7 billion from Europe.¹⁸

**Billion \$ invested in AI between the EU,
North America and China in 2016 (McKinsey 2017)**



18 Digital Transformation Monitor, USA-China-EU plans for AI: where do we stand? European Commission, [2018](#)

“There is not enough money available for scaleups. There is an enormous amount of money but the programmes are very scared to apply their money. It results in nice people doing lots of projects and papers on what could be but not concrete action. Why doesn’t the money go to concrete companies?”

In response to this, many European governments have been investing public money to try and grow the investment ecosystems that startups need to scale and become pan-European and global businesses.

There was some scepticism about how effectively the EU and governments were approaching this investment however, particularly when it came to *high risk* early stage investment – where some participants felt bureaucracy trumped innovation.

Table 3: How are D9 governments investing in and regulating AI?

European governments have introduced a raft of measures to try and grow their domestic AI industries. For example:

- Ireland has [launched](#) a national masters programme in AI, defined by industry and delivered through education institutions throughout the country;
- Finland has [opened](#) the Finnish Centre for AI, and formally launched its own AI strategy, the Age of Artificial Intelligence in December 2017;
- Sweden has funded an AI centre and [Vinnova](#), Sweden’s innovation agency, has funded 190 projects over the past 6 years;
- Estonia is setting up an [AI task force](#), aiming to have a general AI liability framework by 2019;
- [Innovation Fund Denmark](#) has provided €20 million as funding for big data, and the Danish government formally announced its AI strategy in March 2019;
- The UK has published an [AI Sector Deal](#) with a wide range of policies including boosting R&D by £300 million;
- The Netherlands [published](#) a roadmap to a National AI Strategy for the Netherlands in November 2018 an ambitious roadmap for public-private collaboration on AI development;
- Digital Luxembourg recently announced a [partnership](#) with NVIDIA, the American AI giant, to bring together academia and across from across Europe in Luxembourg;
- Belgium is the latest D9 nation to [publish](#) a comprehensive AI strategy, building on its highly developed tech industries.

Talent remains Europe's greatest asset...

"We have a very educated and flexible population, and I think we are in a good place to implement AI technologies"

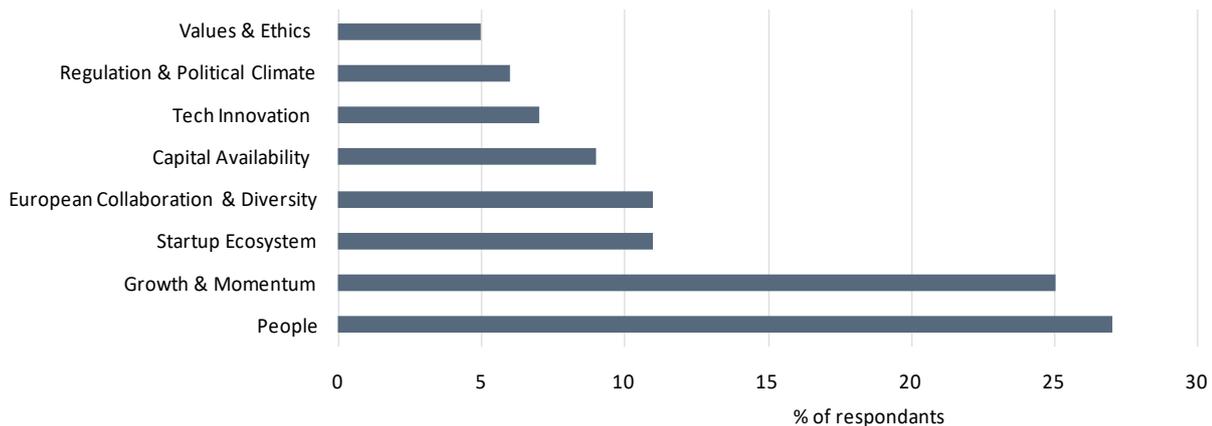
"Our educational infrastructure is good, compared to the US and China"

"Europe has some amazing cities. It is a great place to live [for people coming to work here]"

There was a recognition throughout our workshops that Europe's talent pool is a great strength, with high levels of education and good education infrastructure around Europe. Throughout Europe, at a national and EU level, there is huge interest in ensuring Europeans have the digital skills to thrive in the age of AI.

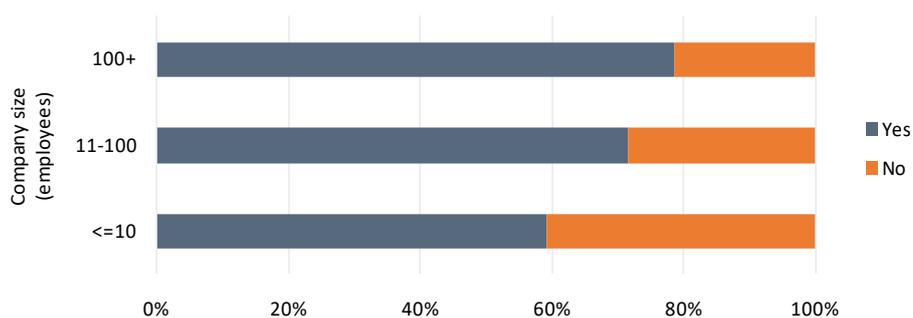
Data from the 2018 State of European Tech Report found high levels of optimism and enthusiasm for the quality of talent and growth in Europe, while there was concern about the political climate and the mood around regulation.

What, if anything, makes you optimistic about the state of the European tech ecosystem?



Talent also flows freely around Europe, which is a huge advantage to businesses. Freedom of Movement within the EU offers developers opportunity across the continent, and it has contributed to significant sharing of ideas between European nations. As the surveys conducted for the State of European Tech Report 2018 found, the vast majority of founders and investors worked closely with people and organisations from hubs other than their own around Europe.

I have interacted positively with investors from other hubs (%)



...but it is hard to hold onto

“Initial AI needs massive amounts of data, skills and education and Europe has really good university and good talent, but we are still struggling to retain some of that talent”

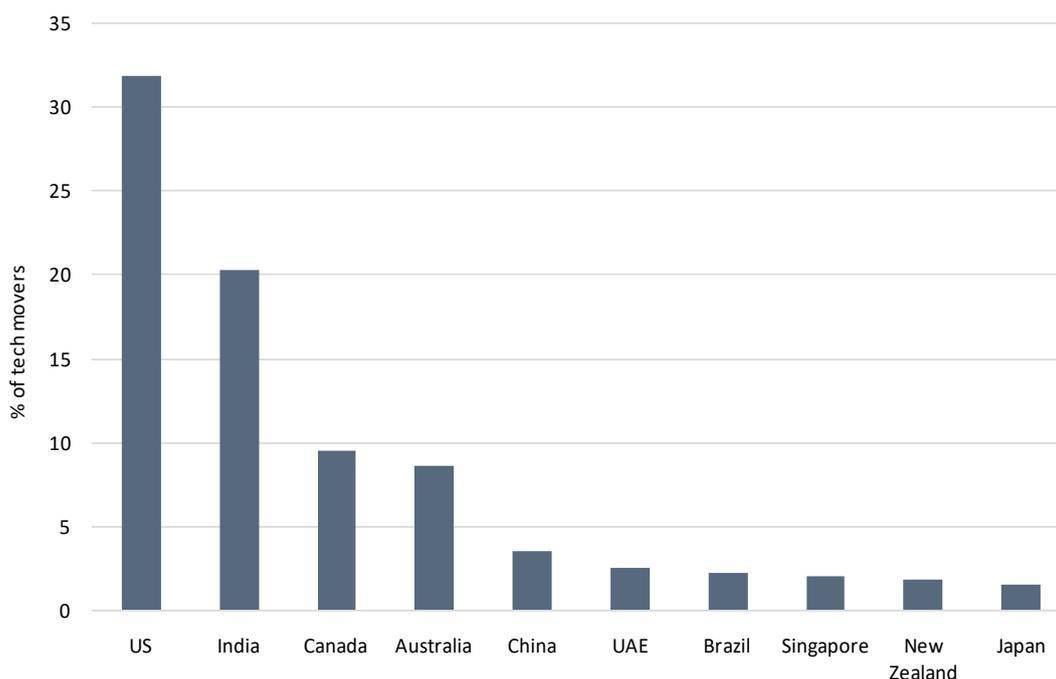
“Keeping these people is linked to the investments. If you have a very vibrant ecosystem with lots of investments then people will stay. It’s about the ecosystem and people are attracted by the ecosystem”

“[Europe lacks] ambition. The optimism in the States changes the world. We should dare to dream and that’s how they attract these stars”

“If you are a small or medium size company in the United States, Silicon Valley would be an obvious place for you to go if you want to take your ideas or inventions further”

As mentioned above, the quality of talent in Europe is one of its abiding strengths, thanks to high quality education and universities. However, recruiting and retaining that talent is proving incredibly difficult, and was the most-cited reason for constraint of business growth by our participants.

Top 10 non-European destinations for European tech moves out of Europe in 2018¹⁹

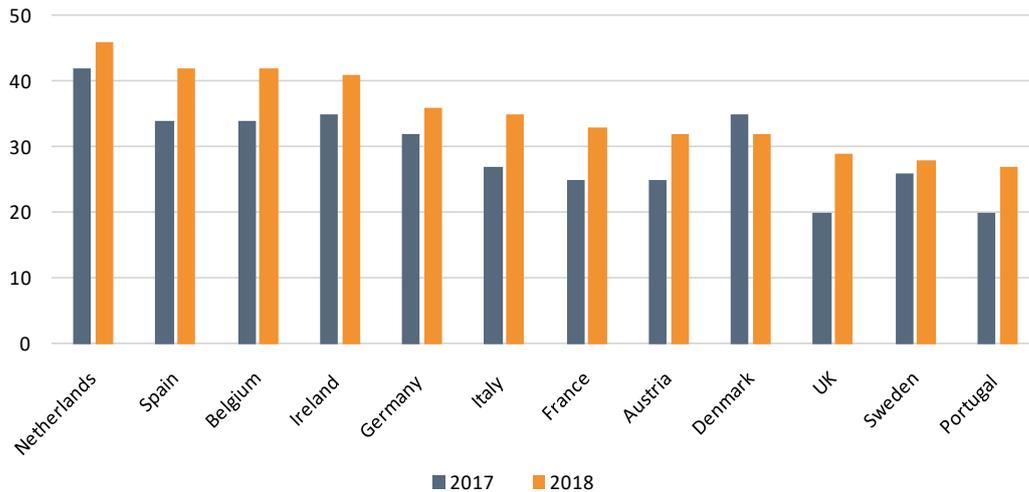


The competition for talent is increasing. In 2018, the UK saw a 42% increase in tech vacancies which are described as ‘hard to fill’, and Denmark was the only leading tech economy in Europe to see this number fall.

According to the State of European Tech survey, 54% of European founders have felt that competition for staff has increased in the previous twelve months, and while Europe continues to be a desirable place to work, the United States and India are proving increasingly attractive to the world’s tech talent. This has made many businesses and policymakers urgently think about how to compensate their staff, and persuade governments in Europe to liberalise their laws and reduce taxes on payment in stock options.

19 State of European Tech Report, Competing for and compensating talent, Atomico [2018](#)

Percentage of software engineer vacancies which are 'hard to fill', change 2017-18²⁰



...is sometimes poorly incentivised

"We are creating products and services that are meant for global audiences so we should have people from across the world making these things"

"Recruiting someone from the US was quite a hassle...particularly trying to bring a spouse. In my country [Denmark] when you're a company of more than 20 people it becomes easier which is totally weird...and we should be able to use equity in the calculation of hiring those people"

"Stock options and making it possible to attract talent when you don't have as much money in the bank as the bigger companies is still one of the most critical issues in my home country"

"The incentives are different in every country, and some incentives are only available to the people that live in a certain country which sometimes limits movement slightly"

AI and tech companies in Europe recognise that they are part of a global competition to attract and hold on to the best staff in the world. In order to do this, they have to be able to offer their staff – both European and from abroad – the right incentives to stay.

While quality of life is important to many, the reality is that AI businesses have to be able to offer their staff the right packages of salary and equity, and participants reported that in many of their countries this has proven difficult.

Stock options have been critical to the success of the US startup ecosystem, creating employee buy-in and offering huge potential gains to staff at innovative companies. According to Allied for Startups, Europe has some of the best *and* some of the worst regulatory environments for stock options, which limits the possibility of pan-European tech companies emerging²¹.

²⁰ Ibid

²¹ Startup policy ideas: The Cluj Recommendations, Allied for Startups [March 2019](#)

...and not adapting to the new age

“The school and university system are not matching up fast enough”

“In [D9 country] we pride ourselves on our programmes, on life-long learning and further education, but we have two big barriers there – first it is difficult for people to understand how to get going and second it is difficult to persuade people to do it (...) even though many people talk about the importance of skills not many people do it because they are comfortable where they are”

“One point where we do have some success is where large companies re-skill their own workers, in order for people to move from one position to another position, but on the whole it is difficult to re-skill people”

“Education should be more practical, robotics stuff like that”

“There is also a massive lack of diversity when it comes to those who are studying these subjects and gaining these skills and it will take years to correct”

Although Europe has high quality schools and universities, many of those we interviewed were critical of a lack of key skills for the age of AI in three dimensions.

First, there is still a gap in how well different school systems are teaching the prerequisite skills (like maths) and tech-specific skills (like coding) for machine learning and AI.

Second, the retraining systems in Europe are highly variable. None have incentives to match those developed by, for example, Singapore, which offers up to 90% subsidy for adult retraining²². There was some praise for some countries’ systems – Denmark was mentioned, as well as initiatives like like [BeCode in Belgium](#), which offer free coding training to unemployed Belgians.

Third, there is continued concern about the lack of diversity of the tech and AI industry, and how this might in turn affect [algorithm bias](#), where AI technologies are being built with inherent biases as a result of being designed and tested by engineers from particular socioeconomic, race, and gender backgrounds.

B. Governments are right to focus on citizen trust

“Is the third way - between US free-rein and China state control - a possibility and an opportunity? Nobody knows whether it can be made to work, but there is an attitude that it has to be made to work”

“For me the D9 countries themselves are a strength, they are digitised, they are open, they are globalised. They are taking a human centric approach which could be good too. The strength is that there is something to build on”

Much has been said about recent regulations like GDPR, which have had huge impacts on the tech industry. The root of these changes are an understandable focus on citizen trust.

This focus was regarded positively by some participants who believed these rules gave their products and their businesses a mark of quality and security that their customers trust.

“We have supported GDPR since it was first proposed in 2012 [...] we have our European values and we want to build these ethical values into the way we build AI products”

However others were concerned that the EU focuses too much on the threats and problems, rather than opportunity and innovation.

“The [D9 country] government is too traditional in focus. The minister thinks of AI too much of a threat rather than an opportunity. A core reason why things are not developing as quickly as they could”

...but the best way to win that trust is to focus on practical benefits

There was a recognition that Europe was beginning to take a lead on the ethics of AI, but many are concerned that Europe was jumping straight to the problems and how to ameliorate them, without first taking advantage of the opportunities.

“There is great fear of dystopian effect of AI, I see a lot of political party developing programmes to constrain the effect of AI on society and people”

“At least in [my D9 country], the ethical discussion around AI is much more present than the discussion about the opportunities and benefits of AI”

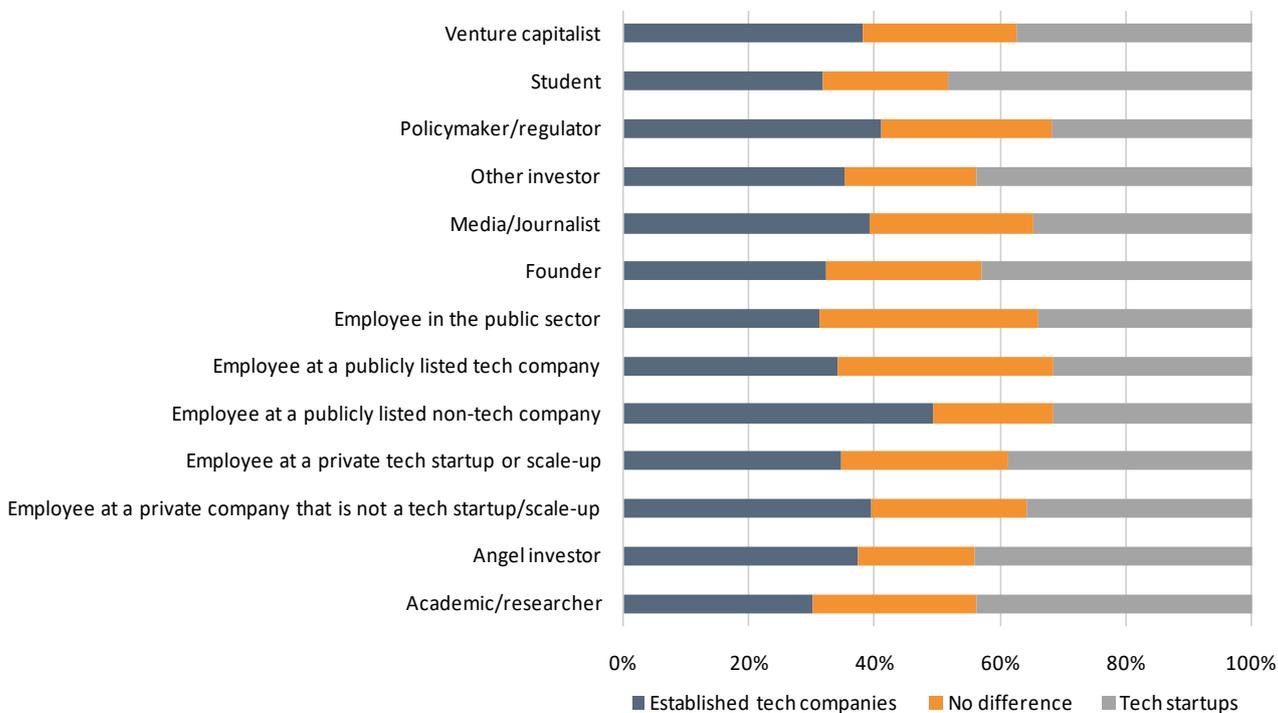
“Don’t neglect the ethical concerns, but flip the question the other way round: AI is a chance an opportunity first, not a threat”

“You need to demystify the story around AI, and take a pragmatic approach. It is not a Frankenstein, it is not a sci-fi movie. It has a culture effect... People think ‘AI is not for me’, when even the smallest companies can use AI. We need to take a pragmatic approach to AI, and then we will see adoption for all citizens”

“In other countries outside of the EU it feels like politicians say ‘how can we make it easier for people to live and make it easier for companies to grow’, but then in Europe it feels like here all the laws are made and the politicians said ‘right this area is covered by law, now is there anyone that could misuse this law in some way, let’s make it more difficult’”

These attitudes were partly borne out in surveys, where a large proportion of respondents felt that new regulations were likely to harm startups and new ventures, instead of regulating the behaviour of the world’s largest tech firms.

Do you think the regulatory burden in Europe is more felt by tech startups or established tech companies?²³



Interestingly, it was investors, startup employees and students – the next generation of startup founders – who were most concerned that small businesses would suffer the most from these regulations²⁴.

Table 4: A D9 ministerial test. How often does your government talk about each of these?

Threats and concerns about AI in Europe

- The use and abuse of personal and private data by international tech firms
- The moral and ethical ramifications of ever-more sophisticated AI and machine learning
- How to tax technology
- Worries about how to bring along older people, the less technologically-aware and the poorest in society with the age of AI
- The threat posed to unskilled and semi-skilled workers from more sophisticated automation in Europe and around the world

Opportunities and benefits from AI in Europe

- The potential for significant growth and innovation in The European economy
- The significant productivity gains which can be gained by AI application
- The huge improvements in quality and efficiency in public services which could benefit citizens and governments alike
- The opportunity for new ideas to emerge from European universities and companies

C. Market harmonisation and size remains a major frustration...

While the Digital Single Market remains a core ambition of the European Union and an asset to the AI industries of the D9, the fragmented nature of markets in reality remains a fundamental weakness of Europe as it develops AI at scale in the future.

Europe's separation of the Digital Single Market and the Single Market fails to realise the way in which digital technologies and the wider economy do not exist in isolation.

The most important recommendation from our previous report was the need to complete the true single market and no longer consider a separate Digital single market. Given the penetration of technology into all sectors this is an increasingly absurd distinction.

*"We have the single market and then the digital single market. For the next four or five years we should connect these two, and think of a **digitised single market** instead of thinking as the digital single market which is something that stands apart from the rest of the economy"*

"[There is] so much room for domestic companies to interpret rules that there is no real single market"

The barriers which exist between different countries in Europe have made it hard to build a truly pan-European market.

...This is true in terms of incentives

"Stock options and making it possible to attract talent when you don't have as much money in the bank as the bigger companies is still one of the most critical issues in my home country"

"The incentives are different in every country, and some incentives are only available to the people that live in a certain country which sometimes limits movement slightly"

"In Sweden they have different VAT depending on the product you buy, in Denmark we don't it is all the same. So, the overarching rules are the same, but the details are different. This is not the case in the US, there they have a very homogenic market – here in the EU it looks like we are one market, but we are not"

As we have already mentioned, many businesses find it difficult to offer their employees the sort of incentives and tax-efficient stock options which can attract global talent and help European nations retain their own people.

In many respects this hits the ambitions of the Single Market and makes its aims harder to achieve, as businesses face all sorts of barriers and different regulations between different European markets.

There are different types of regulations on tax and incentives in European countries, and many European workers feel penalised by the tax system when they cash them in. Index Ventures found that, as a result, startup employees in Europe receive half the amount of stock options relative to their American counterparts.²⁵

²⁵ Europe's stock options muddle in handing America a big advantage, Wired, [November 2018](#)

...and also the public sector – one of Europe’s greatest potential assets for AI and improving lives for citizens

“From our perspective, the focus should be on looking at specific sectors and how AI is used there”

“Europe is definitely lagging in terms of core technology, but Europe is really strong in turning technology into services”

“Access to public sector data [already] works well...with data that is much more structured than in the US”

“We want to see the public sector lead by example on AI adoption”

“What I see from [D9 country] is that they have a long way to go to be more open and have it in their culture. It is a question of the culture in the public sector to have open data. There are a lot of silos and we need another philosophy about data. Just make that data open and we will find what we can do with it!”

But the D9 are already showing a way forward which could be intensified

The large public services of the D9 nations represent huge opportunities for AI in Europe. They are host to vast amounts of historic data which is exactly what machine learning technologies need to develop the best AI in the world. Access to this data is vital, and it offers some of Europe’s greatest strengths.

Some nations in the D9 are powering ahead already. In 2018, [Estonia and Finland announced the completion of both countries’ data exchange systems](#), X-Road and Sumomi.fi, respectively. This makes possible the instant exchange of data Estonia and Finland, and paves the way for significant increases in the use of data by organisations in the two countries.

Barriers still remain however. Many companies have found it difficult to gain access to the sort of public sector data which could contribute to transformational AI application in public services, such as agile, and demand-response public transport.

Chapter 3 – Policy proposals

As described in the previous chapter, our participants want AI policy to reflect:

- A general desire to strengthen the tech and SME ecosystem;
- A deliberate focus on the EU's strengths without attempting to do everything;
- An approach to public trust that is as focused on demonstrating practical benefits as pre-empting concerns.

Perhaps most importantly, the people we interviewed thought the D9 did not need to wait for formal EU policy to demonstrate the benefits that a harmonised multi-state approach could achieve. They see the D9 as the genuine frontrunners and want them to influence EU policy, act domestically *and* work together.

We have outlined below the suggestions that emerged from our workshops and interviews. Not all of these were suggested by every participant – but they do represent responses to the agreed priorities of those we interviewed. All will benefit AI. Many will also support other technological innovation.

A. The frontrunners: how D9 member states can collaborate and propel their public sector

Over the last 25 years, the Single Market has been a key driver of the EU's competitiveness. However the consistent view of our participants both in this process and in the previous work we did for the Estonian D9 meeting was that the Single Market is more complete in theory than reality – and not prepared for a digitised economy.

The view of participants was that initial trust and collaboration both between D9 countries and with other internal stakeholders such as trade unions might be easier and more rapid than across the whole EU – and win public support. By implementing best practice, the D9 could act as 'fast lane' for AI and other digital technologies, acting as trailblazers for the wider single market and showing what a competitive, secure and human-driven data economy looks like. This would also allow the D9 to overcome one of their few potential disadvantages – a lack of scale and size of market and smaller populations (and therefore less data).

The focus of this should be the **public sector** which is close to 50% of GDP on average across Europe and which is one of the EU and the D9's great strengths. **Governments can be a role model**, by examining how AI can improve their own operations, and building the AI talent and expertise which will be of benefit to the economy and society as a whole. Opening up the public sector to innovation will not only propel AI but demonstrate clear benefits to citizens.

Estonia and Finland: a model of high-tech collaboration

Estonia and Finland are leaders in digital government. Estonia's secure digital government platform, X-Road was established in 2001 to enable the seamless flow of data between citizens, public services and businesses.

In 2016 Estonia and Finland announced the [unification](#) of X-Road with Suomfi.fi, Finland's own digital network to allow the seamless flow of information between them. The unification was completed in 2018.

Other countries within the D9 have also collaborated – for example the recent [agreement](#) by Benelux to collaborate on the development of blockchain technology.

Recommendation 1: replicate each others' work on automating government processes and opening up public sector datasets

"[D9 country] is fantastic. They are always asking 'What more can we do?'"

"[D9 country] is too complacent. There's no sense of urgency...always just another roundtable"

Participants' views on the different attitudes of different D9 countries on data and public sector action

"In some of the D9 countries we have good basic registers that are being utilised, so that gives us good building blocks"

"We are not seeing enough sharing of data and especially not enough sharing between public and private sectors"

The European Digital Forum policy dashboard shows varied progress among D9 states in making public sector data public. For instance three D9 countries are yet to fully implement the 2013 public sector information directive which encourages states to 'make as much information available for re-use as possible'.

The D9 should create a common list of:

- **Processes that have been successfully automated for citizens** (for example passport applications or medical visits)
- **Datasets and characteristics that have been made open to new companies**

Each D9 country should then aim to replicate the work of other states to learn from each other, and report on progress at D9 meetings.

D9 states should also commit to full implementation of the public sector information directive²⁶ as soon as is practically possible, starting with prohibition on their public sectors granting exclusivity rights.

Recommendation 2: create common commitments to open data and move to data interoperability between nations

"Maybe the D9 could play a role when it comes to data standards and opening up closed systems, and agree on standards for representing data or making data available"

"In some of the D9 countries we have good basic registers that are being utilised, so that gives us good building blocks"

"We are not seeing enough sharing of data and especially not enough sharing between public and private sectors"

26 European legislation on the re-use of public sector information, [European Commission](#)

D9 countries could **agree on a series of open data standards**, in alignment with the specific needs of different sectors. Many member states already do this – although sporadically and across different areas – on a national basis. For example the UK Government Digital Service selects open standards for use in government technology including standards on cyber threat intelligence systems; job openings in the public sector; and country codes and language tags²⁷. Opened up location data that allowed – for example – BlindSquare²⁸ to support the movement of blind people in Helsinki - could be made common across D9 countries. Where possible they should adopt **existing international standards**, which can be overseen by sector-specific regulators, such as the European Banking Authority for finance and fintech.

Agreeing these across borders will support innovation and scale, and also support a move to make **data interoperability across borders**. For example, this would support the ability of pharmaceutical companies to do more complex trials with real world data and machine learning that would – in turn – allow us greater insight into what medicines are working for people in different population segments. A current disadvantage for innovation in health systems in the D9 – the relatively small size of populations – would be removed.

The D9 could take this further and create explicit **data trusts** from shared datasets which have GDPR and other protections built in, explicitly recognising that it is not just the quantity of data which matters but the quality.

Recommendation 3: develop agreements for the GDPR-compliant movement of data – including personal data in specific areas – across national borders

“It is not a matter of the technical data availability, but instead a matter of legal barriers for data availability”

There have been major shifts in EU policy around the movement of data which means that localised servers are no longer a major burden for companies in Europe. For understandable reasons this has not been applied to personal data. However, many of the greatest benefits to citizens from AI will come from areas like health where personal data – anonymised and delivered through APIs – are essential. Given the relatively high level of comfort D9 citizens will have with neighbouring states **trial agreements in this area should be pursued**.

Recommendation 4: work together to deliver 5G across states

“In the long-run infrastructure is the most important policy area”

“5G is very important for AI, but nobody wants it because people are happy with their 4G”

It is difficult to convince the public of the need for 5G at present as its applications are not immediately obvious to the average member of the public. Why would people need faster internet than they already have when we can already stream ultra-HD Netflix, load web pages instantly, etc?

Our participants however thought this was crucial to the success of AI in Europe. **Shared programmes will help bring down costs and make the investment more acceptable to the public.**

²⁷ Open Standards Principles, UK Government, [2018](#)

²⁸ BlindSquare, [2015](#)

Recommendation 5: there should be a shared approach to identify where regulation can be simplified and clarified

“If there is anything we can do in our countries, compared to France that has even more legislation than us, we can make legislation easier and simplify it. In Denmark we have ideals for better regulation not more regulation – and that is probably something that we could use across the D9 countries”

A problem identified in every workshop was the differing interpretations of EU regulations by different domestic governments. While this is not a problem unique to the tech sector, it is a major disadvantage when one considers how much easier it is to, for example, move data across state lines in the United States. There was frustration that products can be brought to market much more quickly in the United States.

Differing standards have made it harder for companies to operate across borders and grow. But this is not just a problem between D9 states and other EU members - there are problems moving data between D9 states.

This could be implemented through the following proposals:

1. D9 countries should, as best as practically possible, **work together to come to a common interpretation of regulations and directives** to facilitate cross-border trade amongst members. This could effectively create a more integrated digital single market for D9 states and set an example for other EU member states to follow.
2. **A D9-level forum** could be established in which member states and businesses can share their issues with each others’ legal and regulatory systems to raise awareness of the problems.
3. A second, less formal option would be a **commitment amongst members to avoid ‘gold-plating’ of regulations and directives** to keep compliance and administrative costs as low as is reasonably possible.
4. **The D9 could also create a common regulatory sandbox for specific applications of AI.** These would appreciate the varying AI requirements of different sectors, such as music streaming or medical technology, and regulate accordingly.

Recommendation 6: work together to identify hubs of AI excellence and develop the D9 and European ecosystem

“If you are a small or medium size company in the United States, Silicon Valley would be an obvious place for you to go if you want to take your ideas or inventions further, but there are no obvious places to go in Europe”

“I don’t think the big progress on AI would come from small startup because they don’t have the money, the progress will come from research institutes at universities and big companies (...) I would suggest a deduction on taxes in order to incentivise big companies”

One of the challenges named by participants was that every country in the EU wanted to be the centre of AI and it was very difficult to build concentration and therefore the positive externalities we know arise from hubs.

The D9 could work together to **identify key priority areas – including areas of AI growth – and work to invest and prioritise the development of those areas in particular cities, including with research funding; piloting; and tax incentives.** These sectors could include **healthcare, clean energy, manufacturing, transport and logistics, and agriculture.**

Recommendation 7: the D9 can lead the way on liberalising public sector procurement

“What we would like to see is the public sector lead by example on AI. This will help demystify AI to the main-stream economy, and encourage adoption by more companies and citizens”

The large size of the public sector in Europe can, and should, be used to the advantage of the AI industries. Public procurement contracts across European borders are increasing in value, but many innovative businesses are unable to bid for public funds due to a range of regulations.

Many organisations in our coalition noted the importance of public procurement to support the AI sector grow in Europe, particularly when there is a shortfall of venture capital money. [The Cluj Recommendations](#), recently published by Allied for Startups, argue that not enough is being done to open up public procurement to startups and small businesses with innovative ideas.

So far only a few Member States in Europe have set up targets for offering public contracts to innovative solutions and high-tech startups²⁹. Policies should be enacted at both the D9 and EU-level to remedy this. Therefore, we recommend **clarifying the role of the public sector in venture capital, to kickstart specific markets where there is not enough private capital to help AI solutions scale.**

At the EU level, we suggest a review of the public procurement directive to **make it a strategic tool for modernising public services, but promoting shorter-term, open, and transparent contracts with a specific remit to promote innovation.**

These contracts should be offered without prohibitive conditions against small businesses, and offer intellectual property rights to the innovators themselves. This will offer the right incentives to AI startups and scaleups to bid for public contracts, while offering governments and taxpayers high quality solutions in public services.

B. A renewed focus on skills systems and how they need to adapt

If AI is to be a truly inclusive technology, creating greater prosperity for all, it is essential that we improve our system of education and training – ensuring that workers can gain the skills they need to be take full advantage of the productivity enhancements from automation. As AI increasingly replaces old forms of routine and predictable work, new types of skills are likely to become important.

Recommendation 8: the EU or D9 should establish a What Works centre to synthesise and commission evidence

“We have so many programmes [in skills]”

“The EU could recognise best practices and certify those...then channel funding and direct funding in order to increase skills in the EU”

Participants have expressed considerable frustration that across the EU, there are hundreds of different skills programmes and little evidence of their relative efficacy. If member states are to remain globally competitive it is vital that they do not repeat each others’ mistakes and waste resources on ineffective programmes.

The D9 should therefore establish a ‘what works’ centre to establish what the most effective programmes are and focus funding there. **The centre would have two parts to its remit:**

1. **Synthesizing high quality evidence on effectiveness in training at school; post-compulsory education; and crucially adult retraining;**
2. **Fund challenges, additional research, and practical projects to learn how retraining can be done most effectively.**

Recommendation 9: the EU or D9 should make it easier to recognise people’s training outside university

“One point where we do have some success is where large companies re-skill their own workers, in order for people to move from one position to another position, but on the whole it is difficult to re-skill people or for them to move”

The EU or D9 could work to improve the mutual recognition of different technical qualifications. While university level qualifications such as a BA or PhD are generally transferable, this is not always true for lower level qualifications such as diplomas and certifications – reducing the flexibility and power of the wider European labour market³⁰.

As adults retrain – often at sub-degree or qualification level – this will become an increasing barrier to labour mobility and mean people are stuck in particular companies. Mutual recognition of examinations and skills would make a major difference to technical workers.

30 Recognition of academic diplomas, European Union, [2019](#)

Recommendation 10: the EU or D9 should change the incentives for retraining

“We really need to do something about the attitude that people have and take it from ‘when you finish school you are done and now you will make money’ to ‘okay we need to keep educating ourselves to keep up’”

One concern was that people did not see the need to retrain yet, and by the time AI really embedded it would be too late. Incentives to retrain – as for example have been extensively used in Singapore – were suggested. There are a number of options:

1. Subsidy of adult retraining in core subjects such as STEM;
2. Subsidy of adult retraining in industries which are highly vulnerable to AI;
3. Incentives for individuals such as:
 - a. The ability to draw down from retirement savings to fund adult retraining;
 - b. The introduction of lifetime education accounts;
 - c. The ability to enrol for 2 or 3 year degrees and ‘defer’ the final year of training; for later in life, with an active encouragement to universities and other educational institutions to develop shorter degrees and later courses.

Recommendation 11: incentivise retraining in ‘soft’ tech skills

“A lot of the focus is on the STEM skills, but the softer skills and managerial skills to make people job ready are also important. In [D9 countries] we have found that there is a productivity gap between SMEs and larger companies that you can contribute to not having the managerial skills necessary”

One of the consistent views of the participants was that while STEM skills were crucial for the adoption of AI, so were managerial skills. A number of proposals were made including:

1. Incentivising universities to develop deeper company partnerships and ‘sandwich’ courses with experience in industry;
2. Flexing current training budgets (such as apprenticeship levies) to cover more managerial training.

Recommendation 12: A new push on diversity

“We need a more diverse workforce”

Lack of diversity in tech stems from two issues. The first are general challenges in the labour market in terms of women’s careers and those from ethnic minorities. The second are specific problems in terms of the graduate pipeline for tech careers.

On the first, evidence from D9 countries increasingly shows that the biggest barriers for women’s careers occur once they have children. Countries should therefore **look to invest in returner schemes and incentivise flexible working in companies to support women’s career progression. Public procurement schemes for companies over a certain size could be tied to conditions in this area.**

The EU should also fund **increasing numbers of scholarships and bursary programmes for under-represented groups to study shortage tech degrees and courses.**

The EU could also consider common soft reporting requirements – such as gender pay gap reporting – to encourage companies to prioritise diversity in their workforce.

Recommendation 13: educate citizens in AI

There was a strong view that until policy makers, legislators, and the general public understood AI we would never successfully adopt AI. The Finnish programme was praised and recommended for adoption more widely.

“I like the Open University course on AI in Finland idea, I find that really interesting and I find that it looks like a great way to build knowledge and understanding about AI”

The EU or D9 could seek to use the Open University course as a model and build on it for a universal MOOC that citizens and policy makers could use to understand AI and its impact. This has been implemented in Finland to great success, where the University of Helsinki and tech firm Reaktor developed a free online course to teach Finns the basics in AI in May 2018. By September nearly 90,000 people had taken the course, nearly double the target number, and it is proving popular in the UK, Germany, the US and Brazil.³¹

31 Finland is challenging the entire world to understand AI by offering a completely free online course - initiative got 1 % of the Finnish population to study the basics, University of Helsinki, [September 2018](#)

C. A magnet for talent

Many participants noted with sadness that many of their most talented people were in Silicon Valley. To succeed in AI, those people – and others from around the world – need to be attracted back into Europe. One proposal was an explicit campaign to get those people to return.

However in order for that to work more harmonisation was needed to make it easy for people to move into startups in Europe.

Recommendation 14: Supporting people taking a high risk move into startups by allowing them to keep employment rights for a fixed period

“Something that often isn’t clarified is what happens if a startup fails – if people have moved to another country for the startup – are they able to stay and do they have a period where they can look for another job? This is really unclear”

Startups often fail, but they are also where the most innovative ideas emerge. Participants were concerned that the most talented people were deterred from startups because they could get stranded – having moved their families – if the startup failed.

For example, states could offer a **12-month period where those who worked for startups who meet certain qualifications could look for a new job before having to give up their visa (similar to many student visas).**

Recommendation 15: make rules around startup visas consistent and favourable

“We need not just founders but founder teams”

One of the areas where Europe could develop a comparative advantage against the US is in visas. While Silicon Valley remains a draw, US H-1B visas are difficult to get, designed for employees rather than founders of companies and viewed with scepticism by the current administration.

For Europe, the need for non-EU talent can be acute. First, there is a world wide shortage of machine learning experts. Second because there have been relatively few breakout successes in Europe, the talent pool with growth stage expertise is limited.

Half of EU Member States have a version of a Startup Visa but there is not one harmonised approach for Europe, which limits the mobility of founders and entrepreneurs when working across the EU.

Allied for Startups has proposed that existing startup and entrepreneurial visas be collected in one European portal and have their success be measured, and the best-working elements shall inform an **EU Startup Visa for the Schengen Zone.**

A startup visa example

The UK has introduced a 'startup visa' for non-EEA citizens who want to start a business in the UK.

Applicants must receive an endorsement from a body approved by the Home Office (in practice, universities and industry bodies) and be able to demonstrate that they have sufficient personal savings to support themselves. In practice, this means having £945 in a bank account for 90 consecutive days. Successful applicants have no recourse to public funds. Visas are valid for three years.

Endorsing bodies judge an applicant's business venture on three criteria:

Innovation – The business must be original and meet market needs

Viability – The applicant must demonstrate that they have or are developing the skills necessary to run the business

Scalability – The applicant must demonstrate the potential for growth and job creation

D9 countries could **also recognise visas such as those issued by other D9 states to allow entrepreneurs to move between countries, establish subsidiaries and bring products and services to market more easily.**

Finally startup visas should apply **to the crucial first members of a team – including for example the CTO and CMO** – who are crucial to the success of companies and often in very short supply.

Recommendation 16: Make it easier for startups to offer stock and other non-monetary forms of compensation in a tax-efficient manner

"Startups need to be able to attract people and they don't have the big bucks"

One area raised was the ability for startups to use stock and other non-monetary compensation in a tax-efficient manner across EU states. This was regarded as crucial to the success of new startups in Europe and an area where we lagged behind the US.

This has been intensively examined by Index Ventures, one of our participants, who have found it a major challenge for the startups they invest in across Europe.

They have also found that while some D9 countries such as Estonia score highly in their treatment of options others such as Finland, Denmark and the Netherlands score quite poorly. It is acknowledged that taxation is a national competence and a matter of subsidiarity across the EU. The D9 countries should study and share best practice in the area of stock options. Countries could then choose to move towards this best practice model.

D. Making the EU AI-ready

Many of our proposals are designed to fast-track developments we would like to see across the entire EU. However there are two specific recommendations that have been made by other organisations that are essential in preventing AI from moving backwards.

Recommendation 17: The EU should do an “AI refit” of existing proposals and legislation to ensure no adverse effects

“I wish the process was a bit more agile”

A common issue in all our work with the D9 is a desire to see a more agile and adaptive process for EU policy – particularly for startups and scaleups who often lack the resources to notice issues the first time round. For AI, there should be a consistent review and refit of existing legislation to remove barriers. This would, as mentioned in Recommendation 5 above, take into account the various AI needs of different sectors.

Recommendation 18: the D9 and EU should adopt the principle of de minimus exceptions for small companies

Contrasting views of GDPR

“For us it’s been a strength...it allows us to say ‘we follow the gold standard’”

“It’s been very expensive”

The attitude to some EU regulation – such as GDPR – was markedly different between larger more successful companies and startups. The latter saw much higher burdens whereas for some larger companies it was an advantage having the ‘gold standard’ in regulation across the world.

One possibility is to have a more consistent de minimus exception for SMEs from regulation. This does create cliff-edges but enhances the ability of small companies to manage costs and regulatory burdens.

E. What's next for the D9?

The D9 nations can play an important role in shaping the digital agenda in the European Union. These proposals suggest two complementary courses of action. The D9 nations can combine their diplomatic and economic clout to shape the political agenda in Europe, and use their positions in traditional channels to affect the sort of policy change and desired outcomes we have outlined above.

But the D9 nations can also forge ahead with the policies proposed here. Instead of lobbying for policy change at the highest level, they can demonstrate how effective these policies can be in practice, and encourage other nations to join them.

Appendix – the different approaches to AI strategies in the D9 and globally

A. Global comparators

Country	What is the country doing?	What themes are they focusing on?	Main focus/theme
Australia	Australia does not have a AI strategy yet, but the government has announced a four-year AU\$29.9 million investment to support AI development.	The government is planning to create a Technology Roadmap, a Standards Framework, and a national AI Ethics Framework for responsible development of AI. The government will also invest in Cooperative Research Centre projects, PhD scholarships, and further initiatives that will increase the supply of AI talent in Australia	Standards, ethics, research and talent
Canada	Canada's \$125 million Pan-Canadian Artificial Intelligence Strategy was announced in the 2017 federal budget.	The Strategy has four major goals: 1) increase number of IA researchers and skilled graduates 2) establish interconnected nodes of science excellence in the three major centres for AI 3) develop global leadership on legal, policy, ethical and economic implications of AI 4) support the national research community on AI	Research and talent
China	China's announced its A Next Generation Artificial Intelligence Development Plan in 2017. Since then, the government has also release its Three-Year Action Plan to Promote the Development of the New Generation Artificial Intelligence Industry .	The Chinese Strategy is the most comprehensive with initiatives for research and development, industrialisation, talent development, education and skills, standard setting and regulations, ethical norms, and security. The three-year action plan focuses on four major tasks - developing intelligent products, emphasising development of AI's support systems, encouraging intelligent manufacturing and investing in training resources, standard testing and cybersecurity. Additionally, the government is also developing research through partnerships with national tech companies	Manufacturing AI products and support systems as well as skills training

France	France has announced a €1.5 billion plan to make France a global leader in Ai research, training and industry in its French Strategy For Artificial Intelligence .	The plan has four main priorities: 1) strengthen France's AI ecosystem and attract international talent 2) develop an open data policy to encourage adoption and application 3) create a regulatory and financial framework 4) create regulations for ethics	Research, talent, open data, ethical regulations; potential for AI in healthcare and transportation
Germany	Germany adopted its Artificial Intelligence Strategy in November 2018 and in 2019 the government allocated €500 million to the strategy.	The Strategy has three major objectives : 1) making Germany and Europe a global leader on development and use of AI 2) making sure AI serves the good of society 3) integrating AI in society in ethical, legal, cultural and institutional terms	Research and development
India	India's National AI Strategy is unique in the sense that it focuses not only on economic growth but also on social inclusion	The government's strategy has has three main aims: 1) empower and enhance skills to find quality jobs 2) invest in research 3) scale Indian-made AI solutions to the rest of the developing world	Skills and talent, research and domestic AI solutions
Italy	Italy released its White Paper called Artificial Intelligence: At The Service of Citizens in March 2018	The government's strategy focuses on how the government can facilitate the adoption of AI in public administration and government services	Public sector adoption
Japan	Japan published its Artificial Intelligence Technology Strategy in March 2017	The Strategy includes a Industrialisation Road map and sets out the development of AI in three phases: 1) utilisation and application of data-driven Ai 2) public use f AI 3) creation of ecosystems These three phases will priorities three areas - productivity, health and mobility and the strategy will be realised by policies of new investment in research and development, talent, public data and startups	Research, skills and talent, public data and investment in startups
United States	The United States does not have a coordinated national strategy, however in May 2018 the government's goals were outlined during a White House Summit on AI	The US government has four main goals when it comes to AI: 1) maintain American leadership in the AI sector 2) support American workers 3) promote public research and development, particularly in defence technology 4) remove barriers to innovation	Barrier removal, research and development

D9 Country	What is the country doing?	What themes are they focusing on?	Main focus/theme
Denmark	Denmark released its Strategy for Denmark's Digital Growth in January 2018. DKK 75 million was allocated in 2018, followed by DKK 125 million ever year until 2025.	The Strategy focuses on for key areas and contains 38 initiatives to achieve these. Key areas are: 1) responsible foundation for AI 2) access to more data 3) strong competences and new knowledge 4) increased investments Major initiatives include: creating digital hubs, digital support to SMEs and fostering data skills	Development, skills and talent, open government data
Finland	Finland has so far released two reports on how the country can become one of the world's top countries at the application of AI. The first Finland's Age of Artificial Intelligence and the second Work in the Age of Artificial Intelligence , was both prepared by an appointed steering group and included many policy recommendations.	The first report recommends key initiatives such as the Finnish Centre for AI to foster research and talent, an AI accelerator pilot program and public service integration. The second report looks as the future of work and especially four aspects: growth and employment, labour market, learning and skills and ethics	Research, skills and talent, public sector adoption, ethics
Sweden	Sweden released its strategy in May 2018 entitled National Approach for Artificial Intelligence , the strategy is a guiding document rather than a policy document and outlines strategies priorities for AI in Sweden.	The main goal of the Strategy is for Sweden to lead in the realisation of AI benefits for competitiveness and welfare. To do this Sweden will: 1) train more skilled professionals 2) increase research (basic and applied) 3) develop legal framework	Skills and talent, research and regulations with focus on ethics
Estonia	Estonia is one of the front-runners when it comes to digitalisation and e-governance, however the country is yet to release a AI Strategy.	The Government is currently developing a AI Strategy, as well as a legal framework around AI liability. The end goal is a broad use of AI systems	Continued investment and invitatives, regulations with focus in liability
The Netherlands	The Netherlands does not yet have a AI Strategy, however the public-private partnership AINED released a report outlining the first steps for a Dutch AI Strategy in November 2018.	There are many ongoing AI invitatives in the Netherlands, especially in the the business community and in academia. However, the report aims to find a way to make these less fragmented and find key priority areas. The report highlights retention of talent and skills as one major area to priorities	Talent and skills

Belgium	Belgium launched its AI strategy in March 2019. The government also launched Digital Belgium to streamline AI development, and create 1000 new AI startups and 50000 new jobs related to AI	Digital Belgium includes the following key policies: 1) A 30-45% reduced investment tax for companies under four years old 2) A commitment to 50% of household connections up to 1 Gbps 3) €18 million invested in the Digital Belgium Skills fund financing projects to enhance digital skills of socially vulnerable children, and the building of a new digital skills training centre 4) Government G-cloud which collects private sector data and makes it available for use in new applications and technologies (also includes statute on open data)	Startups, skills and training
Luxembourg	Similarly to Belgium, Luxembourg does not yet have a AI Strategy. However the government has launched Digital Luxembourg	Digital Luxembourg's overall goal is provide the country with an excellent environment for the development of artificial intelligence and machine learning technologies. Digital Luxembourg focus digitalisation and modernisation in five key areas: government, skills, policy, infrastructure and ecosystem. The most current AI initiative was the creation of a joint AI laboratory by the government and NVIDIA.	Research and skills
Ireland	Ireland identifies itself as the AI Island . The country does not have a concrete AI Strategy yet, but the government has hosted workshops and announced a national AI Master program. The Irish Government has committed to the delivery of a national AI strategy in Q3, 2019.	The AI Master program is defined by industry and delivered through education institutions throughout the country. The Masters programme came out of an organised workshop including industry, academia, trade unions, the military and civil society. €3.5 million was invested into the course. Private-University partnerships include Samsung invested €4 million into AI research at University College Dublin, and Huawei announced a partnership with Trinity College)	Skills and talent, research
United Kingdom	The UK released its AI Sector Deal in April 2018. The deal is part of the UK's larger Industrial Strategy and its goal is to make the UK a global leader in AI.	The Deal is comprehensive and includes the following: 1) investment in research and development 2) investment in skills and talent 3) improving digital infrastructure 4) ensure the UK leads on data ethics	Research and development, skills and talent, ethics

These strategies are broad and varied in their approach, fitting the different priorities of each nation. However, there are some common themes to be found. While China is driving full throttle on application of AI and commercialisation of research, many western and D9 nations are putting a heavy focus on skills and talent, in terms of training and reskilling their current and future workforce, and thinking of new ways to attract the world's AI talent.

B. The D9 Approach

Benelux

- [Benelux Association for Artificial Intelligence](#) (BNVKI): coordinating association comprised of universities and institutes in Belgium, the Netherlands and Luxembourg. Their mission is to bring together academics and industry contacts. The BNVKI organises the Benelux Artificial Intelligence Conference (BNAIC) every year and encourages academic funding bodies to fund AI research.
- The Belgian government, appointing Deputy Prime-Minister Alexander de Croo as Minister for the digital agenda, launched 'Digital Belgium' with the goal to have 1000 new AI startups and 50000 new jobs related to AI. The initiative is aimed at streamlining efforts towards AI but has not been allocated a specific government budget. Policies include:
 - A [30-45% reduced investment tax](#) for companies under four years old;
 - A [commitment](#) to 50% of household connections up to 1 Gbps;
 - [€18 million invested](#) in the Digital Belgium Skills fund financing projects to enhance digital skills of socially vulnerable children, and the building of a new digital skills training center;
 - [Government G-cloud](#) which collects private sector data and makes it available for use in new applications and technologies (also includes statute on open data).
- In [collaboration](#) with the ICT Research Platform Netherlands, the BNVKI created a special interest group on AI, comprising of researchers who are now putting together a National AI Manifesto on socially aware, explainable, and responsible AI.

Denmark

- [Innovation Fund Denmark](#) has provided €20 million as funding for big data.
- In 2018 the Danish government allocated €75 million into its [digital growth strategy](#), and pledged an additional €125 million each year until 2025, this includes funding for the Digital Hub Denmark (cluster for digital technologies), SME:Digital supporting digital transformation of SMEs, and the Technology Pact meant to invest in digital skills.

Estonia

- Estonia started to think about AI when it began considering how it could integrate autonomous vehicles into the ecosystem. As Estonia started to allow [test driving](#) for such vehicles (from 2 March 2017), it concluded that instead of focusing on traffic laws it would be better to focus on a more general plan of AI laws, legal systems, systems of liability, accountability, data integrity and ethics.
- Estonia is taking a holistic [cross-sector approach](#) concerning legal matters and AI in order to have fewer and simpler laws facilitating the end-user's engagement with these systems. Estonia intends to co-author these laws together with the wider society, including ethical and legal experts. In September 2017, it started a public debate and consultation asking how the liability issues related to AI and AI-based systems could be addressed and resolved.
- Estonia is setting up an [AI task force](#), aiming to have a general AI liability framework by 2019. By establishing a comprehensive liability framework and enabling the use of a variety of AI systems, Estonia hopes to attract new investors to the country.
- They are currently running a [pilot](#) that tests data integrity and cybersecurity of self-driving vehicles and internet of things devices.
- In 2016 Estonia [digitised all healthcare data](#) of its citizens creating the e-patient portal. Once legal issues concerning AI have been cleared, they will attempt to use AI in healthcare provision.

Finland

- Opened the [Finnish Centre for AI](#) following recommendations from the government steering group meant to examine how Finland can lead in AI technology which is to release its final report in April 2019. The Centre aims to increase AI talent, research, and industry collaboration. The steering group has released two interim reports with policy recommendations, including that which led to the creation of an AI accelerator pilot program, and the incorporation of AI in the public service.
- Finland announced the [unification](#) of its digital government platform, Suomi.fi with Estonia's X-Road in 2018, establishing a new age of digital relations between the two nations. This will enable the secure sharing of digital information, ranging from healthcare to taxation, between the countries, after many years of close cooperation.

Ireland

- [Announced](#) a national masters programme in AI in January 2018, defined by industry and delivered through education institutions throughout the country. The Masters programme came out of an organised workshop including industry, academia, trade unions, the military and civil society. €3.5 million was invested into the course. Private-University partnerships include Samsung invested €4 million into AI research at University College Dublin, and Huawei announced a partnership with Trinity College).
- [Tech Ireland](#) tracked €580 million in 2017 spent by venture capital firms on AI companies, of which €256 million was directly spent on AI and related technologies. Very private sector focused, but government has released the Island AI Strategy.
- Ireland is also a leader in access to [open data](#).

Sweden

- Sweden released the [National Approach for AI](#) in April 2018, which does not contain specific policy but what is supposed to be a guiding document for all actors in Sweden to align towards. The document also includes the government's approach and its subsequent aspirations for AI, which include closer work with the EU, the development of set standards, rules, norms, and ethical principles to pursue ethical and sustainable use of AI, as well as a need to oversee the digital infrastructure required for/with AI.
- The government has funded an [AI Centre](#) with an initial turnover of SEK 50 million (approx. €4.9 million) per year in R&D, over 4 startups, more than 50 experts, and around 30 active industrial collaborations (e.g. Nokia, Ericsson, ABB, and H&M).
- [The Wallenberg AI, Autonomous Systems and Software Program](#) (WASP) is a ten-year research programme, sponsored by a private foundation with more than €300 million in funding. It is developing a recruitment programme with internationally competitive offers, has created industrial PhDs, and is currently hosting 120 PhD students, with 50 PhD students being employed by industry. The programme was extended in 2017 with more than €100 million for AI, and is led by Professor Danica Kragic.
- Vinnova funded [AIDA](#): Analytic Imaging Diagnostics Arena, to use AI for better clinical routines in medical data imaging. Skelleftea municipality also invested in, and collaborated with startupNoomi to create a self-taught e-health system for the elderly, which monitors movement, medication, and wellbeing.
- Individual investors have realised the importance of keeping Sweden and the EU at the forefront of AI exploration, and the Wallenberg family have [invested](#) over \$114 million worth into AI research in Swedish universities.

United Kingdom

- The AI Sector Deal was released in April 2018 as part of the government's broader industrial strategy, and included policies to boost public and private R&D with £300 million GBP in private sector investment announced shortly after, investment in STEM education, improvement of digital infrastructure and developing AI talent and conversations on ethics. The deal also included the launch of the Centre for Data Ethics and Innovation. The sector deal also provided large scale funding for post-docs and announced a number of investments from private companies.
- Professor Dame Wendy Hall and Jérôme Pesenti have published an independent government report entitled [Growing the Artificial Intelligence Industry in the UK](#), containing several key recommendations. They include (1) the development of data trusts, to improve trust and ease around sharing data, (2) establishing 200 more PhD places in AI at UK universities, (3) greater diversity in the AI workforce, (4) a programme to support public sector use of AI, and (5) an AI Council to promote growth and coordination in the sector.

C. A case study – China’s approach to AI

China is midway through implementing its ‘New Generation Artificial Intelligence Development Plan’, which was announced in 2017. This plan, alongside ‘Made in China’, a 2015-2025 plan of investment in manufacturing, is the largest single government AI strategy in the world.

Full investment numbers have not been made public, but it is estimated that China is spending tens of billions of dollars on AI. Some published figures show that two provincial governments alone are spending nearly \$15 billion on AI.¹ China’s attitude to AI is distinct to the rest of the world’s, and it is well-summarised in this extract from its strategy²:

AI has become a new focus of international competition. AI is a strategic technology that will lead in the future; the world’s major developed countries are taking the development of AI as a major strategy to enhance national competitiveness and protect national security; intensifying the introduction of plans and strategies for this core technology, top talent, standards and regulations, etc.; and trying to seize the initiative in the new round of international science and technology competition.

Though this approach is not to be recommended for European nations, China’s strategy is forthright and ambitious. It is built around concern for national security, the global technological race, and the latest era of industrial transformation. With little of the same regard for personal privacy as European governments, the Chinese state wants to use AI to engineer significant social change.

AI brings new opportunities for social construction. China is currently in the decisive stage of comprehensively constructing a moderately prosperous society. The challenges of population aging, environmental constraints, etc., remain serious. The widespread use of AI in education, medical care, pensions, environmental protection, urban operations, judicial services, and other fields will greatly improve the level of precision in public services, comprehensively enhancing the people’s quality of life. AI technologies can accurately sense, forecast, and provide early warning of major situations for infrastructure facilities and social security operations; grasp group cognition and psychological changes in a timely manner; and take the initiative in decision-making and reactions—which will significantly elevate the capability and level of social governance, playing an irreplaceable role in effectively maintaining social stability.

While making great progress on application and investment, China still lags behind the US on the quality of its core AI technology, innovation, and talent. Though this may not be a problem for China in the long run, as many agree that the greatest future advances in AI will be made by those with sufficient access to scale and large volumes of data, which China has in abundance³.

1 Understanding China’s AI Strategy, CNAS, [2019](#)

2 China’s ‘New Generation Artificial Intelligence Development Plan’, New America, [2017](#)

3 EU – outsider of the AI Revolution led by US and China, Vote Watch Europe, [2018](#)

The importance of defence

The US and China are host to [6 and 4 of the world's ten largest internet businesses](#) by market capitalisation, respectively. They may have built these businesses in very different ways but the primacy of defence technology unites the American and Chinese approach to AI. In D9 workshops, participants lamented how “there is no European DARPA”, and therefore no unified investment in defence technology, which is so important for creating future technologies. Whether overcoming the barriers to creating a European DARPA to encourage European AI development is possible or desirable is an issue for EU policymakers and Member States. However, as greater quantities of sensitive data are poured into AI applications at scale, it may soon be impossible to separate defence and national security from AI.