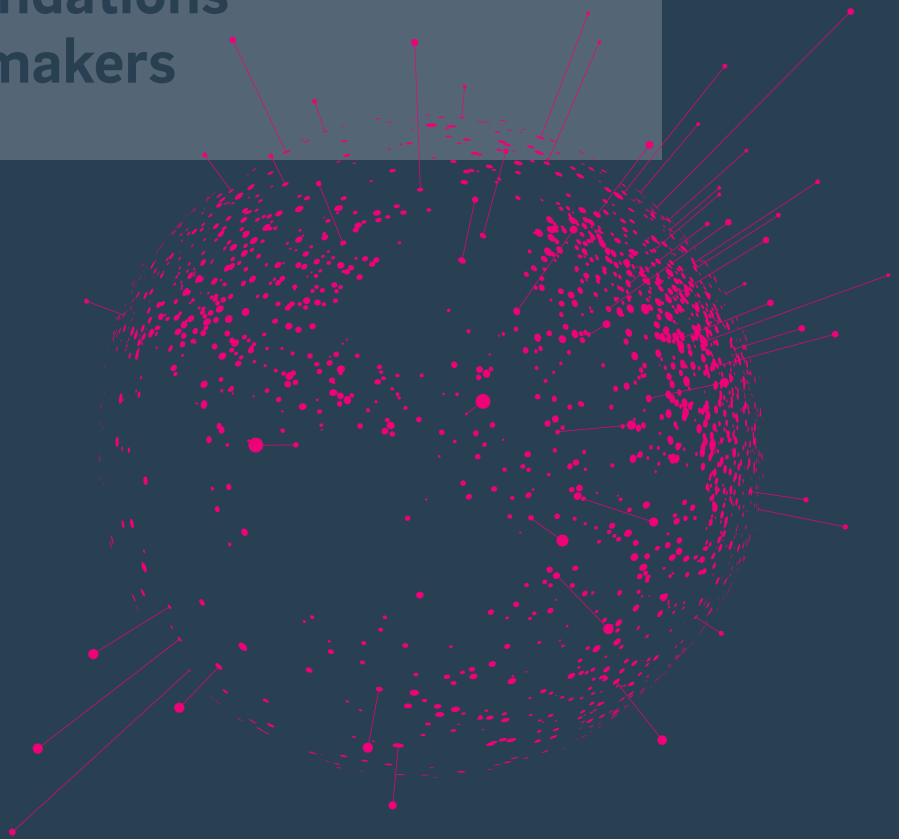


Artificial Intelligence – A strategy for European startups

Recommendations
for policymakers



Management summary

Artificial intelligence (AI) is set to revolutionize production processes, enable better and new services for customers, and transform the way that companies work. As production of goods and services become truly digital, the traditional relationship between production facilities and human resources will change. AI, besides improving productivity, will become a factor of production like capital and labor. The new technology will also have a major impact on the competitive positioning of players: Investing in AI not only cuts costs but by the same token enhances the competitive advantage of firms that innovate.

In AI we are currently witnessing a remarkable shift in innovation. Rather than coming from multinational firms as in the past, innovation now stems largely from research laboratories, digital platforms and startups. These are the players creating algorithms and developing use cases, they are the brains behind innovations in image recognition, natural language processing and automated driving.

With this in mind, Roland Berger and Asgard have carried out the first comprehensive global investigation of startups working in the field of AI, the results of which we present in this paper. Unsurprisingly, the United States dominates the picture, accounting for nearly 40 percent of AI startups. Europe ranks second with 22 percent of startups, ahead of China in third place. However, no single European country achieves critical mass on its own.

In terms of sectors, some key European industries such as energy or the automotive industry, and some areas of technology such as the Internet of Things (IoT) or robotics, are weakly represented among European AI startups.

This finding may indicate that the true engines of the European economy have not yet embraced the shift to AI. While the United States and China benefit from their highly developed digital industries, research and capital, the European landscape remains fragmented with the continent lacking a clear strategy for coordinating and structuring the AI ecosystem.

We see two main challenges for Europe. First, Europe should promote the emergence of homegrown AI champions that are able to offer the best solutions for enterprises and consumers. Second, Europe must rapidly adopt AI technology across all industries in order to benefit from competitive gains. In the process, Europe must make sure it is not overtaken by early adopters in North America and Asia.

We believe that Europe can become a third player in the "arms race" between the United States and China. To gain a competitive position, European policymakers should promote startups as the main technological and economic drivers of AI. This involves profoundly changing the shape of public involvement in the innovation ecosystem and adapting support schemes specifically for startups. The European Union should quickly strengthen the competitiveness of startups and support the emergence of a European AI ecosystem.

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Methodology

Roland Berger and Asgard partnered up to provide the first comprehensive overview of the global AI ecosystem based on data from startups in all regions of the world.

The data collection carried out by Asgard focused exclusively on startups working in AI technology, ignoring firms involved in other digital topics and technology, such as hardware-only startups and the R&D departments of corporations. Within this, the study further focuses on startups producing AI solutions, and expressly excludes startups using existing AI solutions on the market to develop new services or products.

This selection procedure is dependent on the availability and quality of the data gathered at the local level, in an ever-changing environment, with different languages and standards in companies' registration. It therefore cannot reflect with scientific certainty the state of the local startup ecosystems.

Roland Berger then analyzed the information on 3,465 startups to define their geographical distribution and reach. The study looks at two key variables: the main sector that the company focuses on, narrowed down to the 26 commonest industries, and the main technology used or provided.

Preliminary definition & scope

AI company definition

One that produces a primary product or service utilizing machine learning, deep learning, image recognition, natural language processing, or other frontier AI technology

Exclusions

Non-AI focus, purchased by another company, R&D departments of corporations, hardware only, mainly active in other markets such as virtual reality, limited frameworks

Initial list ≈7,500 startups. We scanned the list for closed businesses and filtered for key terms to confirm actual use of AI. **Final number of observations: 3,465 true AI startups**

Sectors & technology

Two variables are created to characterize the technology & sector of the startup:

Sector variable

We narrow down the available categories to the 26 most common industries, and determine each company's primary orientation. If the startup applies to major functions in cross-cutting sectors (such as accounting, human resources) they are listed as "B2B services"

Technology variable

Two main groups are created:

Core AI (research-driven, developing new forms of AI but no market, customers, or business model)

Applied AI (target market and product to address a specific need)

Limitations

Potential **lack of available reliable information** in certain regions of the world

Comparability issue

Categories are defined differently, public/private sources report information differently, and bases exist across global regions (we tried to keep this report neutral and unbiased by widening the net of resources and broadening our base of information)

Geographies, sectors and technologies

Our investigation reveals uneven development of AI across countries, and different levels of maturity across industries and technologies. Contrary to popular belief, the European continent as a whole is not lagging behind the rest of the world. Indeed, it ranks second in terms of the number of AI startups located here. But unlike the United States or China, Europe is made up of a patchwork of countries that individually have little weight on the international AI scene. An additional cause for concern is the small number of startups in certain key European industries and areas of technology.

US leading – Europe strong but fragmented

Looking at individual countries, the United States leads the AI ecosystem, with 1,393 startups – 40 percent of the total number of AI startups worldwide. China comes in second place, with 383 startups (11 percent of the total worldwide) and Israel in third place, with 362 startups (10 percent).

If we take Europe as a whole, however, it easily pushes China out of second place, with 769 AI startups (22 percent of the total worldwide). But no individual European Union Member State achieves critical mass: The United Kingdom is No. 4 in the country rankings (245 startups), France is No. 7 (109 startups) and Germany No. 8 (106 startups). → **A**

Key sectors have not embraced AI

AI development is fostered by data availability. So, it should come as no surprise that data-driven sectors are currently ahead. B2B services (related to internal company processes or customer data) are the No. 1 sector for AI startups, followed by healthcare and FinTech, at both global and European levels.

Yet, some major sectors of the European economy are weakly represented in terms of startups. The energy industry, for instance, accounts for just two percent of European AI startups, and similar underrepresentation is found for the automotive industry (one percent), real estate (one percent), agriculture (one percent) and public administration (less than one percent).

Core artificial intelligence – that is to say, fundamental research in AI not targeted at a specific sector or activity – is a key indicator of future development potential. Here, Europe is in line with the global average, with ten percent of European startups working in this field compared to nine percent globally. However, the picture changes when we look at leading European areas of

technology such as robotics, the Internet of Things (IoT) and self-driving cars. By rights we would expect these technologies to be represented in Europe at levels above the global average. But in fact we find that they are roughly on a par with the global level. Thus, robotics accounts for five percent of European AI startups, compared to six percent globally, IoT accounts for four percent of startups in Europe, as it does globally, and self-driving cars account for one percent, the same as the global level. This places a question mark over the ability of European core industries to adapt to the next wave of technological developments and maintain their leadership position. → **B**

Getting ready for AI: A major policy issue

In the long term, the winning countries will be those that opt for a clear strategy. In this respect China and the United States are clearly one step ahead at the moment. The United States and China also benefit from their big digital players – Google, Apple, Facebook and Amazon ("GAFA") in the United States, and Baidu, Alibaba and Tencent ("BAT") in China. These companies have all the necessary ingredients: access to data, the financial means to invest in the most up-to-date technology and buy data, sophisticated search engines, control over the IT infrastructure and the ability to attract a skilled labor force.

Europe will only be able to compete by bundling the strengths of the EU-28 to achieve critical mass and by establishing close links between research, companies and startups. Europe needs an ecosystem in which these actors play a key role in transforming ideas into concrete economic opportunities. We are convinced that Europe must rapidly develop an ambitious AI policy vision with startups at its heart. → **C**

A. The race for leadership

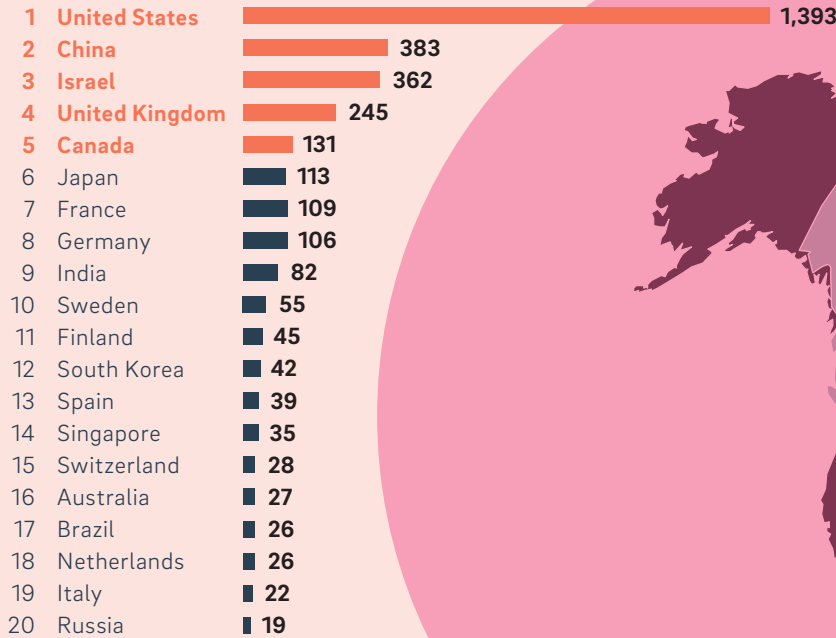
Global distribution of AI startups

Top countries and cities by number of startups

United States

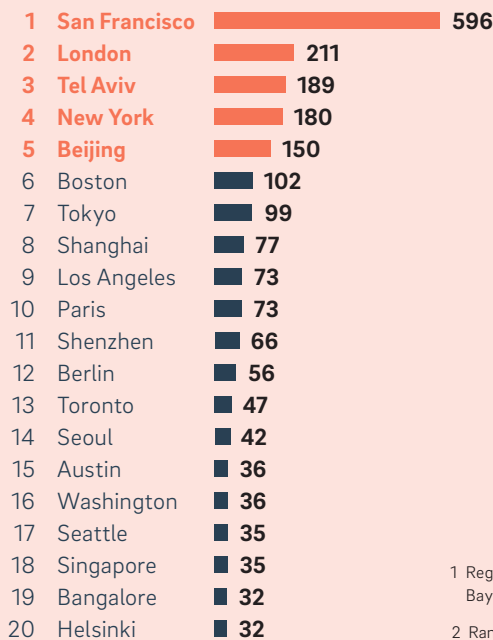
1,393

Top countries



Top regional hubs

Cities' extended urban areas¹²

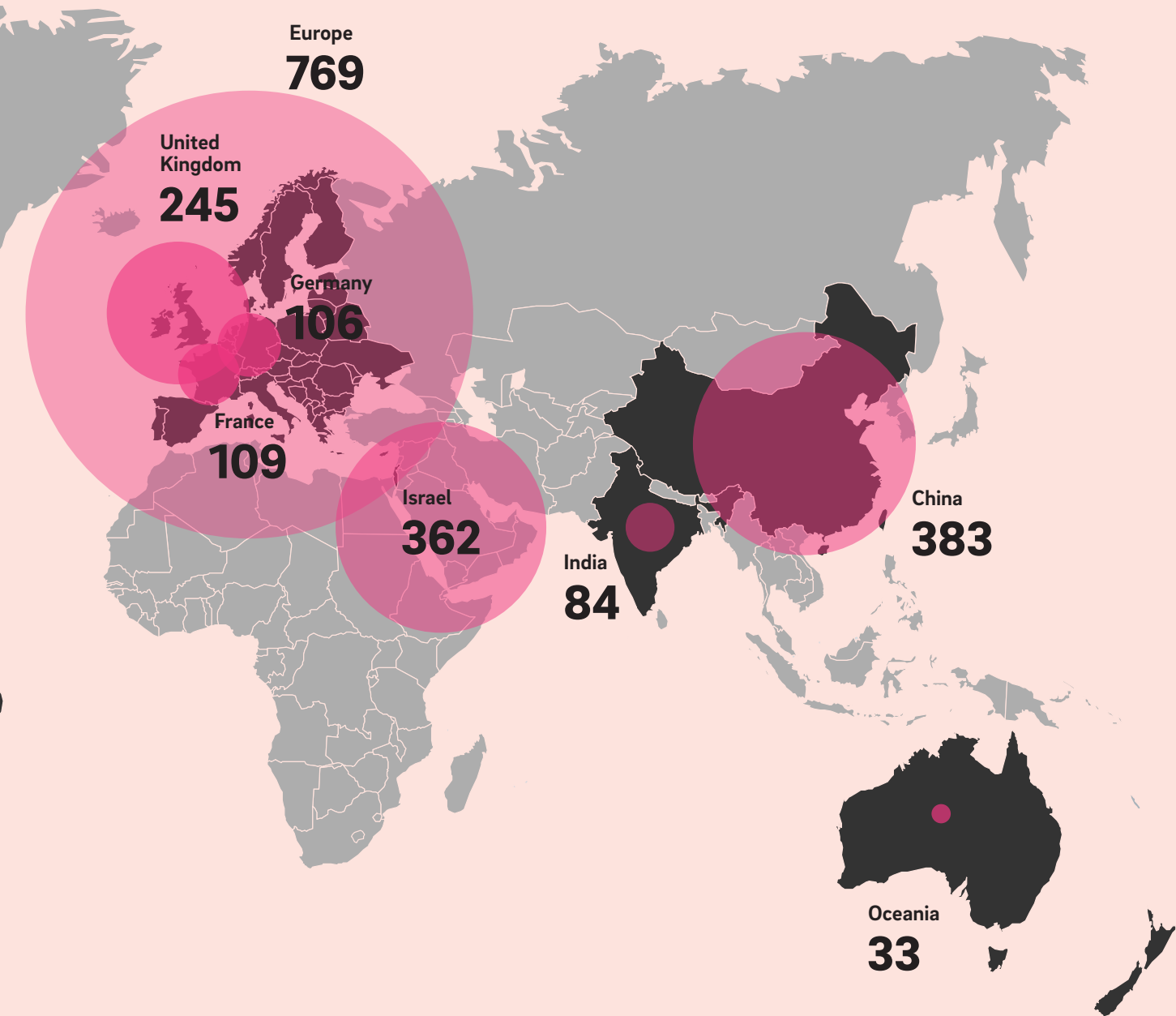


Latin America

41

1 Regional hubs comprise a core city plus its extended urban area and wider agglomeration: e.g. San Francisco plus Bay Area, London plus Oxford & Cambridge et al., Beijing plus Tianjin, Shenzhen plus Guangzhou et al., etc.

2 Ranking excluding 180 startups for which information on city was not available – Among them, 130 are located in Israel

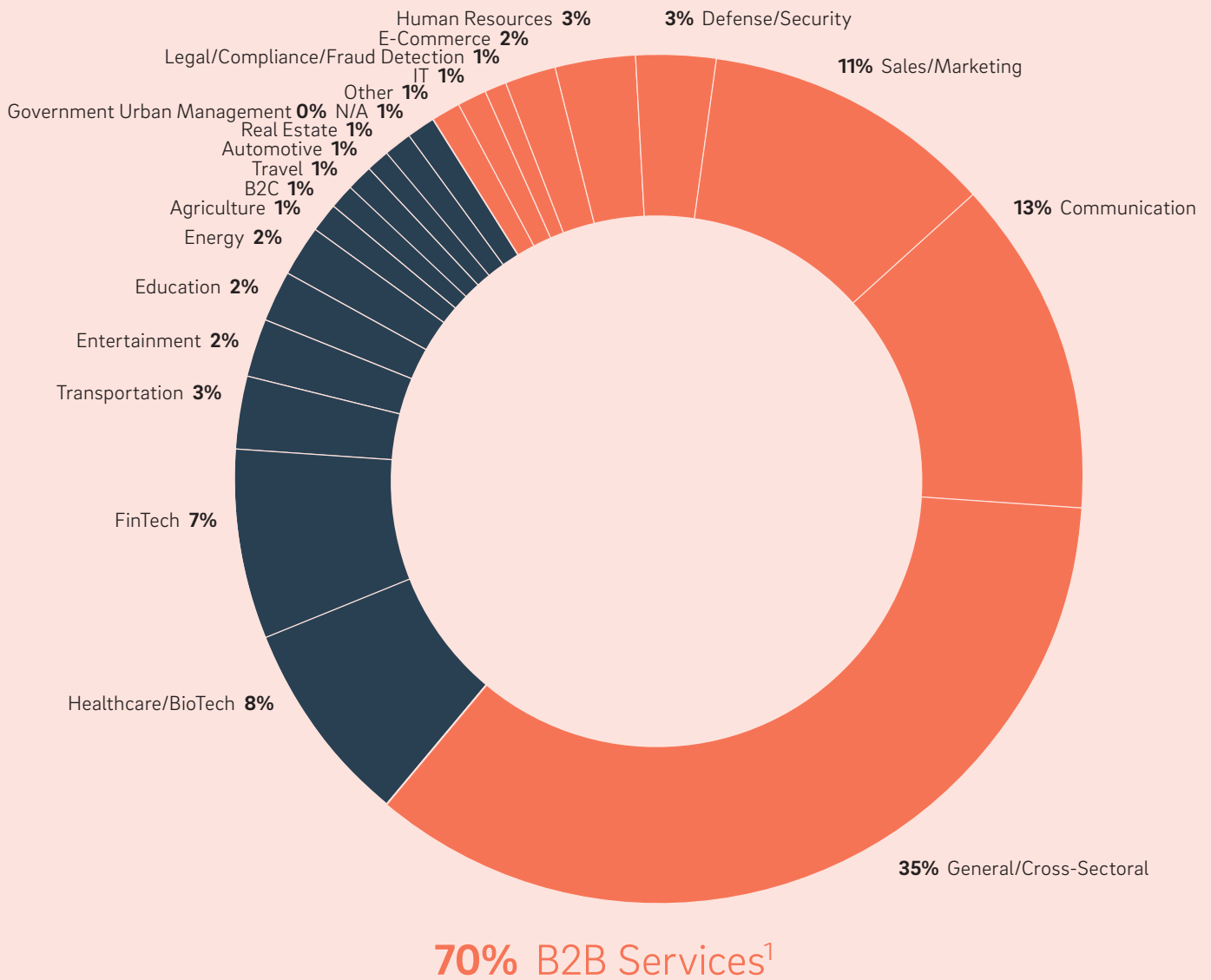


Source: Asgard, CB Insights, Crunchbase, Israeli startups shortlist, AI list Nordics and Baltic, Machine Intelligence 2.0, Chinese AI list, European AI landscape, German AI landscape, Israeli AI startup map, Japanese AI list, UK AI list, French AI ecosystem, Korean AI list, own research.

B. Uneven disruption

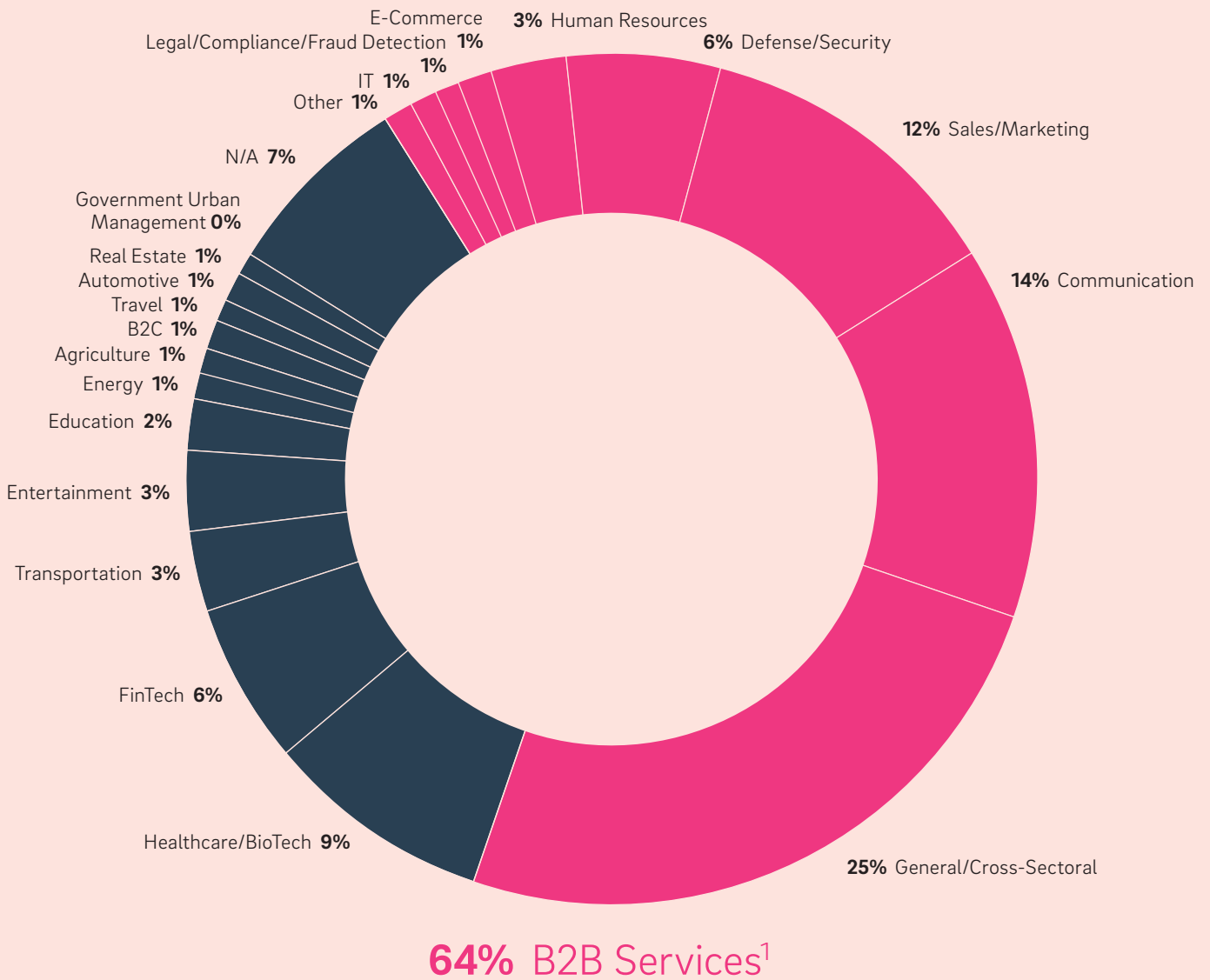
Distribution of AI startups by industry

Europe



Source: Asgard, CB Insights, Crunchbase, Israeli startups shortlist, AI list Nordics and Baltic, Machine Intelligence 2.0, Chinese AI list, European AI landscape, German AI landscape, Israeli AI startup map, Japanese AI list, UK AI list, French AI ecosystem, Korean AI list, own research.

Worldwide



¹ Services include those applicable in all sectors for various industry functions (Communication, Marketing, Security, HR, E-Commerce, Legal, etc.)

C. Two giants and a patchwork

National strategies and action plans in AI



United States

National Artificial Intelligence
Research & Development Strategic
Plan (October 2016)

At least 16 separate agencies govern
sectors of the economy related to
AI technologies

Major AI research hubs
(San Francisco Bay Area,
New York-Boston)

Most AI deals since 2012 have gone
to US startups (73% in Healthcare &
Wellness, 58% in Commerce,
76% in Advertising and Marketing)

UK

Industrial Strategy
Green Paper

Public funding
(GBP 500m)

Education (increasing
computer science
teachers to 12,000)

European Union

FinTech Action Plan

European Artificial Intelligence-on-demand platform

Call for a High-Level Expert Group on Artificial Intelligence

Horizon 2020: EU funding to foster AI development

France

Man Machine Teaming (MMT) program

Banque de France initiative

Germany

DFKI and Fraunhofer Institute

Coalition Agreement

China

Next Generation Artificial Intelligence Development Plan (July 2017)

Research centers in Beijing (USD 2.3bn), Tianjin (USD 5bn)

Government partnership with iFlyTek (image and voice recognition company) by giving access to biometric data in vast quantities

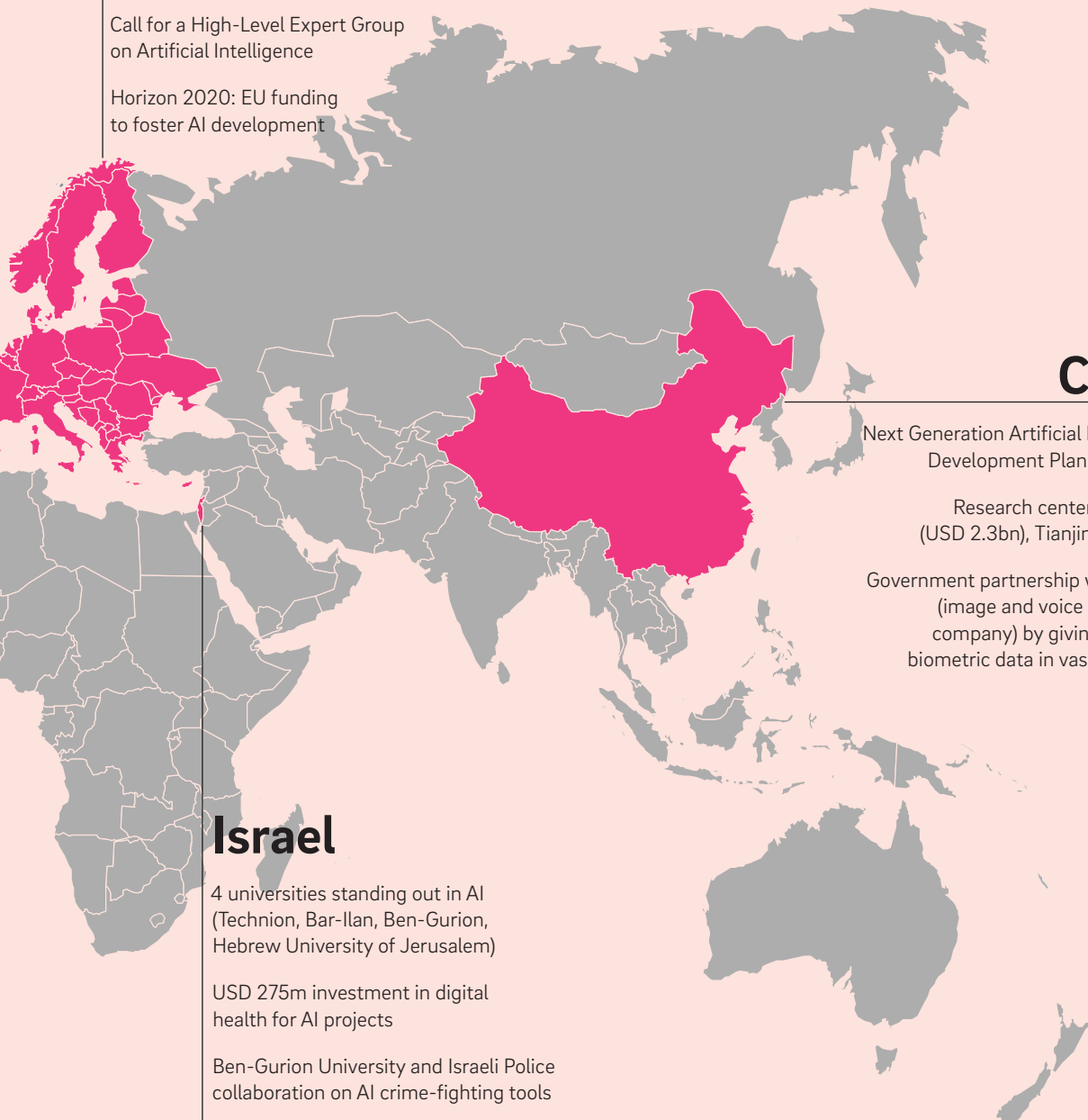
Israel

4 universities standing out in AI (Technion, Bar-Ilan, Ben-Gurion, Hebrew University of Jerusalem)

USD 275m investment in digital health for AI projects

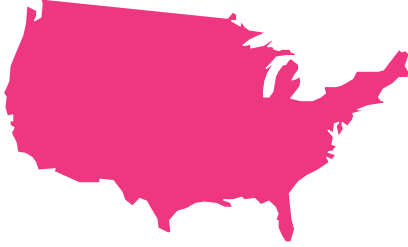
Ben-Gurion University and Israeli Police collaboration on AI crime-fighting tools

30% of border protection ensured by AI systems



AI strategies and ecosystems across regions

Developing AI requires a specific combination of assets, namely data, capital and researchers. The leading countries and regions not only have these assets, they also tap into synergies between the different players and stakeholders to create robust ecosystems.



United States

Still the global leader

The United States has established strong leadership in the field of AI. The country publishes the most AI papers in the world, holds the most AI patent applications (15,317 in 2010–2014), has the most people working in AI (approximately 850,000) and accounts for the biggest share of private investments in AI (66 percent). With its leading digital players – most notably the GAFA companies – the United States has the perfect foundation for developing and implementing AI applications. American tech companies are very active in research and development, and able to attract the most talented people. What is more, the country has top-quality universities and is home to the leading global investors in AI: Google Ventures and Khosla Ventures. Its corporate players are highly active in the area of mergers and acquisitions, especially the GAFA companies, which cumulatively acquired close to 40 AI startups in the period 2010–2018. US industry leadership is backed up by a long-term, credible strategy. The federal government produces plans and publishes reports such as *The Future of Artificial Intelligence; Robotics, Automation and Artificial Intelligence*; and *AI, Automation and the Economy*. In 2016 it also invested approximately USD 1.2 billion in unclassified AI research and development, and almost as much in 2015 (approximately USD 1.1 billion).



China

On track for global domination

China's ambition is to become the world leader in AI. This drive is backed up with a strong political agenda. In July 2017 China's Ministry of Industry and Information Technology (MIIT) published its Next Generation Artificial Intelligence Development Plan, which sets a number of clear targets: to reach the same level in AI as the United States by 2020, to become the world's premier AI innovation center by 2030, and to build a domestic AI industry worth RMB 150 billion (USD 22.2 billion) by 2020 and RMB 400 (USD 59.1 billion) by 2025. In addition, local governments are constructing research centers in AI in Beijing at a cost of USD 2.3 billion and Tianjin at a cost of USD 5 billion.

These efforts are paying off. The number of patents in deep learning and AI published in China grew much faster than in the United States in the period 2013–2017. In 2017 China published 641 patents related to AI, compared with 130 in the United States.

Beijing's emphasis on security and surveillance allows it to collect a large amount of data – for example, by camera. This data then feeds into AI applications. Chinese AI startups benefit from close ties with the government, which gives them access to huge public-sector funding. In the domain of facial recognition, for instance, the company CloudWalk received a USD 301 million grant from the Guangzhou Municipal Government in 2017, while Megvii raised USD 460 million in a funding round led by the central government's venture capital fund. On top of this, China's AI companies benefit from the country's closed system that protects domestic firms from outside competition.



EU

Awareness exists, but more action needed

Europe's AI assets are highly fragmented. Talent, capital and research are spread across the continent – quite unlike the situation in the Silicon Valley, for example. Moreover, most universities with AI departments are located far away from the leading AI innovation hubs of Paris, London and Berlin.

We have seen few actions specifically targeting AI at a European Union level so far. But there is some evidence that moves are now underway. In April 2018 the European Commission announced the outlines of a European strategy, to be detailed by the end of the year. This strategy includes a call for EUR 20 billion in investment in the period 2018–2020, the money coming from the European Union, Member States and the private sector. The European Commission is increasing investment under the Horizon 2020 research and innovation program. The European Investment Bank (EIB) will support companies and startups through a targeted investment platform under the European Fund for Strategic Investments (EFSI). And the European Commission and the European Investment Fund (EIF) have launched a pan-European venture capital funds-of-funds program (VentureEU) for startup and scale-up companies.

Twenty-five European countries have now signed a Declaration of Cooperation on AI. Additionally, in an open letter published in April 2018, European scientists advocated the creation of a multinational European institute devoted to world-class AI research, aiming at retaining talent in Europe and avoiding a brain drain to big tech firms.

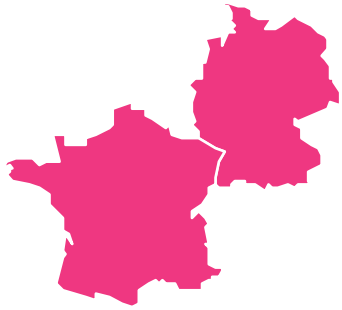
Yet, critics fear that the actions taken by the European Union may ultimately be limited to coordinating national strategies. Doubts also exist as to whether the volume of financing is really sufficient.



United Kingdom

The local leader

In January 2017 the UK government's Industrial Strategy Green Paper identified AI as a major issue for the future of the UK economy. Alongside robotics, AI was selected to receive funding support from the Industrial Strategy Challenge Fund. In November 2017 Chancellor of the Exchequer Philip Hammond announced in his Autumn Budget GBP 500 million of funding for AI, 5G and full-fiber broadband, plus GBP 2.5 billion to help businesses grow to scale and GBP 21 million over the next four years to expand Tech City UK into a nationwide network. He also made a commitment to tripling the number of qualified computer science teachers to 12,000.



Germany and France

Plans to work together

The German blueprint for a coalition agreement of early 2018 between Chancellor Angela Merkel's Christian Democrats and the Social Democrats urges the creation of a national master plan for AI and a research center on AI within the framework of Franco-German cooperation. The master plan will be developed in summer 2018 and is expected to be finalized in autumn 2018. In Germany, several public-private partnerships are active in AI:

- The German Research Center for AI (DFKI), founded in 1988, brings together 519 highly qualified researchers and 384 graduate students from 60 countries working on 295 research projects. Its budget in 2015 was EUR 41 million.
- The Fraunhofer-Gesellschaft, an organization for applied research with 69 institutes spread across Germany, has a specific department for research in AI, the Fraunhofer IAIS. Some 70 percent of its contract research revenue comes from contracts with industry and public funding.

In France, in the wake of the Villani Report, President Macron outlined a national strategy for AI. He announced actions relating to building the ecosystem, valuing data and the ethics of AI and undertook to spend EUR 1.5 billion of public money on AI. He also stated his desire to foster German-French projects and to push ahead with regulatory and financial issues at a European level, calling for a European budget and the creation of a European version of the US Defense Advanced Research Projects Agency (DARPA). The Governor of the Bank of France, François Villeroy de Galhau, announced in January 2018 the creation of a taskforce at the French financial markets authority (AMF) to assess the impact of AI on the financial sector. Likewise, in March 2018 the French Minister of the Armed Forces, Florence Parly, officially launched a EUR 100 million Man-Machine-Teaming (PEA MMT) program to develop AI for combat aviation.



Israel

The international technology hub

Israel comes third in the world in terms of the number of AI startups in the country, and first in terms of the number of AI companies per inhabitant. Due to national security concerns, there has been an emphasis on AI security applications. Indeed, today 30 percent of Israel's border protection is based on AI systems. Ben-Gurion University and the Israeli Police are working together to develop anti-crime tools using AI in the newly inaugurated Center for Computational Criminology in the city of Be'er Sheva. The government additionally plans to invest USD 275 million in the digitalization of health data to foster AI projects, and there is a national program promoting smart transportation with AI applications.

Recommendations for Europe

Europe is facing stiff competition from the heavyweights in artificial intelligence, mainly the US and China. To catch up with their development, Europe cannot rely on 28 different national strategies and action plans. Policymakers in the EU should join forces and create a truly European ecosystem for AI startups. Joint EU action is the only path to European leadership.

On April 25, 2018 the European Commission presented an initial set of measures relating to AI, aimed at coordinating the national initiatives already announced by some Member States. It also announced that it would be directing more clearly the funding programs for research and innovation in this field, and launched the idea of common governance in relation to ethical and legal issues.

While this step has greatly raised awareness of the relevant issues, we believe that Europe does not need so much a coordinated plan for AI as a unified, unique plan that brings together all the available resources and energy, and in so doing multiplying their impact. We are convinced that leadership in the field of AI will only be possible if Europe unites its forces and bundles its strengths. Below, we outline three major recommendations for policymakers, each of which comprises a number of subsidiary actions.

RECOMMENDATION

1

Create YES!

*Young European Startup

European support programs generally target small and medium-sized enterprises (SMEs), even where their aim is to promote innovation. Some financing mechanisms exist to help startups, such as the European Fund for Strategic Investments (EFSI). However, their reach is limited as they do not clearly define potential recipients and are not specifically designed to include startups. Startups, whose rapid-growth model requires huge investments in technology, especially AI, have very specific requirements. To create the necessary conditions in Europe for leadership in AI, policymakers therefore need to address the specific needs of startups.

We recommend establishing a distinct, pan-European enterprise status for young startups, to be known as Young European Startup or "YES!" status. No single national market is big enough for European startups to grow to the same extent as their competitors in China and the United States, which have huge domestic markets and can access enormous volumes of data. YES! status would allow startups to benefit from new fiscal and social arrangements and grant them access to the entire European market, as well as European support programs. It would facilitate cross-border activities, recruiting within Europe and international investment. What exactly the new status means should be defined at a European level, but it must go beyond a simple alignment of existing national measures.

Creating this new status requires a clear definition of "innovation" as it relates to startups. This definition should draw attention to the capital needs and high-growth perspectives for these young companies. One option would be to use the definition of innovation given in Article 2, paragraph 2 of the Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement.

The tax system for enterprises with YES! status should favor the sale of transferable securities across the continent and apply the same progressive rates. If agreement cannot be reached between Member States, unifying the fiscal regime applicable to startups could be placed on the Eurozone agenda and the "enhanced cooperation" procedure applied. Share distribution mechanisms should also be standardized following the example of the French BSPCE system, which allows employees to participate directly in shareholders' equity with a pre-fixed price for share subscription.

Create one-stop shops within a European network of incubators and accelerators

Enterprises with YES! status should have access to "one-stop shops", in other words physical or virtual single points of contact, in every European country. These one-stop shops should provide startups with all the necessary information and training on applicable regulations in European countries, including legislation on tax, labor, intellectual property, consumer protection and data privacy. The one-stop shops should be financed at a European level by the European Regional Development Fund (ERDF). They could be located within selected incubators and accelerators, which would together constitute a "European Tech Network" in tech capitals. Each Member State should commit to setting up such one-stop shops within incubators in the network.

Grant startups a European Tech Pass

The most promising startups could be granted a "European Tech Pass" by one of the European institutions – for example, the European Innovation Council, once its governance and missions are confirmed. The European Tech Pass would give startups access to dedicated EU and national funding, incubation programs within the European Tech Network of incubators and accelerators, support in communication and marketing, and visas for foreign team members.

RECOMMENDATION

2

Invest YES!

If Europe is serious about having its own AI champions, it must not only facilitate the creation of startups but also enable the most promising ones to scale up and remain European.

Many observers believe the issue of funding for startups will soon be resolved. Europe has undeniably made progress in this area. But startups working in AI need larger investments than their peers in other fields. This is because their fixed costs are high due to the need for data collection and aggregation, computing power and human resources. The upward pressure on salaries for the best talent – developers as well as Chief Technology Officers – and the expense of internationalization exac-

erbate their capital needs. This is particularly true in the initial development and launch phases, which are especially labor-intensive.

Yet, despite the growth of the investment market, access to funding for European AI startups remains limited. So far, there has been no large-scale fundraising (exceeding USD 100 million) by an AI startup in Europe, unlike on other continents – Element AI in Canada, for instance, or SenseTime in China. The investment culture is to some extent responsible, with private investors in Europe often more cautious and risk-averse than their North American counterparts. The needs of AI startups are not being met.

Risk in AI is two-dimensional. Commercially, the markets are not yet mature and concrete applications may still be a long way off. Technologically, it is not certain that the startups will succeed in developing a solution at all, based on their fundamental research. This risk is as high as the risk of failure in scientific research, and it is one of the major business challenges faced by entrepreneurs.

AI startups should be seen as business labs, basing their experiments on fresh algorithmic research – a model that is not easily captured by traditional due diligence scanning. Consequently, no objectives can be set for immediate return-on-investment on the results of research and development. Instead, higher risk-return incentives must be set, which means improving the chances of startups being taken over, making exits more attractive.

Strengthen exit prospects for European startups

European startups have poor exit prospects, due in particular to the low level of external investment by European companies. The absence of big technology companies, with a few exceptions, is a clear disadvantage in the

funding of AI startups. The United States invested USD 23 billion in artificial intelligence in 2016 compared to just USD 4 billion invested in Europe.

External growth strategies are particularly necessary in the field of AI, where technological developments are fast and test instruments such as open-source machine-learning platforms and computing capacity are largely accessible. Major European companies in key industries – banking, insurance, automotive and transportation, energy, luxury goods, retail, and so on – should start investing in the AI market with venture capital, private equity, and through mergers and acquisitions.

With their investors demanding a quick return on investment, corporates will need strong advocates to justify such ambitious venture strategies and portfolio diversification. These advocates can argue that AI startups should be treated as strategic assets in the company's business model, rather than simply a receptacle for investments. Importantly, the objective of the companies making the investments should not be to kill off any potential competition but rather to integrate effective technology into their own business in order to improve their productivity and accelerate growth.

Meanwhile, some European entrepreneurs are reluctant to open up their capital to multiple investors. These players must realize that this step is essential in order to achieve high growth. The European Union, with its financing instruments, would be an excellent vehicle for disseminating this message. The guidance given by the European Commission should be unambiguous: The acquisition of startups by large corporates, if the valuations and timings are correct, is favorable to the development of a European ecosystem of innovation and does not just serve the financial interests of the startups' founders.

Promote cross-European investment by corporate venture

Corporate investment in startups can be either direct or indirect, via venture capital funds. Indirect investment gives corporates strong leverage: Their investment choices are no longer arbitrated internally according to set factors and constraints, but via a third party providing later tickets. However, corporate venture is still uncommon in Europe, with only 10 to 20 percent of funding deals for startups involving corporate money.

European policymakers can help here. By harmonizing the tax depreciation scheme for corporate venture, they can enable large firms to invest easily across the continent rather than just in individual countries. Corporate venture should be closely coordinated by Brussels. Indeed, Brussels should push for corporates to acquire startups as much as it strives for the development of internal R&D funded by public institutions.

1+1= 3: When venture capital funds come together

In a fragmented European financing market with relatively small entities, players have no choice but to work together to support the development of startups. This implies "sharing the pie" and striving to work on a transnational basis. The need for a Europeanization of private investment is all the more pronounced today, when AI startups require support for their internationalization strategy from experts in the markets that they target. The Europeanization of investment funds would not only multiply funding opportunities but also prevent entrepreneurs from wasting precious time and energy – resources that they spend today trying to understand foreign markets.

Yet, initiatives are surprisingly rare and remain modest. Often they are limited to partnerships. Instead, financ-

ing initiatives should shift from a national to a European scale, with offices being opened in European capitals and the creation of truly mixed teams, be it in Berlin, Paris, Stockholm, Lisbon or Tallinn. The success of such initiatives is down to trust. The first step will probably be to create an informal European network of venture capital firms, business angels and family offices led by key investors in Europe. Initiatives already exist, mainly at a national level or between close friends, but they still lack sufficient depth and impact. The European Investment Bank (EIB) has a particular role to play in encouraging international rather than national initiatives.

Not just venture capital

Innovative players within the European ecosystem require a diversification of the sources of funding. Realizing that Europe's savings market was not sufficiently geared toward equity investing, the 2015 Capital Markets Union Action Plan set the objective of putting European savings to better use. The issue here is not only how to trigger investment in the capital market, but how to redirect savings toward startups. They are the ones that are particularly suffering from the European shortage in equity.

However, recent funding rounds for AI startups in the United States and China show just what Europe is up against. In 2017 the average fundraising deal for AI startups was approximately USD 10 million in the United States and USD 36 million in China, compared to just USD 3 million in France and USD 2 million in Germany. European startups have significant valuations and a real need for increased funding. But apart from venture capital and public subsidies, no European mechanism exists for offsetting the relative weakness of investment in Europe.

AI startups would also benefit from access to a larger and more varied pool of investors. Once again, European startups face unfair competition here: US startups

The absence of big technology companies is a clear disadvantage in the funding of AI startups. In 2016, Europe invested six times less in artificial intelligence than the United States. Brussels should push for corporates to acquire startups.

can rely on capital investment from trusts, universities, pension funds, sovereign funds, and so on. Europe has no choice but to massively diversify its sources of funding for innovation to include private equity funds, investment banks, pension funds and sovereign funds. The EIB could assist in developing closer cooperation between the various players through the use of innovative cross-financing tools.

VentureEU – The way forward

Since private investment in AI has failed to achieve critical mass in Europe so far, public funding clearly has a role to play – directly, through equity funding addressing market deficiencies, and indirectly, through public institutions acting as a guarantee for private investors. The latter approach would trigger a multiplier effect on the amounts raised.

Action at a European level is vital in order to achieve sufficient public-private funding for startups and scale-up companies. The new pan-European venture capital funds-of-funds program VentureEU could be a vehicle for this financing. As recently announced, VentureEU will be backed up with EUR 400 million in EU funding, and aims to raise up to EUR 2.1 billion including private investments. This initiative could contribute to the growth of European leaders in AI.

Increase EU commitment to public funding

A number of countries have announced ambitious measures to finance disruptive technology such as AI. France was the first to move, with Bpifrance – the French public bank for investment – playing an important part. France also plans to create a new fund dedicated to innovation, increasing Bpifrance's resources for direct investment in startups to EUR 195 million. A further EUR 150 million will be allocated to major economic and societal

challenges, and not less than EUR 100 million specifically to AI technology.

Yet, compared to other parts of the world, European funding remains meager at a national level. Public intervention is necessary to finance AI more than any other field of R&D. We have already mentioned some of the reasons for this, such as the risk-averse nature of private investors, their pursuit of short-term return on investment, long go-to-market periods and the lack of use cases. The scarcity of long-term investors means that European startups sometimes fail to achieve sufficient funding in later funding rounds, leading to early sale or strategic errors born of excessively rapid growth.

Public financing should address these market deficiencies, providing AI startups with the stability of long-term investment (with a horizon of more than five years) following a "patient capital" doctrine. This, in turn, would reassure private investors. The presence of public financing would also attract co-investment from different countries. The European Investment Fund (EIF) could play a fundamental role as a catalyst and amplifier of investment.

The multiyear budget proposed by the European Commission in 2018 indicates much greater ambition in terms of research and innovation, with a particular focus on digital initiatives. Some governments, such as that of France, have expressed their disappointment regarding this ambition. But the budgetary debates are just beginning, and it is to be hoped that all Member States and the European Parliament will support the increase in the research and innovation budget.

A new intervention doctrine for the European Investment Fund

The role of the EIF is to unblock the funding bottleneck for AI startups in Europe, independently of national mechanisms. The specific financial instruments used

for this funding will be crucial. If it is mainly based on the traditional financial instruments of the EIB, such as loans, guarantees and grants, there is a real risk that it will miss its target group, namely firms that are able to develop groundbreaking innovations. The financial instruments of the EIB and EIF mainly finance companies' research and development (R&D) or research and innovation (R&I) budgets, according to the traditional pattern of support for research funding in the private sector. But in the case of AI, the ability to conduct research is an essential commercial asset that often defines the business model of the company in question – research and commercialization take place at the same time and in the same geographical locations.

A European Innovation Agency modeled on DARPA

China and the United States demonstrate that public procurement can have a major influence on technology-driven markets such as AI. This is particularly clear in the case of military procurement. The creation of a European Innovation Agency modeled on the American DARPA (Defense Advanced Research Projects Agency) could support the development of a European AI ecosystem. But if Europe is to follow the DARPA model, it will have to raise its budgetary ambitions. In 2015, for instance, the US government invested approximately USD 1.1 billion in unclassified R&D in AI-related technology. The figure for 2017, according to the Trump administration, was USD 3 billion. For the last 15 years, around USD 300–400 million has been invested each year in DARPA and NSF (National Science Foundation) programs relating to AI.

In Europe the size of the market and the population is roughly equivalent to the United States. The European Commission has proposed investing just over EUR 23 billion a year over the next seven years in all research

Given this specific model, we believe that European public funding should focus on the following actions:

- Providing equity, with more systematic intervention by the EIF and funds of funds, following the Bpifrance model. The increase in the investment budget should make the EIF indispensable within the European investment landscape. It should co-invest with multiple players in various segments
 - Increasing investment targets – in particular, the EFSI 2.0 should be doubled from EUR 500 million to EUR 1 billion
 - Implementing an effective operating process, with rapid decision-making (taking less than a month) for direct and indirect investments
 - Defining criteria that are applicable to startups and not to SMEs or larger mid-caps, for which strong, up-and-running revenues are required
 - Enlisting high-level technology experts to assess products and services, in addition to commercial profiles
 - Using the type of request as the sole criterion for using financial instruments, with no prior allocations between countries or sectors, as a national allocation system would not be relevant
-

The European Commission has proposed investing EUR 23 billion a year in all research and innovation programs. It would be advisable for at least EUR 1 billion to be dedicated to AI.

and innovation programs, including fundamental research. So, out of this general budget, it would be advisable for at least EUR 1 billion to be dedicated annually to AI.

For the moment, however, there is no European investment or research program dedicated specifically to AI, except for robotics projects. The European Commission has stated that it will focus its efforts on this topic as part of the future research program Horizon Europe. It formalized this intention in the document of May 2, 2018 "A Modern Budget for a Union that Protects, Empowers and Defends the Multiannual Financial Framework for 2021–2027". The Commission proposed a 64 percent increase in the European budget dedicated to research, innovation and digital investment under direct management in the next Financial Framework, to be complemented by the European Structural and Investment Funds.

Proper governance of the projects selected for funding will be as important as the amounts themselves. The military dimension of DARPA means that it is difficult to adapt this model to the European landscape, where countries invest unevenly in defense-related budgets. However, future European research and funding programs should adopt the methodology used by DARPA. In particular, they should consider the following actions:

- **Employ** highly agile structures, not restricted by internal agendas and corporate structures. The 9th EU Framework Program for Research and Innovation, which will replace Horizon 2020, is traditional in nature; it does not highlight startups or differentiate research funding from industrial partnerships, nor is it adapted to AI, where deployment and research are simultaneous
- **Identify** major societal issues and challenges. The announcements made by the European Commission concerning the second pillar of the future 2021–2027 Horizon Europe program take a general approach, de-

fining major world issues and broad themes (health, resilience and security, digital and industry, climate, energy and mobility) as European priorities. The questions raised as part of "calls for projects" should be reformulated as "calls for problems", which startups can then address. It would be useful to involve European citizens in defining these major challenges, possibly through a civic-tech platform. This platform could record the preferences of European citizens through calls for projects, partially resolving the gap between the priorities of experts and those of citizens

- **Avoid** creating an additional organizational structure as a result of the third pillar of the program, dedicated to supporting innovative companies through a European Innovation Agency. Instead, the European Innovation Council (EIC) can play this role and supervise the second and third pillars along the model of DARPA, provided that its budget is increased and sufficient human resources are dedicated to monitoring selected projects

- **Focus** public funding on a limited number of calls for projects and large investments, to avoid the scattering of resources

- **Define** an achievable goal with a major strategic impact and realistic routes for scientific investigation

- **Define** clear governance conditions for the projects financed. It will be important to build mixed teams of people from different backgrounds – scientists, engineers, humanities experts, designers, innovators, and so on. These teams should be managed directly by the European Innovation Agency in a time-limited competitive co-creation process

- **Monitor** and support projects closely. Financing teams, for example from the European Innovation Agency, should monitor projects carefully, providing progressive financial support during the ramp-up period. The teams should have the ability to stop projects that they consider failures

- **Make** 25 percent of the budget for funding research and innovation programs "federal". Projects should be financed blind, solely on the basis of their quality. Reporting should take place on a strictly European basis. This means that there should be no national indicators such as the number of projects in which a country is involved, the number of projects coordinated by a country, or such like. Projects should be European, not national

RECOMMENDATION

3

Staff
YES!

Although we live in a highly technological world, an organization's human resources are increasingly its main asset. This is especially true for startups, which compete with larger firms for the best talent. They need individuals who are both entrepreneurs and innovators, researchers and businesspeople. Recruiting has become the main brake on the growth of startups.

To prepare the European workforce for the advent of AI, Europe should insist that education reflects today's requirements. With this in mind, the European Commission has announced greater support for advanced digital skills, including AI expertise, in its proposed multiyear financial framework for the European Union

(2021–2027). It is to be hoped that the Member States will support this measure.

Unify the status of share warrants

In the short term, the European Commission could consider increasing the fiscal harmonization of employee profit-sharing and incentive plans. This action would help companies recruit and retain employees. The Commission could follow the example of France's business creator share warrants (BSPCE). Startups should be able to deploy teams in all European countries without modifying their payment conditions due to fiscal competition.

Create a European visa for researchers and entrepreneurs

In a globalized technology market, driven by usage and relatively open in nature, Europe must position itself as an attractive destination for entrepreneurs. The war for talent has begun, and the tougher recent stance on immigration in the United States may be an opportunity for Europe to attract international entrepreneurs and managers. The mission of the European Innovation Council could include coordinating migration policies relating specifically to the hosting of foreign entrepreneurs and researchers.

It makes no sense to distribute subventions to firms and research laboratories but ignore the mobility of people directly employed in project management. The creation of a European Startup Visa modeled on the French Tech Ticket could raise the European Union's ability to attract talent. The French program offers a package that includes a residency permit for entrepreneurs and their families, financial support for settling in France, a position in an incubator within the network and dedicated administrative support for dealing with officialdom.

Support "researchers cum entrepreneurs"

Researchers in the field of AI, especially young doctoral and post-doctoral students, often spontaneously turn to the idea of creating a startup. This is good news for Europe, which hosts a large number of researchers.

Startups that produce AI technology are something of a hybrid between companies and research labs in terms of their areas of focus, team makeup, duration of product development, and so on. Research and go-to-market occur simultaneously, requiring a redesign of traditional technology transfer schemes. Funding is required for "research for economic purposes", which differs from the commercial purpose of traditional firms.

Startups need to be able to work together with research laboratories and co-build products and services. Technology transfer processes must be fast. Professorial chairs in industrial subjects must be open to collaborating with startups. European programs should provide support here. For example, research labs, schools and universities could be required to encourage companies to "sponsor" startups through their professorial chairs in industrial subjects, or to sign up to collaboration agreements with startups, as a prerequisite for funding. This could include the signing of joint knowledge agreements between research labs and startups, allowing for equal sharing of knowledge and intellectual property. This practice already exists, but only on the basis of individual contracts and not as part of European funding programs.

It is difficult to assess at this stage the real economic impact of AI on industrial production models. Research is essential so that industry can anticipate and absorb the changes. Universities could be mobilized to analyze the disruption to the traditional value chain potentially caused by AI.

Europe's attractiveness for researchers, from leading specialists to PhD students, is at stake. The research sys-

tem must provide freedom and independence through the creation of a European researcher status that enables mobility between the public and private sectors. This status should give holders the ability to raise external funds and the right to keep a majority of the intellectual property rights for their personal research, or equity in the case of creating a company. When evaluating researchers, universities could include whether they had created a startup as a positive criterion. A harmonized EU status, applicable to all universities involved in certain AI consortia, could even be extended to a "student-entrepreneur-researcher" status at European level.

Europe needs to act fast if it wishes to shape the coming AI transformation and remain competitive with the United States and China. A promising startup scene in the field of AI has been developing in the European Union in recent years. But the landscape remains fragmented, spread across different countries and hindered by inconsistent national AI strategies.

Only a common and truly European AI action plan will prevent Europe from being left behind and losing its best talent. We recommend the creation of pan-European enterprise status for innovative AI firms: the Young European Startup or YES! status. Companies with YES! status would benefit from new pan-European networks, major funding and easier recruiting. The goal is to create a thriving, competitive European AI ecosystem that can deliver groundbreaking ideas for manufacturing, services and daily life.

Credits and copyright

WE WELCOME YOUR QUESTIONS, COMMENTS AND SUGGESTIONS

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