

Insight Report

Innovate Europe

Competing for Global Innovation Leadership

In collaboration with McKinsey & Company

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Preface



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Europe's innovation ecosystems are growing more quickly than ever, and the continent has recently taken forward-looking steps to shape the future of innovation: last year's regulations on protection and the free flow of non-personal data were a significant step by the European Union to provide a regional framework for dealing with data, protecting citizens and developing an effort to recognize the competitive nature of data-driven economies and the need to protect values and the rights of citizens.

Despite this momentum, challenges for Europe remain. Large platform companies from Asia and North America are beginning to dominate emerging deep technologies. Europe is lagging in the digital transformation of industries key to its success in the Fourth Industrial Revolution. It is also behind in investment in new technologies, such as artificial intelligence, where it captured only 11% of global corporate investment and venture capital in 2016 compared to 50% in the United States and 39% in China. European start-ups find it difficult to achieve scale, while talent remains a scarce resource.

This report sets out a vision for Europe to become a global leader in innovation. Supported by the World Economic Forum System Initiative on Shaping the Future of Digital Economy and Society, the Digital Europe project team engaged entrepreneurs, investors, corporate and public figures and representatives from academia across Europe. Together, they worked to create a common vision, identify action areas, develop concrete suggestions to make European innovation ecosystems more successful, and identify Europe's innovation model to compete with other pioneering regions.

The report continues the work of the World Economic Forum and its Digital Leaders of Europe community in collaboration with McKinsey & Company as a Knowledge Partner. It builds on last year's work, including the "Declaration on a Pan-European Ecosystem for Innovation and Entrepreneurship", a White Paper entitled "Collaboration between Start-ups and Corporates" and the 2018 *Renew Europe* report.

We would like to thank the members and the board of the Digital Leaders of Europe community for their commitment and ideas, and McKinsey & Company for their analysis, expertise and support.

This is an important year for Europe. A new European Commission will set a new agenda for a European Union that may look very different than in the past. Europe's leadership in the Fourth Industrial Revolution will play a major role in defining its future, and we hope this report leads to discussions and actions that will drive Europe's global leadership in innovation. The World Economic Forum is keen to provide a platform for this continuing exchange of ideas and calls on European citizens and leaders to join the discussion and implementation of concrete actions at #InnovateEurope.

Digital Leaders of Europe community

The World Economic Forum Digital Leaders of Europe are recognized, pivotal figures in their respective European innovation and entrepreneurship ecosystems. The community comprises over 80 leading founders, investors, incubators and public and corporate figures from 27 countries across Europe. Its Board provides strategic direction and champions specific topics. The community helped develop the ideas along the key building blocks in this report through in-person workshops, calls and digital collaboration.

Executive summary

European innovation model

Europe has an enormous opportunity to leverage the new wave of digital or digitally enabled technologies – such as artificial intelligence (AI), machine learning and blockchain – to create value for its people through new jobs and better, cheaper products and services. For example, developing and diffusing AI in its current assets and digital position could add up to an estimated €2.7 trillion to European economic output by 2030.

Europe has strengths to build on: its start-up scene is increasingly vibrant and its tech workforce is growing faster than ever at 2.6% a year. It boasts many small and medium-sized enterprises (SMEs) that are leaders in their fields. Its strong industrial base is ripe for innovative disruption, as the application of new technologies increasingly focuses on industrial supply chains and the integration of industries. Five of the top 10 leading countries in eGovernment are from Europe. And with a new wave of technologies, activity may shift towards economic sectors where Europe already has a competitive edge.

To seize the opportunity, however, Europe must overcome challenges:

- Private investment in research and development (R&D) lagged that in the United States by about \$90 billion in 2015, while public R&D investment remained below the level of 2010.
- R&D investment is unevenly distributed: 90% can be found among just eight EU Member States.
- The situation looks even grimmer for key future technologies: in 2016, Europe attracted only 11% of venture capital (VC) and corporate investment in AI, while the United States and Asia captured 50% and 39%, respectively. As a result, Europe also lags in intangible capital, such as structural and implementation knowledge, strong innovation networks, intellectual property and brand reputation in technology and innovation.
- Europe's innovative companies face global competition for technical and entrepreneurial talent, with a projected 760,000 unfilled positions for information and communications technology (ICT) professionals to 2020.
- Europe must also manage the effects innovation will have on its citizens – for example, new skill sets will be required to adapt to shifting patterns of employment.
- In many ways Europe's markets remain fragmented, despite efforts at the European level to complete the single market.

Europe needs a new ambition: to compete for global innovation leadership. In addition to mitigating issues and catching up, Europe will need to develop its own, more ambitious innovation model, anchored in its strengths. The foundations of this model are 10 fundamental building blocks for the competitiveness of its innovation ecosystem:

1. Pan-European approach
2. Corporate-start-up collaboration
3. Innovation funding
4. Enabled government and public institutions
5. Data access and protection
6. Entrepreneurial talent
7. Digital education, reskilling and upskilling
8. Gender diversity
9. Digital infrastructure and interoperability
10. Harmonized legislation and standards

But Europe cannot compete on a global level by just mimicking its competitors' ingredients for success. Many digital technologies and business models exhibit zero-marginal cost and winner-take-most characteristics, and Europe has not grown any of the large platform companies that in recent years have come to dominate the technology world and capture large revenue shares. To compete globally, it needs to achieve scale. The innovation model therefore also comprises four catalysts to change the rules of the game and achieve scale by "supercharging" across these 10 building blocks. For each catalyst, an illustrative three-year ambition for Europe was defined:

➔ Leverage industrial assets: Funding digital platforms and technologies for strategic European industries

Europe has world-leading innovative SMEs and large incumbents in key industries ripe for disruption as the application of new technologies increasingly focuses on integrating industries. To catalyse innovation, Europe could build on its existing assets and fund national industrial strategies to digitize and integrate at scale, for example through digital platforms that enable more cross-sector and cross-company collaboration. The focus should be on core industries with high potential, including basic and advanced manufacturing, pharmaceuticals, healthcare and wholesale trade.

Illustrative three-year ambition: Create cross-sector innovation strategies and platforms for high potential industries, including regulatory sandboxes for experimentation, and cumulative funding of €80 billion to eliminate the R&D funding gap with the United States.

➔ **Change data dynamics: Leading on governance for data access and trust**

European companies have amassed fewer customers and less data than non-European global platforms. To catalyse innovation and level the playing field for European innovation, Europe could open its large vaults of government-owned non-personal and anonymized data for research, while creating new governance rules that give citizens more control over their data and more companies access to them. Transparency and cybersecurity have become key concerns for citizens. Europe could foster secure platforms that make transparent which data are shared and when, and that allow citizens to change access rights for data sets.

Illustrative three-year ambition: Make at least 30% of government data accessible for research via standardized interfaces across Europe.

➔ **Boost talent: Competing with digital skills and diversity**

Europe has strong education systems and a well-educated workforce, but it also has large untapped talent pools both abroad and at home. To catalyse innovation, Europe could attract international talent through its comparative advantages in diversity and quality of life and by improving remuneration options. To tap existing talent pools, Europe could encourage female talent in technology and entrepreneurship and leverage new technologies to up- and reskill its population.

Illustrative three-year ambition: Double the number of female tech entrepreneurs, as only approximately 5% of European founders of companies that raised >€1 million were female in 2017.

➔ **Create demand at scale: Leveraging public-sector leadership in procurement and standardization**

Europe's large public sector is often seen as slowing innovation, but it offers opportunities to intervene on the demand side of innovation, for example in healthcare, education or public works. To catalyse innovation, Europe could maximize public procurement as an innovation driver, establish common digital government standards for public services and thus enable more innovation in government technology ("GovTech").

Illustrative three-year ambition: Double the share of digital innovation requirements in tenders for Europe's €2 trillion annual public procurement spend.

The ideas presented in this report are concrete ways to build momentum. They are not intended to form a comprehensive agenda but to accelerate Europe's trajectory in key areas. It will be essential to mobilize stakeholders across Europe. As a tangible start, three flagship initiatives could be launched in 2019:

- A **Women Entrepreneurship Network** to increase the diversity of talent through coaching and mentoring, leveraging existing networks
- A **Centre for the Fourth Industrial Revolution for Europe** to drive public-sector digitization, standardization and citizen-centred data access
- A **European sovereign wealth fund for innovation** to build on existing assets and scale investments.

The Digital Europe project is a collaborative effort of the World Economic Forum and McKinsey & Company. McKinsey & Company and the McKinsey Global Institute facilitated access to analyses and expertise. The ideas in the building blocks of this report were collectively developed with the Digital Leaders of Europe community.

European Innovation Model

Leverage industrial assets

Funding digital platforms and technologies for strategic European industries

Change data dynamics

Leading on governance for data access and trust

Boost talent

Competing with digital skills and diversity

Create demand at scale

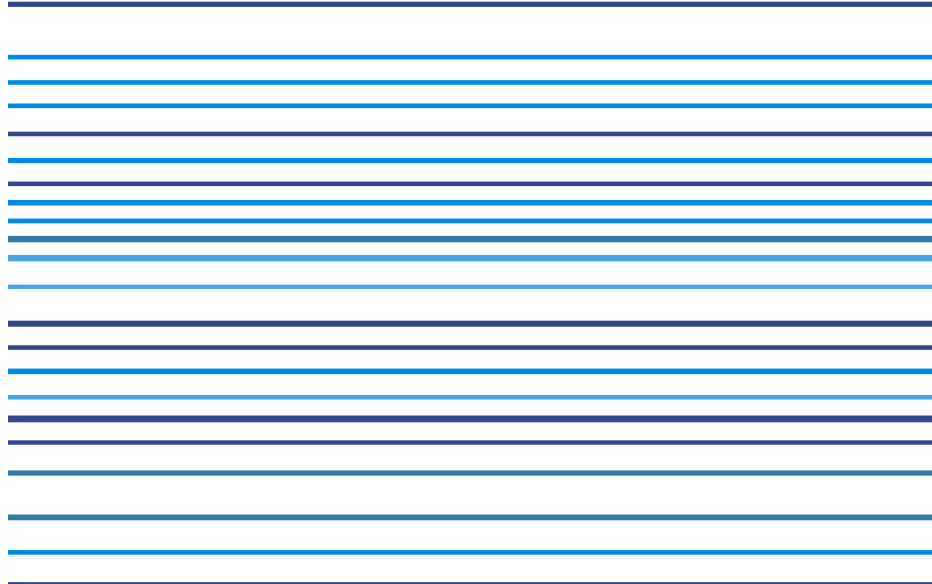
Leveraging public-sector leadership in procurement and standardization

1. Pan-European approach

Europe is still largely focused on ambitions, capital, talent and markets in a local context, but needs to develop a pan-European focus and global mindset for local ecosystems in a game of scale.

3. Innovation funding

The overall funding situation for innovation is improving, but Europe needs to address issues in quantity and quality of funding and find ways to improve large disparities in its distribution across geographies and recipients.



10. Harmonized legislation and standards

Efforts to complete the Digital Single Market, i.e. to remove barriers to scale by reducing legislative and regulatory differences across countries, need to be intensified and pan-European regulations prioritized over national directives to combat fragmentation.

9. Digital infrastructure and interoperability

Europe needs to address shortcomings in its innovation backbone with strong investment in hard infrastructure, such as 5G, and soft infrastructure, such as interoperability standards, to drive digital innovation supply and adoption.

■ Building Blocks

■ Catalysts

2. Corporate-start-up collaboration

European incumbent and new companies can collaborate with each other despite competition and join forces through investments and projects to integrate new technologies with existing assets.

4. Enabled government and public institutions

The public sector has a major role in driving and enabling digitization both within and outside public institutions, set the right guidelines and standards and foster a more innovative culture.

5. Data access and protection

With data as a key enabler for the new wave of technologies, Europe can build on its legislative track record, including GDPR (General Data Protection Regulation), to improve access and protection.

7. Digital education, reskilling and upskilling

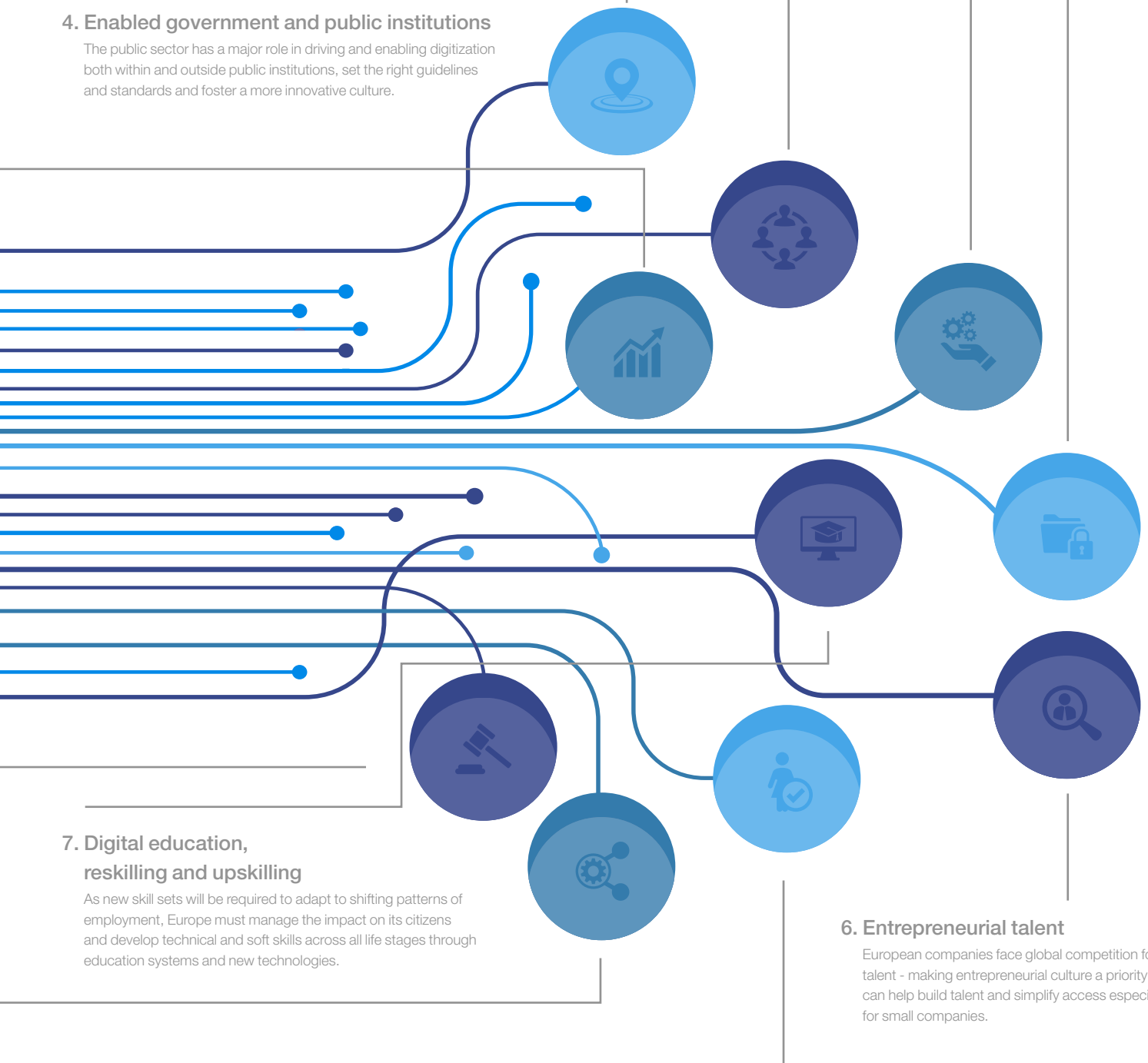
As new skill sets will be required to adapt to shifting patterns of employment, Europe must manage the impact on its citizens and develop technical and soft skills across all life stages through education systems and new technologies.

6. Entrepreneurial talent

European companies face global competition for talent - making entrepreneurial culture a priority can help build talent and simplify access especially for small companies.

8. Gender diversity

With only 5% females among founders in the European tech industry, Europe needs to address this underrepresentation through better funding, culture change and role-modelling.



Competing for global innovation leadership

The Fourth Industrial Revolution has immense potential for Europe's economy and citizens. For instance, fully implementing a digital single market (DSM) could increase Europe's GDP by up to an estimated €415 billion per year to 2025.¹ Lagging European firms, were they to double their digital intensity, could add up to €2.5 trillion in GDP in 2025.² According to a report by McKinsey Global Institute, developing and diffusing AI technology in Europe's current industrial assets to match their current degree of digitization could add up to €2.7 trillion to the European economy by 2030.³ Europe's foundations look promising. Atomico reports that, in 2017, the European tech industry workforce grew by 2.6% year-on-year, and 90% of European founders were optimistic about the future.⁴

However, labour markets will be disrupted: in 60% of today's occupations, 30% or more of activities are already automatable with existing technology, and European workers will require new sets of skills – technological, social and emotional⁵ – to make new technologies successful and mitigate job losses due to automation.⁶ New policy approaches will be needed to enable all citizens to benefit.

In the waves of new technologies it has delivered so far, the Fourth Industrial Revolution has begun to fuse the physical and virtual worlds. Bold first movers have been rewarded, with value shifting rapidly.⁷ Many digital technologies and business models exhibit zero-marginal cost effects and winner-take-most characteristics. "Superstars" – very large global companies – have captured an increasing share of revenues and grown their margins relative to other firms.⁸

Despite major efforts by countries and the European Union, Europe's innovativeness has lagged other regions, according to the World Economic Forum *Global Competitiveness Report 2018*.⁹ Europe's private investment in research and development – a major factor for innovation capacity¹⁰ – trailed the United States' by 0.4% of GDP, about \$90 billion, in 2015,¹¹ while total R&D spending has been stagnating at around 2% of GDP.¹² Europe attracted only 11% of VC and corporate investment in AI in 2016, compared to 50% in the United States, and 39% in Asia, primarily China.¹³

However, the coming wave of new technologies – from mobile supercomputing to artificially intelligent robots and self-driving cars, from brain enhancements to genetic editing – may change the cards again.¹⁴ Driven by strong competitive dynamics among firms,¹⁵ market shares may shift as the application of new technologies increasingly focuses on entire production chains and green or circular economy objectives,¹⁶ where Europe already has an edge. They will enable new opportunities for innovation in products, services, processes and business models. Research suggests that the diffusion of technology across European value chains will have a fundamental impact on innovation competitiveness.¹⁷

Europe already has strengths in some pivotal economic sectors, such as finance, advanced manufacturing and robotics, and possesses digital disruptors in such sectors as transportation and healthcare,¹⁸ but it needs to improve in other areas critical for innovation, including digital and internet-enabled services, biotechnology and semiconductors, and it needs to find ways to empower its potent base of SMEs and foster diffusion of technologies.

Europe cannot realistically hope to outcompete the United States and China on their terms, because:

- Its markets are more fragmented, making it harder to offer the same scale
- It lacks deep-pocketed tech giants to fund the next wave of innovation
- Its citizen-focused regulatory stances and mindsets can slow the radical disruption of business models
- Its governance structures make heavy public investment and intervention more challenging or slower than, for example, in China.

For Europe to have a chance for success in becoming a world leader in digital innovation in this coming wave of the Fourth Industrial Revolution, it will need to catalyse its own strengths. These include a highly skilled population, including in science, technology, engineering and mathematics (STEM); a history of collaboration and standard setting; an industrial base that is leading in many manufacturing and service sectors and has many market leaders among its SMEs; and a public sector that provides many critical services to citizens.

Key catalysts to achieve scale

There is no silver bullet to achieve scale and make Europe competitive in global innovation. A concerted, pan-European effort is needed to catalyse innovation at all stages, driving the supply of, diffusion of and demand for innovation. These catalysts are not meant to be exhaustive but represent opportunities for Europe to make bold moves.

Leverage industrial assets: Funding digital platforms and technologies for strategic European industries

Europe has a large base of established companies and a network of successful SMEs but resembles a sleeping giant – it needs to wake up to the full force of digitization. In 2016, Europe underperformed on its digital potential relative to the United States, with the European economy's overall digitization at only 60% of the US economy, according to an analysis by the McKinsey Global Institute.¹⁹

Large European players are often challenged by regulatory differences between countries and find it difficult to integrate across sectoral boundaries. Private R&D funding has largely concentrated on lower-growth sectors, in contrast to the United States, which focused on high-growth sectors such as biotechnology and computer hardware and software.

Medium-sized companies in Europe are often innovative and exhibit symbiotic effects with large players in certain sectors, such as biotech and industrial supply chains.²⁰ However, they tend to be less digitized than larger firms, including in the B2B and services sectors.²¹ Access to finance is a concern for them,²² as is access to resources for scale and interoperability to enable cross-sectoral integration along supply chains.

For small entrepreneurial firms and start-ups, the main barriers to scale include financial constraints – especially the shortage of late-stage funding – difficulties in hiring talent and handling cross-border regulatory differences.²³ The lack of scale explains Europe's significantly smaller share of unicorns (<15%) than the United States' (47%) and China's (30%).²⁴ Start-ups need more opportunities to collaborate on digital platforms, pilot innovation at a large scale and engage in public-private partnerships.²⁵ They can play a key role in generating radical innovation.²⁶

Europe should focus on strategic industries that are well prepared to advance in digitization. These include leading sectors, such as healthcare and financial industries, but also advanced and basic goods manufacturing, chemicals and pharmaceuticals, and wholesale trade.²⁷

To catalyse scale, Europe could:

- **Provide funding to expand breakthrough innovation.** To foster the adoption and commercialization of innovation and support industry to build its own platforms, European

governments could fund mission-based platforms in well-known critical innovation areas, such as mobility. Funding for large-scale innovation is required, ideally across all stages, with transparent and clear conditions, and in sufficient amounts since the industrial sectors best prepared for digitization are often capital intensive.²⁸

- **Foster cross-sector collaboration.** European companies could establish cross-sector platforms that allow players – from large corporates to SMEs – to collaborate by providing access to key capabilities in analytic tools and standardized interfaces to access tools and exchange data.
- **Create dedicated, coordinated European testing areas (sandboxes) for key technologies.** Local geographies could pick key technologies and create safe spaces in which businesses can test innovations on a temporary and geographically limited basis. Sandboxes can help innovative firms to cope with regulatory obligations in real-life situations and enter a two-way dialogue with regulators. If coordinated among European states, the sandboxes could also be used to develop new, smart European regulations based on the lessons learned in real-life conditions and drafted in disruption-friendly terms.

Europe's three-year ambition could be to institute innovation strategies for at least five strategic sectors, with dedicated platforms, established sandboxes for experimentation and total cumulative funding of at least €80 billion. This would eliminate Europe's R&D spending gap with the United States.

An example worth scaling: European Automotive-Telecom Alliance for cross-border, cross-sector collaboration

The European Automotive-Telecom Alliance includes large telecom operators, vendors, car/truck manufacturers and suppliers, and promotes the scaling of connected and autonomous driving. Projects have gotten under way to test concepts such as highway chauffeur, coordinated truck driving, LTE (4G) broadcasting and cross-border highway networks.²⁹ Similar initiatives could be fostered across other breakthrough technologies and sectors, for instance in healthcare.

An example worth scaling: Regulatory Sandbox of the UK Financial Conduct Authority

The Financial Conduct Authority (FCA), the United Kingdom's financial services regulator, created a regulatory sandbox in 2016, a safe environment particularly for FinTech start-ups to test products and services before widely launching them on the market. Among the technologies tested were online platforms, biometrics and distributed ledger technology (blockchain). According to the FCA, 90% of firms in the group that received participation approval progressed to a wider market launch.³⁰

Change data dynamics: Leading on governance for data access and trust

Data are a key resource for innovation and business success, to ensure the quality of research and apply it at scale.³¹ Free flow of data could contribute 0.5-1% of growth for European countries, according to Bughin.³² Access to large amounts of data will be paramount:³³ in healthcare, for example, data availability can increase the effectiveness and efficiency of R&D and clinical trials and overall drug effectiveness. In China, recent regulation mandates companies to share transaction data with competitors through a central clearing house, with the aim of promoting competition and innovation.³⁴

Previous waves of innovation have led to a few large US-based players providing digital platforms for tech-enabled services to half the world's population, due to their winner-takes-most characteristics.³⁵ As data has largely been harvested by these platforms, European companies have built comparatively small repositories of data, platforms and customer networks. The large global platforms are now beginning to integrate stakeholders and data across industrial boundaries, value chains³⁶ and geographies, creating a new dynamic, driven by economies of scale. This dynamic could create an unequal playing field for innovation for European companies, and raises concerns about privacy and data protection: citizens have to trust the institutions that govern them and that hold their data.

Altering this dynamic would be a game changer for Europe. With its General Data and Privacy Regulation (GDPR), the European Union demonstrated that citizens can be empowered, and this has the potential to change the economics of entire industries.³⁷ Europe could use its track record on governance and standard setting to support a level playing field for small and large, new and established innovators, and renew citizens' trust in sharing non-personal and anonymized data.

To catalyse scale, Europe could:

- **Foster transparent and secure platforms for citizen data.** European governments could foster the creation of secure platforms for reaching B2B and B2C customers that enable citizens to store, administrate, share and unshare data with government and private entities. More trust and transparency could enable citizens to share data consciously.

- **Open government data vaults.** Governments and academic institutions could lead in providing access to quality data sets through open interfaces that give other institutions and companies a level playing field for innovation. It would be natural to start with open government data, including transportation, smart cities and healthcare, before extending to traditional businesses, such as financial services. In doing so, it is important to address the risk of merely shifting power from incumbents in traditional businesses to large digital aggregator platforms.³⁸

As yet, data are only sporadically available for research and innovation. Europe's three-year ambition could be to create standardized interfaces for at least 30% of data owned by public institutions and allow access to authorized organizations.

An example worth scaling: DECODE aims to change citizens' relationship to data in Amsterdam and Barcelona

Funded by the European Commission, DECODE aims to change the relationship between users and data-collecting platforms. Between 2017 and 2019, Amsterdam and Barcelona are building technology to give citizens more active involvement in how their data are used.³⁹ Citizens will get a digital interface ("wallet") and blockchain technology will enable them to set "smart" rules for what projects can use their data, and how.⁴⁰

Boost talent: Competing with digital skills and diversity

The talent and skills to collaborate across industries and traditional B2B and B2C boundaries will be key to applying the next wave of new technologies to complex industrial structures, networks and supply chains. European workers will increasingly require collaborative skills and the capacity for continuous learning,⁴¹ as well as skills in complex problem-solving, critical thinking and creativity.⁴² The challenge is significant: in 2017, 37% of Europe's labour force lacked basic digital skills, with 11% having no digital skills at all, and demand for digitally skilled employees is growing by about 4% annually.⁴³ Reskilling Europe's current workforce will be a major challenge for national governments and the European Commission.

Creating, attracting and retaining sufficient professionals proficient in new technologies will be necessary to gain a competitive edge. For example, the lack of skills is a significant roadblock for AI adoption: Globally, only 22,000 PhD-level computer scientists are capable of building AI systems, and many large companies are competing to attract them – at least 10,000 open positions exist in

the United States alone.⁴⁴ Meanwhile, 64% of European companies surveyed by McKinsey reported in 2018 that the adoption of AI must be directly tied to digital capabilities built to operate previously adopted digital technologies.⁴⁵

Attracting more international talent – including Europe-grown talent now based in other regions – can contribute to Europe’s economic growth and build bridges to global markets.⁴⁶ With fierce competition for talent, exploring diverse talent pools becomes ever more important; notably, women are systematically underrepresented in technology entrepreneurship.⁴⁷ Increasing female work activity in general contributes significantly to GDP,⁴⁸ and female entrepreneurs in particular could boost innovation through better-performing teams and more inclusive innovation.⁴⁹

To catalyse scale, Europe could:

- **Reverse migration flows and attract international entrepreneurial talent.** European governments and companies need to develop a more consistent approach to attracting tech talent, leveraging Europe’s comparative advantages in diversity and quality of life.⁵⁰ They could work to further remove barriers to hiring – especially for SMEs and start-ups that lack the capacity to search for foreign talent. Top talent also seeks competitive rewards; raising funding levels for innovative firms or simplifying rules for stock option remuneration to let talent participate in the success of their companies will be important for European firms to be able to attract top talent.
- **Leverage new technologies to re- and upskill workers.** European countries and employers could not only rely on existing education systems, but also use digital technologies to achieve scale in reskilling workers in non-digital sectors and upskilling workers for new skills, including soft skills.
- **Increase the level of talent diversity, including female STEM talent, and attract women to become tech entrepreneurs.** European governments could aim to provide more incentives for women to enrol in digital engineering classes, and work to provide inspiration and knowledge through strong female coaching and networks. They could also retain talent through sufficient start-up funding and promote successful female entrepreneurs as role models.

Only about 5% of European founders of companies that raised >1€ million in 2017 were female,⁵¹ which amounts to approximately 50 women receiving seed or series A funding in total.⁵² Europe’s three-year ambition could be to at least double that number.

An example worth scaling: Online coding lessons for young people

42 is a self-serve programme for students aged 18 to 30 to learn computer programming using project-based and peer-to-peer methodologies, open 24 hours a day and leveraging new technologies.⁵³ The programme has started to scale into other countries, including Romania, Bulgaria and Belgium. BeCode is a similar project, backed by the Digital Belgium Skills Fund, which offers free coding lessons to disadvantaged youth.⁵⁴

Create demand at scale: Leveraging public-sector leadership in procurement and standardization

Europe’s large public sector is often regarded as an inhibitor rather than driver of innovation. However, it can play a primary role in two important areas.

First, the public sector can be a role model for the adoption of innovative technologies. Government procurement can create large and stable demand long before a commercial market is possible. Other regions have seen massive public investment in new technologies. This begins with encouraging innovative companies to bid in requests for proposals, opening government processes up for co-creation, and heavily investing in digital technologies, such as cloud computing and blockchain to increase demand. Including new players in major contracts can help create a more diverse development and production ecosystem.⁵⁵ High-potential areas for Europe include digital government, e-health, education and public transport.⁵⁶

Second, the public sector can serve as an enabler for innovation through the provision of standardized core digital services, or “soft infrastructure”. By harmonizing standards and driving the implementation of the DSM, Europe can enhance the availability and usability of government services, encourage the development of new solutions and deliver tangible value to citizens.

To catalyse scale, Europe could:

- **Leverage public procurement rules.** In areas such as healthcare and public construction works, the public sector could mandate – or purchase – digital approaches and services at scale. For example, many governments already mandate the use of Building Information Modelling in public construction.

- **Implement a digital-by-default principle for public services.** European governments and public entities could increase innovation adoption and demand by stipulating the use of digital technologies in government service delivery. For example, any newly implemented process could be designed for digital delivery and consider use of technologies such as blockchain or AI, without specifying a particular technology to allow for creative implementation ideas.
- **Drive convergence on standards.** To enable innovative companies to develop GovTech solutions, European countries, regions and cities could drive open service platforms following an interoperability-by-default principle and open government interfaces, beginning in strategic areas such as healthcare. This means companies can develop new services that can be integrated with existing public services and add value for citizens in a transparent, controlled and inexpensive way.

European public procurement for public services and products amounts to 14% of GDP annually, equal to approximately €2 trillion.⁵⁷ Europe's three-year ambition could be to double the share of digital innovation requirements in its public procurement tenders.

Examples worth scaling: Electronic Identification, authentication and trust services (eIDAS) in the Netherlands and Estonia

The European Union's eIDAS initiative aims to enable secure transactions between citizens, government agencies and businesses.⁵⁸ In the Netherlands, this has triggered a large-scale cross-border eID project, connecting 200 public services of around 100 municipalities that can be accessed with nationally issued eIDs of 32 countries. As a result, private businesses are beginning to offer eID to simplify log-ins and transactions for customers.⁵⁹ Estonia developed the world's most advanced national ID card system, with a mandatory card providing secure digital access to almost all citizen-oriented government services.⁶⁰

Building blocks for European innovation

1. Pan-European approach

Technology companies need the ability to scale across Europe

The previous generation of tech companies flourished mostly in the industries that were easier to conquer, either because the industry itself was new – for example in online content, communication and gaming – or it was not well developed in a particular region. In China, for example, the retail sector's relative lack of development aided the rise of Alibaba. Proactive government industrial policy also helped, as with China's Xiaomi. Europe did not grow tech giants in these easy-to-conquer sectors.

Still, many industries provide opportunities for Europe to produce leaders in the next generation.⁶¹ Europe needs to position itself proactively, especially as its lack of previous generation tech companies has resulted in a dearth of role models and investors.

Scaling on a pan-European level is essential for tech companies to be competitive globally, but this requires uniting the comparatively small European countries. In the right surrounding conditions, tech companies can grow cost-effectively with very low marginal costs, and digital technologies can quickly expand to new markets – even companies that begin in smaller markets can thus emerge to become global leaders.

Achieving scale requires a pan-European approach

For a business to scale takes ambitious founders and leaders, access to capital, access to talent⁶² and access to markets.⁶³ In each of these factors, a pan-European approach is needed across all levels of the ecosystem. The following challenges should be addressed:

Ambition and rebellion: European countries have very different attitudes and cultural norms towards risk-taking and challenging the status quo. This makes it more difficult for people to band together. When consumers and institutional frameworks react differently to disruptive ideas, this also complicates the challenge of achieving scale.

Capital: A few VC firms with a pan-European focus exist, such as UK-based funds Index Ventures, Accel Partners, Balderton Capital and Atomico,⁶⁴ but their number is not yet sufficient to create a deep, liquid market for capital for pan-European start-ups. Local funds are often constrained by their strategy, focus, ability or preference to invest only in local start-ups, and large companies from other countries often do not consider local companies based elsewhere, thus limiting exit opportunities that can be key to attract further investment.

Talent: Europe has abundant tech talent, but cultural and regulatory barriers make it complicated for growing firms

to hire across borders. In comparison to countries such as the US and China, which are relatively unified by a common language and culture, individuals can find it hard to move from one European country to another. Only 18.7% of start-up employees are currently from other European countries⁶⁵ and only 16.2% have founded a start-up outside of their home country.⁶⁶

Markets: Corporate and tax laws are highly heterogeneous, making it difficult for companies founded in one legal framework to expand across borders. According to the *European Startup Monitor 2016*, currently 45% of revenues are generated in start-ups' home countries, and only 31% from elsewhere in Europe.⁶⁷ Entrepreneurs need to be strategic about where they incorporate and how they manage their capitalization tables.

Ideas for switching from local to pan-European scale

Europe should aspire to truly connect local ecosystems, enabling them to complement each other's strengths, fostering exchange and innovation while saving time and resources.

1. European institutions, national governments and local ecosystem builders could **help create a positive narrative for European entrepreneurship and innovativeness** by showcasing success stories. For example, short online videoclips could aim to inspire a pan-European or even global thinking process about creating and developing a business. The European Union could facilitate building a platform to connect regional officers, investors and corporates.

Existing examples that could be scaled:

- #NordicMade – a network of start-up ecosystems that collects success stories from Nordic countries and advertises them on social media⁶⁸
- Start-up alliances – such as the Sharing Cities Alliance, Cities for Digital Rights, Allied for Startups, European Startup Network (ESN) and the Startup City Alliance (SCALE), that help create and disseminate such a narrative in their local and national networks

2. European governments could **encourage founders to start with pan-European scope**, to consider incorporating in other European countries. Founders should contemplate incorporating in other European countries early, while thinking globally rather than locally from the outset.

3. Large tech events could **collaborate on building a strategy that presents Europe as one ecosystem**, and support cooperation through targeted side events aimed at promoting cooperation among ecosystems.
4. European and national policy-makers could **foster the rise of pan-European technology companies** by looking for ways to compensate for Europe's current fragmentation. For example, financial support could be conditioned on start-ups quickly expanding into other European markets.
5. Major innovation hubs could **combine their stakeholder databases into one digital collaboration network**, sharing their knowledge across borders. This could become the springboard for a permanent pan-European network to promote new ways of collaboration between verticals (incubators, accelerators, VC and start-ups) and across ecosystems.

Existing examples that could be scaled:

- Startupbootcamp provides tech-specific acceleration programmes across Europe and internationally.⁶⁹
- The European Institute of Innovation & Technology (EIT) provides access to co-location centres across Europe for joint meetings and projects, and connects enterprises, SMEs, start-ups, universities and research centres across Europe.⁷⁰
- The European Commission is boosting the creation of Digital Innovation Hubs that orchestrate regional ecosystems around specific supply chains or specialization areas.⁷¹

2. Corporate-start-up collaboration



Corporate-start-up collaboration could be an important success factor for Europe

An innovative European economy rests on both established corporates and new companies. Collaboration between the two can become an important success factor for Europe in a global environment that demands speed in implementing innovations and conquering new market segments, and in which promising companies and technologies may be controlled by non-European players. Chief executive officers of both corporates and start-ups may have strategic goals that put them at odds, but the case is strong for each to explore partnerships with the other.

For **start-ups**, collaboration with corporates can provide access to alternative sources of funding in addition to VC, as long as it does not create conflicts for a potential exit at later stages. It offers potential access to a large customer base for expansion, attractive new sales channels, access to the corporate's market insights and technical capabilities, and opens up the opportunity to use proprietary corporate assets such as data. Collaboration can reduce a start-up's risk exposure and provide opportunities to validate ideas in specific customer segments.⁷²



Investors in start-ups look too much at technology and not enough at markets. The fastest route to market is to sell to corporations.



Eurico Neves, President, Inova, Portugal

For **corporates**, collaboration with start-ups opens opportunities to work in a more entrepreneurial way with an agile culture and to overcome the difficulty for established businesses of disrupting from within.⁷³ This can speed up rethinking the status quo, trigger cultural changes and accelerate internal projects. It can be an opportunity to gain access to more innovative suppliers and talent and to help stay on top of market developments by testing ideas more quickly. Collaboration can be a source of innovation to drive a digital transformation and ensure competitiveness.⁷⁴



Corporates often think they can only engage with start-ups through corporate venturing, because many misunderstand what start-ups are. (...) They are ready to provide products, help corporates cut costs, be very good suppliers. We want to help corporates understand that working with start-ups can be a way to embrace innovation today.



Giuseppe Zocco, Partner and Co-Founder, Index Ventures, Switzerland

Both sides can leverage collaboration to improve brand perceptions and focus on core capabilities. Corporates and start-ups co-innovating and exploring future paths together could create a win-win scenario for both sides,⁷⁵ and help Europe to become more competitive with a healthy balance of corporates and start-ups. The number of unique corporate investors in Europe more than doubled from 2015 to 2017 to a total of 580, and could grow further.⁷⁶

Collaboration presents challenges that need to be overcome

To make collaboration work, challenges need to be overcome: For start-ups, these include corporate sales cycles that do not match their need for quick results and revenue; difficulties in navigating corporate organizational structures and business units working in silos; protective middle management and power structures making it complicated to engage corporate teams; establishing trust when products are not yet proven, references are not available and a lack of resources constrains the ability to offer free trials; and continuing a collaboration with the core business after development of a proof of concept.

For corporates, challenges include winning the support of senior management in relevant business units to make collaboration a key strategic decision; a lack of understanding of how certain business segments might be about to be disrupted, and what kind of internal changes may be necessary to adapt; and a corporate culture that does not incentivize risk-taking and heavily punishes failure, making it difficult to implement innovations from start-ups in a useful way.

A key ingredient is creating the right mindsets: for start-ups, to leverage corporates to achieve scale more quickly; for corporates, to leverage start-ups to accelerate cultural change, digital transformations and innovativeness. One-third of European accelerators were already supported by corporates in 2015.⁷⁷

Ideas to improve corporate-start-up collaboration

Europe should aspire to overcome these challenges and remove barriers to collaboration by creating a shared understanding among start-ups and corporates.

1. Industry associations and chambers of commerce could come together with local accelerators and innovation hubs to **develop clear guidelines that educate both sides on the nature and benefits of corporate-start-up collaboration** and improve the understanding of each other's positions. Start-ups should be represented in associations to improve mutual understanding and the exchange of collaboration opportunities. This can also help mitigate conflicts of interests that arise when companies abandon projects after a pilot phase to pursue them outside of the partnership.
2. European governments and academic institutions could seek to **fund initiatives that require corporate-start-up collaboration, such as competitions focused on specific sectors**. These could involve fiscal or tax benefits, and mandating senior management commitment could help both sides to develop the right internal incentives for collaboration.

Existing examples that could be scaled:

Germany is building implementation-oriented campuses that mandate collaboration in exchange for participation in research; for example at the Technical Universities of Aachen and Karlsruhe.⁷⁸

The Netherlands Enterprise Agency is operated by the Ministry of Economic Affairs and supports entrepreneurs, including with international business and networking.⁷⁹

3. European governments could **foster neutral platforms to connect start-ups and corporates and encourage all stakeholders to exchange ideas**. Such platforms can attract start-ups that do not want to get involved in relationships with a single corporate, but they will only work if start-ups and corporates take on a leadership role.

Existing examples that could be scaled:

The Startup Europe Partnership is a European Commission-backed open innovation platform run by organizations from various countries that connects young European scale-ups with senior corporate decision-makers across Europe.⁸⁰ Corporates connected to young companies include BBVA, Microsoft and Enel. Startupbootcamp, an accelerator, works with corporates to develop ideas and businesses, and helps them get excited about innovation and identify start-ups for potential collaboration.⁸¹

3. Innovation funding

Capital is a key need for European innovation

Funding is one of the most important enablers for Europe to drive innovation by increasing digital value creation and the number of scaled-up companies. Funding typically needs to cover several stages of innovation, with various kinds of investors coming into play at each stage:

- Early-stage investors provide pre-seed and seed capital for start-ups that have just begun to develop an innovative idea. They are primarily angel investors, but increasingly include forms of equity crowdfunding.
- At a second stage, larger investments are needed to develop prototypes into products and enter the market. This stage is dominated by VC firms and can be divided into multiple rounds, reflecting changes in valuations as a company grows.
- In later stages, companies need money to expand across markets and regions and develop new products. These later stages are covered by later funding rounds of VC funding but can also include institutional investors.
- A final form of funding might be an initial public offering, selling stock to investors.

Tech funding in Europe has leapt forward, but challenges remain

Europe's funding situation for technology start-ups has strongly improved, with total capital invested growing by over 400% in the last five years.⁸² A total of \$19.6 billion was invested in European technology companies in 2017,⁸³ and a further increase by 21% to \$23 billion is estimated for 2018.⁸⁴ However, Europe still lags behind other regions, notably the United States and Israel, on a GDP-adjusted basis.⁸⁵ Four key challenges exist:

- **Scale:** The gap in seed funding between the US and Europe has narrowed, but still stands at a multiple of 1.6. In 2016, VC investment was five times higher in the United States than in Europe, and the average size of US funds was three times as large.⁸⁶ This makes it harder for European firms to find sufficient funding for fast growth. A deeper pool of sophisticated investors is required for Europe to compete with the United States and Asia.
- **Distribution:** Capital varies significantly between regions: 90% of the European Union's supply of VC is concentrated in just eight Member States. Mature hubs, such as London and Berlin, primarily face challenges with late-stage funding, while hubs in southern and

eastern Europe are in need of angel and seed funds and are largely underrepresented in VC portfolios. Cross-border investments are partially addressing this challenge, with one-third of investments now being made across borders.

- **Quality:** Overall, 19% of companies progress from seed funding to series A funding, but that figure is 40% for companies funded by top-quartile seed investors compared to 6% for bottom-quartile investors.⁸⁷ The failure rate of companies that seek funding through initial coin offerings (ICOs) remains high, but Europe is beginning to become a hub of excellence in this field⁸⁸ and could gain access to a new pool of capital.
- **Source:** The share of public funding in VC is much higher in the European Union than in the United States – it more than doubled from 2008 to 2014, and typically favours local companies. Conversely, institutional investors, such as pension funds, invest much less VC in Europe, for reasons that include a lack of understanding of start-ups as an investment class and capable VC investors working on their behalf. This large potential source of funding is as yet untapped.

Ideas to foster European innovation funding

Europe should aspire to build on its strengths in innovation funding, taking inspiration from what is working to set guiding principles, and create a more collaborative environment for investors:

1. The European Union could **unlock institutional investment** by creating a conducive regulatory framework, eliminating friction and providing incentives for more liquidity. Following the example of the United States, European pension funds and insurance funds could be incentivized to allocate a certain percentage of capital under management to European venture investments.
2. Governments, in collaboration with local hubs and investors, could **improve the know-how of institutional and first-time angel investors** ("LPs", short for limited partner) regarding the asset class of start-up and venture investment by streamlining knowledge across European ecosystems. Support from the existing LP community is needed to anchor new managers.

3. Investors and governments could **address the mismatch between typical VC funding round sizes and the large-scale investments** that LPs typically undertake, e.g. by improving the conditions for existing funds of funds – investment vehicles bridging the gap between institutional investors and smaller funds by raising funds at scale and investing into veracious smaller VC funds – with less restrictive terms and faster movement than existing ones.

Existing examples that could be scaled:

The Danish Growth Fund invests equity and provides loans and guarantees for SMEs in collaboration with private partners and Danish financial institutions.⁸⁹ Calls for similar funds or funds-of-funds that are suitable for institutional investors are being discussed in other countries, including Austria and Switzerland. The VentureEU funds-of-funds, established in April 2018 and backed by €410 million in EU funding, aims at collecting institutional investments through six different funds.⁹⁰ The terms have been found to be restrictive for some investors.

4. Government-funded and privately funded VCs and corporate funds could **incentivize cross-border investments and equalize funding opportunities** to increase scale. Cross-border investors could be rewarded with tax incentives or matching mechanisms from public funds. To facilitate this, investment regulations need to be harmonized across countries, or at least made more transparent. Funds and angel investors from different markets could be connected to build trust and enable the development of pan-European syndicates. Funds need to be deployed both into existing VC managers and support emerging ones to increase the diversity of the investor landscape.

An existing example that could be scaled:

The UK's Enterprise Investment Scheme has fuelled growth in Series A funding by offering tax relief to individual investors who buy new shares in a company. Extending similar schemes across borders and to larger, later-stage rounds of funding would increase the available capital for the most promising scale-up companies.⁹¹

5. European governments could **develop clear frameworks for innovative funding instruments** where none yet exist, such as ICOs: Europe has the chance to be first to clarify, legitimize and lead this new funding methodology by setting an example, through a European pilot fund on blockchain.
6. The European Union could **simplify access to public funding by streamlining the large number of existing instruments into a one-stop shop**, making it easier for firms to navigate the different requirements for each instrument. One concrete action is to remove criteria that exclude founders who have previously failed in start-ups, as many success stories follow from failures.

4. Enabled government and public institutions

The public sector can help Europe to remain competitive

Governments have traditionally innovated in incremental steps, as they operate on a massive scale, and bold change can incur large negative consequences. However, given the current pace of technological and social change, marginal improvements may no longer be able to make meaningful changes in citizens' lives.⁹² European governments need to take a smarter role, making policy and legal systems more adaptable to change. Agile governance creates risks, however, and thus needs to be inclusive and sustainable.⁹³

When it comes to innovation, the public sector has multiple roles, including the following, according to the OECD:⁹⁴

- 1. Experimenter and driver:** The public sector can spearhead innovation and speed the adoption of new technologies by creating new markets. Governments support applied research, provide early-stage funding and play a key entrepreneurial role: in the United States, for example, nanotech and biotech are among the fields being advanced by public institutions, including NASA, the Small Business Innovation Research programme, and the National Science Foundation.⁹⁵
- 2. Protector and regulator:** Europe leads in setting values-based standards, from cybersecurity to data protection and privacy of electronic communications. Governments are expected to lead the discussion on the ethical use of data, especially as government itself is increasingly data driven.
- 3. Scout and convener:** Governments can bring stakeholders together around specific problems, require the use of digital tools in interaction with public services, or leverage innovative companies to deliver citizen-centred services. The public sector's role of a "launching customer" in procurement could create innovation demand and have a strong influence on culture, norms and ideals in society.



With its legislation proposal on the free flow of data, Europe demonstrates global leadership in agile governance. It can build out this role by defining a common approach to other areas of technology where regulations are now unclear or non-existent, such as AI and self-driving cars. The public sector should also lead by example in fostering innovation by experimenting with technologies and increase the offering of digital services across borders. Pan-European initiatives can build on Europe's existing frontrunners in e-government.



Jüri Ratas, Prime Minister of Estonia

Ideas to make the public sector an innovation role model

Europe should aspire to provide a positive narrative for digital innovation, moving towards agile policy processes, and embrace disruptive innovation e-government.

1. European governments could **enshrine in legislation the digital-by-default principle for public services**, conceiving new public services in a digital form and encouraging citizens to interact digitally. This means that current paper-based processes need to be redesigned from ground up to capture the full value of digital technologies. Similarly, governments could adopt a **no-legacy policy** that requires the redesign of processes and corresponding information systems and provides the technical backbone for new services and open government.

An existing example that could be scaled:

The "X-Roads" platform allows Estonia's various public and private sector e-service databases to link up and function in harmony. It effectively implements the once-only policy across the entire government ecosystem and improves resilience by keeping data where it is generated and allowing it to be queried, rather than by making copies.⁹⁶

2. Governments could **enable and encourage innovative companies to deliver services with new technologies**. For example, governments could incentivize agile development through fast, iterative improvements, testing ideas first with proofs of concept. Procurement processes would need to become more accessible and interactive with short feedback cycles. To facilitate, governments could develop open interfaces (APIs) that allow services from private companies to be quickly integrated into existing public services offerings. The European Union could help governments and innovative companies to match technologies and ideas with demand for a public service solution through an online platform.

An existing example that could be scaled:

In the United Kingdom, the Bank of England's FinTech Accelerator project includes work on proofs of concept with innovative companies, while the Financial Conduct Authority's Project Innovate aims to tackle regulatory barriers to allow technology companies to innovate.

3. Public institutions could **nurture an experimental culture**. To make innovation ecosystems more adaptable and resilient, innovation needs to be tested in action, with room for failure and learning built into procurement processes. European governments should **build in-house talent**, including digital leadership skills among top public servants, and digital skills in the public administration more generally. To attract young talent, governments could offer flexible employment schemes that allow changing roles frequently.⁹⁷

5. Data access and protection

Data access and protection are paramount for innovation

Access to data, both personal and non-personal, has become key to economic growth. It enables research and innovation in new technologies, particularly AI, and underlies many applications that are already a familiar part of life. To reap the full benefit of big data analysis, large quantities of data must be available.

However, the dynamics of the data economy have so far tended towards concentration: large firms have accumulated bigger and better-structured data sets, along with more resources to deploy them to develop new technologies and business models.⁹⁹ Access to data has become difficult particularly for European SMEs.

Policy-makers have recognized this challenge.⁹⁹ Some countries have begun to make public agencies' large data sets available, in downloadable and machine-readable form, to the public or to specific qualified entities.¹⁰⁰ The European Union has improved access to data through mandated interfaces in the financial industry with its Payment Service Directive (PSD 2),¹⁰¹ which might serve as a catalyst for innovation.¹⁰²

Protecting individuals' privacy is critical to the success of these efforts, as is data protection more broadly to the goal of increasing access to data. The GDPR has improved European citizens' ability to control who can access their personal data. In practice, however, it remains a challenge to ensure full transparency over vast amounts of data.

Data protection concerns have led many European countries to impose localization requirements, limiting when data – especially data held by public institutions and not critical for public security – can be stored or processed outside national borders. With its recent regulation on the free flow of non-personal data, adopted in November 2018 and going into force in May 2019, the European Union is taking a major step towards addressing these concerns, deregulating and harmonizing data exchange and creating a common European data space.¹⁰³ According to the new rules, any other data that is not related to an identifiable person can be stored and processed anywhere in the European Union, and the portability of data between cloud providers is simplified. It is hoped to generate substantial GDP growth.



The free flow of non-personal data *de facto* establishes data as the fifth freedom of the EU Single Market. By removing borders, burdens and barriers such as data localization rules, we enable a level playing field for European companies to compete globally.



Anna Maria Corazza Bildt, Member of the European Parliament, Strasbourg

Ideas for maximum access to data and high levels of protection

Europe should aspire to ensure an open and secure internet for all and to level the playing field for innovation companies by creating rules for data access and exchange, as the movement of data grows in volume and importance.

1. European governments could **make data held by public institutions available as a resource** by investing in data quality enhancements and sharing platforms, starting in high-impact sectors, such as healthcare and public services. If made open, publicly held data could enable not only large amounts of economic value but could also set the tone for openness among other institutions.¹⁰⁴

Existing examples that could be scaled:

Israel is digitizing its citizens' personal health records in partnership with European software company SAP.¹⁰⁵ The government plans to create a database for academics and healthcare companies to use in the development of new drugs and personalized care. Doctors are able to access clinical data on almost the entire population.¹⁰⁶ The Swedish innovation agency, Vinnova, is backing a project with Swedish start-up 1928 Diagnostics to share genetic data from bacteria between countries. Key objectives are to understand the spread of bacteria by tracking and comparing genetic patterns, validate meta data sharing regarding legal and security aspects, and evaluate possibilities and obstacles for cross-country data sharing.

2. European governments, investors and local hubs could **help educate entrepreneurs and innovators** on what data exist and are accessible, especially data from government entities. This could be done, for example, through meetings, workshops and intense workshop series (“code-a-thons”).¹⁰⁷
3. The European Union could **explore ways to give citizens and businesses more control over data**, allowing them to manage data held by the public administration – for example, to access data, see when it is being used, submit corrections and authorize use and re-use. Promoting citizens’ individual and collective ownership and governance of data will require an analysis of the legal and technical solutions. This could increase transparency and control for citizens and enable individuals and companies to make data sharing secure and easy to understand.
4. The European Union could **develop horizontal organizational, technical and legal** standards to lay the practical basis for cross-border data exchange, building on the free flow of non-personal data regulation. To facilitate their development, data-sharing legal agreement templates could be devised that are easy to use and designed to comply with the legal systems of all EU countries. This could improve access to high quality, unbiased data that can feed into AI and machine learning technologies, starting with general principles that can later be adapted for individual sectors.
5. To improve the availability of data, government could **incentivize companies to share non-personal data**, for example through tax incentives or official recognition. Innovative ideas, like the possibility to pay taxes through data, could be explored. A start could be the development and implementation of data providers’ codes of conduct to facilitate data sharing. For example, the European Commission has started to encourage this form of self-regulation for cloud service providers.¹⁰⁹
6. All European governments **could invest in building internal capacity by employing, training and retaining in-house talent** with an excellent understanding of technologies, such as big data or AI.

An existing example that could be scaled:

Mydata.org is a civil society initiative that originated from Open Knowledge Finland but has now evolved into a larger network that spans multiple countries to empower individuals with personal data.¹⁰⁸ Pilots endorsed by the Finnish and Estonian governments test out concepts that give citizens more control over their data, e.g. health data in Estonia.

4. The European Union could **develop horizontal organizational, technical and legal** standards to lay the practical basis for cross-border data exchange, building on the free flow of non-personal data regulation. To facilitate their development, data-sharing legal agreement templates could be devised that are easy to use and designed to comply with the legal systems of all EU countries. This could improve access to high quality, unbiased data that can feed into AI and machine learning technologies, starting with general principles that can later be adapted for individual sectors.

6. Entrepreneurial talent

Entrepreneurial talent is key for Europe's innovation economy

Talent is Europe's most critical resource for sustainable competitiveness and innovativeness. As a knowledge economy, Europe depends on highly skilled people,¹¹⁰ particularly for technology companies, where entrepreneurial and business acumen matters alongside technical and scientific knowledge.

Entrepreneurial minds with the motivation and skill set to turn knowledge and research into a business proposition are necessary for every successful enterprise. Entrepreneurial talent can be developed within Europe and attracted from elsewhere. Within Europe, building the right skill sets to **create a new company** is the first part of the challenge. According to a 2016 World Economic Forum report, Europe is already strong in developing innovation and entrepreneurial activity within existing organizations but lags far behind other regions in early-stage entrepreneurial activity.¹¹¹

The competition for talent is becoming increasingly global. The European blue card visa scheme can already be used for **attracting talent** from outside Europe. It offers high-skilled workers mobility between European countries. But adoption has been slow: just 24,000 such visas were issued in 2017, with Germany accounting for 85%, according to Eurostat.¹¹² Reasons include reservations about immigration and the existence of fragmented, individual programmes in EU Member States,¹¹³ and possibly a lack of awareness or interest.

Despite consensus on the importance of talent acquisition, many companies lack clarity about the regulatory processes for recruiting global talent. Regional cultures, rules and markets complicate the situation for businesses who are already struggling with country-specific immigration requirements. Meanwhile, many international students leave Europe shortly after graduating from European universities because of the difficulty of securing the necessary visa to stay.

Europe also needs to focus more on **retaining talent**,¹¹⁴ as it continues to lose top scientists in particular.¹¹⁵ While global talent in STEM tends to be attracted by higher compensation and better working environments, location decisions for entrepreneurial talent are often driven largely by other factors, including laws and taxation, ease of securing investment, market size,¹¹⁶ social prestige and personal impact.

Ideas to build a world-class talent pool of entrepreneurs

Europe should aspire to greatly expand its talent pool, particularly in entrepreneurship, by developing entrepreneurship at all life stages, and become an importer of talent.

1. The European Commission could **recommend a clear path towards a common regulatory and tax framework for stock option remuneration** to improve compensation for start-up employees that can then become national law. Europe lacks a coherent regulatory framework in this area: in Germany or Spain, for example, start-ups report that local taxation frameworks make it difficult to set up stock option schemes. The resulting comparatively less attractive risk-reward profile is a barrier to attracting and retaining talent. For example, the possibility of using stock options gives start-up employees in the United States twice as much exposure to upside than in Europe.¹¹⁷

An existing example that could be scaled:

The Enterprise Management Incentives scheme of the United Kingdom allows companies with less than £30 million in assets and fewer than 250 employees globally to grant employees stock options up to the value of £250,000 in a three-year period. Employees under this scheme pay a capital gains tax only when they sell their shares and first realize any financial gain.¹¹⁸ An advantageous scheme called BSPCE is also available for start-ups in France. The first versions of similar programmes were introduced in 2018 in both Ireland (KEEP) and Sweden (QESO).

2. European institutions could incentivize academic institutions to **foster more entrepreneurial mindsets and a culture of risk-taking** by holding innovation launch-pad competitions in which students build business models around existing patents; encouraging them to build more cross-departmental hubs to foster entrepreneurial activities; and ranking European universities according to the number of start-ups emerging from their students and recent alumni. European start-ups and corporates could **contribute towards changing mindsets** by empowering their employees with a sense of ownership and purpose, helping to not only attract top talent, but to hold on to it and increase productivity by combating employee churn.

3. The European Union could **build a platform for hiring international talent** that **increases transparency about processes and country-specific visa policies**, helping companies to understand how to hire talent from overseas and reducing the time and cost involved. This is especially relevant for smaller firms that typically rely on local and online networks for hiring.
4. Investors, especially VC funds, could play a more active role in supporting companies to secure visas for international talent. European countries should **unite behind existing visa schemes and continue to develop the blue card**.
5. The European Union could **celebrate entrepreneurship** and promote Europe as a place of innovation, focusing on the attractiveness of Europe's high quality of life, its tradition in diversity and values, and the interesting assets of established companies and supply chains that can be innovated. Likewise, governments should **make entrepreneurship a national priority** through public programmes and clear innovation strategies.

Existing examples that could be scaled:

The "Tech Nation Visa" scheme in the United Kingdom, launched in 2014, is for founders and employees with technical or business backgrounds, including sectors such as FinTech, AI or cybersecurity. It is valid for up to five years and enables the person to work, change employers or be self-employed. For the past four years, applications have doubled each year.¹¹⁹

In 2017, the French government introduced new rules allowing non-European software developers and founders to be fast-tracked on the French visa programme *Passeport Talents*.¹²⁰ The process is streamlined on one website, <https://visa.lafrenchtech.com>, and offers a four year work permit for tech founders, employees and investors, their spouses and close family members.¹²¹

Existing examples that could be scaled:

The French government recently released its AI strategy, putting technology high on the national agenda.¹²² The UK Government's early push into AI has attracted a wide pool of talent from around the world, from social scientists to algorithm engineers.

7. Digital education, reskilling and upskilling

Europe's need for technical and soft skills will change significantly

As technologies change how humans interact and work and the talent and skills required, education also needs to change. Automation is expected to replace and create about 4.5 million jobs by 2030 in Europe's digital front-runner countries (Belgium, Denmark, Estonia, Finland, Ireland, Luxembourg, Netherlands, Norway and Sweden) alone.¹²³ Europe's workforce will increasingly need soft skills, such as communication proficiency, complex problem-solving, critical thinking and creativity, according to a World Economic Forum report,¹²⁴ as well as technical skills in STEM subjects.

The growth in demand for advanced and basic technological skills will be substantial. McKinsey research projects that time spent using advanced technological skills may increase by up to 41% in Europe by 2030, and for basic technological skills by 65%.¹²⁵ As much as 90% of jobs over the next decade will require digital skills that almost half (44%) of Europeans today aged between 16 and 74 do not possess.¹²⁶

Demand will also grow for workers with social and emotional skills that machines are still far from mastering – by an estimated 22% across all industries in Europe between 2016 and 2030.

Europe needs to act in three areas:

1. **Building skill sets** through primary, secondary and tertiary education
2. **Upskilling** to prepare the workforce for new technologies and transformations
3. **Reskilling** to navigate changes within and across industries.

The speed of change needed will challenge education systems

Education systems in many European countries are fragmented, making it a challenge to achieve change at sufficient scale and speed. Inertia in the sector needs to be overcome if Europe is to move ahead in the next wave of innovation and enable its citizens to participate.

European education systems are world class, but graduation numbers in STEM subjects are insufficient to cover demand. Some European companies cannot develop as quickly as they would like due to the lack of employees with the right digital and technical skills. According to the European Commission, there will be 500,000 vacancies for

ICT professionals by 2020.¹²⁷ According to an analysis by Manpower Group, talent shortages are at a 12-year high, while 45% of employers are having difficulty filling roles.¹²⁸



The digital revolution brings about unprecedented opportunities. We cannot miss the opportunity to seize them due to a lack of skills, nor can we let inequality in access to these skills grow.



Alexander De Croo, Deputy Prime Minister and Minister of Finance and International Development of Belgium

Ideas to boost digital education, reskilling and upskilling

Europe should aspire to improve all elements of the education cycle.

1. European governments could **improve schools by investing significantly more in education** to lay the groundwork for future innovation:
 - Prepare teachers to develop and deliver digital curricula through standardized online trainings.
 - Develop guidelines on preparing students to use new technologies responsibly, by discussing the values, advantages and risks of modern technologies, from data sharing and digital footprints to cybercrime and fraud.
 - Focus schools on teaching creative and experimental aspects of science, algorithmic thinking, problem-solving and computer logic, with programming as examples despite programming languages becoming outdated rather quickly; leverage online classes to achieve scale, given the current shortage of teachers in this field.
 - Ensure data and technology are integrated in all subjects; for example, history classes could specifically include the history of technology, and geography classes could involve the challenges of mapping migration.
 - Focus schools on teaching the entrepreneurial skills required to build a company (“How to build a start-up”), leveraging existing methodologies used by start-up incubators and accelerators, and invest in the best projects launched by students.

- Enable and finance the launch of programmes outside schools to test and kick-start new ideas, bringing those that work back into schools.

Existing examples that could be scaled:

England and Estonia are among countries that have started to introduce technical skills into school curricula for children above five years of age, including logic, algorithms and internet safety. In Sweden, lessons on digital competencies in primary schools include coding and evaluating sources.¹²⁹

2. European governments could **incentivize private corporations to develop life-long learning programmes** for the existing workforce that address skills gaps for people of all ages, and provide employees with the skills necessary for tomorrow. Companies should **build vocational programmes** that leverage remote learning opportunities and concepts such as gamification, in partnership with academic institutions and innovative start-ups, and build a culture in which learning and upskilling are encouraged and recognized. **Transparency for employees regarding the changes ahead and the need for requalification needs to be emphasized** to manage the rapid transition.

Existing examples that could be scaled:

Digital Pipeline LDN is a 14-week employment and training initiative funded by the Mayor of London's Digital Talent programme to address the digital skills gap for young people.¹³⁰

Generation is an independent, not-for-profit initiative across nine counties, founded by private companies and USAID, that trains young unemployed people for one of 20 professions in sectors such as healthcare, customer service and retail.

Manpower Group launched the Experis Tech Academy in Italy that provides IT courses in a curriculum that directly connects employees from declining industries with the skills needed in growth industries. This effort will be scaled to other countries.

3. European governments could financially **encourage early-stage start-ups to hire experienced people** without entrepreneurial skills or industry knowledge, e.g. in support functions such as sales, marketing or customer support, to re- and upskill them on the job in companies that need resources to build a new business.
4. European governments could **provide tertiary education systems with the large-scale funding necessary** to develop excellent talent in cutting-edge technologies and attract students and researchers from around the world to research and work in Europe. Existing programmes could be made more flexible to allow for innovative solutions and collaboration with other programmes.

8. Gender diversity

Diversity and disruptive innovation strengthen one another

The diverse mindsets and knowledge of innovation creators lead to more diverse and user-centric ideas and solutions. Likewise, the need to create innovation ecosystems for new technology is an opportunity for Europe to disrupt old standards. This creates the potential for a virtuous circle – using disruptive innovation to promote diversity, which can then improve disruptive innovation.

Various aspects of diversity – including gender and cultural diversity – have been shown to correlate with the profitability of companies.¹³¹ A report shows that start-ups in the United States founded or co-founded by women perform better over time than start-ups founded only by men.¹³² Diversity in leadership roles affects not only the performance of teams, but also diversity lower down the corporate ladder.¹³³ Increasing the representation of women in senior positions, for example, can expand the talent pipeline.¹³⁴

It is especially important to have diverse teams of innovators – not only to tap all pools of potential creativity, but because new technologies can reflect the unconscious biases of the teams that develop them.¹³⁵ For example, Buolamwini and Gebru found that face recognition algorithms, which are trained by their creators, work best with white men and worst with black women.¹³⁶

It is important to highlight that, while the rest of this section focuses on gender, some points apply also to other facets of diversity, such as ethnic and social background, disability, age and sexual orientation.

Europe's lack of gender diversity in innovation

Women are vastly underrepresented in Europe's innovation ecosystems: across Europe, only 5% of start-up founders in tech¹³⁷ are female, and only 2% of the capital raised go to all-female founding teams, compared to 93% that go to all-male teams.¹³⁸ Most speakers at tech conferences are male. More broadly, in 2016 women accounted for only 23% of board members of the European Union's largest publicly-listed companies.¹³⁹

Showcasing female role models has been shown to help attract girls to STEM subjects.¹⁴⁰ In Denmark, for example, the proportion of female students enrolling in STEM bachelor-degree programmes had risen to approximately one-third by 2018.¹⁴¹

The challenge may be exacerbated by unconscious biases that influence the perception of diversity: surprisingly, 52% of male and 60% of female entrepreneurs believe that employee composition in European tech companies already positively reflects gender diversity,¹⁴² which stands in strong contrast to actual female representation.

Ideas to leverage diversity in European innovation

Europe should unlock the potential of female entrepreneurs, ensure that technology does not perpetuate existing biases, create awareness of the issue and connect all relevant stakeholders.

1. Businesses, media, governments and European institutions could **find and promote relatable female role models**, including through dedicated communication. Event organizers in tech, politics and business could include more women speakers, while conferences dedicated to female leadership could focus on the vision of diversity rather than promoting women by excluding men.

Existing examples that could be scaled:

The German Association of the Digital Economy is building up a pool of female speakers after committing to at least one-third representation at its own events.¹⁴³ A women-only business magazine has called for applications for an award for female tech role models, using the hashtag #25Frauen (25 women).¹⁴⁴

2. To introduce young women to innovation and entrepreneurship and inspire them to study STEM subjects, education departments could **mandate secondary schools in particular to organize visits from incubators, local hubs and industry associations**. These could be integrated into existing curricula on society-related subjects, alongside materials that showcase successful female entrepreneurs and innovation environments in which women can thrive. Funding programmes for start-ups run by government institutions and private investors could dedicate a percentage of funding and entrepreneurs' time to educating the next generation.

Existing examples that could be scaled:

The Dutch website F-site¹⁴⁵ provides educational material for schoolteachers about famous women in history. A similar idea could promote knowledge about successful women in science, technology, business and start-ups. The “Nevertheless” podcast has developed posters featuring female STEM role models.¹⁴⁶

3. European governments and private funds could work on **addressing gender bias in funding and structurally raise funding to female founders**, either directly or through competitions on problems that could be solved through technology, particularly focusing on “femtech” and related issues.

An existing example that could be scaled:

Innovate UK’s Women in Innovation competition is a government-funded initiative that offers funding and mentoring to female entrepreneurs.¹⁴⁷

4. Companies could **include diversity in their core values systems** and support these values, for instance by offering workshops on unconscious biases.

9. Digital infrastructure and interoperability

Digital infrastructure serves as the backbone for European technology innovation

Successful innovation rests on digital infrastructure, both hard – including fibre optic broadband, mobile networks, hardware clients and data centres – and soft, such as common software platforms and standards for the interoperability of networks, devices and data.

In terms of hard infrastructure, a study recently found that fewer than half of rural households in 14 European countries have access to 30 Mbps broadband. Only 15% of all households experience broadband speeds exceeding 100 Mbps, well below the European Union's target of 50% by 2020.¹⁴⁸ Network costs for telecommunication operators are increasing significantly, with the total cost of ownership for mobile access networks expected to rise by about 110% between 2020 and 2025 for a scenario assuming 35% growth in the volume of data.¹⁴⁹ Economies that invest in quickly rolling out such technologies as 5G and fibre can lay a foundation to boost innovation in areas like the internet of things (IoT),¹⁵⁰ by improving speed, latency and the number of connections that can be carried simultaneously.¹⁵¹

In terms of soft infrastructure, Europe has made some progress: it has published standards in areas such as the IoT and cloud computing¹⁵² and has enhanced the implementation of electronic IDs and payment standards. Recent European proposals foster expertise and research into interoperability,¹⁵³ and programmes have been launched to support interoperable services, such as "ISA2".¹⁵⁴ GDPR has been a key step in standard setting but needs fine-tuning for its full implementation, for example regarding the functionality of technologies such as blockchain.

The lack of interoperability remains a significant obstacle to a thriving digital economy. Europe lags other regions in establishing common standards and aligning sector-specific regulation in order to benefit from market opportunities created by enabling technologies, such as big data analytics, AI, cloud computing and blockchain.

Many digital services created by governments and companies need to be brought closer to citizens in ways that avoid customer lock-in due to closed platforms or hardware protocols and the lack of communication among services.¹⁵⁵ Europe should avoid a situation in which small players focus on developing tailored solutions for small markets, rather than focusing on growing across Europe.

Ideas to address infrastructure shortcomings and boost interoperability

Europe should aspire not just to catch up with other regions but to take a global lead in setting regulatory standards, drive investment in soft and hard infrastructure, lower integration costs and ensure maximum benefits in key sectors, such as healthcare, energy or social services.¹⁵⁶

1. European governments could **improve the coordination of national soft infrastructure and information systems** to ensure interoperability, the reusability of services and technical resources, and transparency about services. Government services should be designed to easily connect with other services from other levels of government and even private-sector providers. A concerted effort to reduce friction in soft infrastructure across borders could include increased collaboration among European and international standards organizations, such as the International Organisation for Standardization, the Institute of Electrical and Electronics Engineers (IEEE) and the International Telecommunication Union.

An existing example that could be scaled:

Estonia's Information System Authority coordinates the development and management of the country's public information systems and monitors relevant legislative processes. Technical and administrative data from existing public-sector databases are centrally collected to ensure the interoperability of public-sector information systems.¹⁵⁷

2. The European Union could **foster pan-European working groups on interoperability** relating to areas with high citizen impact, including financial services, AI, blockchain, telecommunications and mobility. Public-private partnership projects funded by framework programmes could be leveraged. European companies could engage through existing cross-sectoral organizations, though the voice of start-ups would need to be included to avoid domination by incumbents.

An existing example that could be scaled:

Grassroots initiatives have proposed the foundation of an intergovernmental organization to drive AI research in Europe, to be called the European Lab for Learning & Intelligent Systems (ELLIS).¹⁵⁸ Embedded in a network of research centres,¹⁵⁹ it could set interoperability standards.

3. European governments could **heavily invest in digital infrastructure**, prioritizing the rollout of ultra-fast broadband over raising funds from spectrum allocation auctions. The rollout of 5G necessitates an aggressive plan to avoid falling behind other jurisdictions in launching innovative services on 5G. Member States could cooperate in allocating spectrum bands and work on expediting the process.

The 5G Public Private Partnership (5G PPP) project is a joint initiative between the European ICT industry and the European Commission, funded with €1.4 billion. Its primary mission is to rethink network infrastructure. It aims for the European industry to drive the development of 5G standards and to develop and exploit at least 20% of 5G standard essential patents.

10. Harmonized legislation and standards

The European single market is challenged by remaining fragmentation

As one of world's largest markets, the European single market provides tremendous economic opportunities for European citizens, businesses and governments.¹⁶⁰ Now is an opportune time to develop it into a harmonized and globally competitive DSM. Along with fostering competition, creating an adequate regulatory framework was found to be one of the main drivers of adoption for digital technologies.¹⁶¹ The European Union has already adopted some important policy initiatives to unleash Europe's digital potential, for example in cybersecurity.

However, Europe's digital economy remains fragmented, which is a major impediment for companies to achieve scale. While growing platform companies in the United States or China can easily access large home markets as a basis for global competitiveness, companies expanding within Europe need to adapt to regulatory and legislative regimes that differ by country. For example, the existence of 81 different national value added tax (VAT) regimes is a burden particularly for SMEs. Additional differences in laws and standards create further barriers to cross-border commerce for incumbent and fledgling companies alike.

Progress on addressing challenges has been slow

Attempts to counter fragmentation are ongoing, for example with a proposal to better coordinate the enforcement of consumer rights in the EU.¹⁶² However, they are not keeping pace with the speed at which companies grow and make decisions: while the VAT DSM legislation will likely reduce compliance costs and facilitate cross-border trade, most of the measures will not be implemented before 2021. Employee incentive schemes still differ greatly between countries, and Member States sometimes set up new national measures in areas where the European Union is in the process of proposing EU-wide regulation.

Regulatory requirements that differ between Member States, including labour law, taxation and administrative procedures, are cited as the second-largest obstacle faced by EU start-ups, after access to finance. Although the European Union's Start-up and Scale-up Initiative demonstrates awareness of these challenges, aiming to remove barriers for start-ups to scale, it has not yet made significant progress in tackling fragmentation. For example, Member States can vary the age of consent to use online services, thus complicating cross-border service delivery.

Ideas to harmonize legislation and standards across borders

Europe should aspire to continue removing barriers to firms accessing broader markets and deliver on the DSM agenda in the agreed Horizon 2020 timeline while driving the innovation-friendly implementation of existing regulations, including GDPR, copyright and online purchasing rules.

1. Coordinated regulation: The European Union and governments could **prioritize binding regulations, instead of directives** that are put into different national laws. A single regulator or competence centre should be established with responsibility for developing principles in key areas for innovation, such as algorithm governance, the fair taxation of digital players and fair competition in mobile applications.¹⁶³ Industry players should be consulted in creating these standards using open-source projects as a starting point, facilitated by government institutions.

An existing example that could be scaled:

FIRE is an open source format for data on financial regulation developed by Suade Labs that could facilitate the efficient exchange of data between businesses and with regulators using defined standards.¹⁶⁴

2. Business processes: To nurture start-ups, European institutions could **harmonize operative rules and regulations where feasible**. For example, there could be a uniform and simple process to establish a new company and set up a bank account. Standards for accounting and regulations for human resources could be simplified to more easily hire staff and gain necessary work permits, which currently require specialist advisers for each jurisdiction a company operates in.

An existing example that could be scaled:

Electronic identification has the potential to create tangible benefits. The European Union's eIDAS initiative aims to enable secure transactions between stakeholders, and applications building upon that standard can facilitate transactions between businesses, governments and consumers. An example for a solution building on eIDAS is Evrotrust, which enables pan-European remote identifications and signing for smart devices.

3. Consumption taxes: European governments could try to **reduce the complexity of consumption taxation** by coordinating those taxes at the European level. As a first step, information on VAT rules should be provided on a central platform to simplify adherence, especially for small companies.¹⁶⁵
4. Language: The **language barrier to pan-European markets could be removed** by mandating that public procurement notices be published in English as the most widely spoken foreign language,¹⁶⁶ opening up opportunities for small companies from across Europe.

Flagship initiatives: Moving to action

As the speed of innovation continues to increase, swift and concerted action is needed to build momentum around the key catalysts and building blocks. The World Economic Forum and its Digital Leaders of Europe community are proposing to launch flagship initiatives in 2019 to boost European competitiveness:

Women Entrepreneurship Network

With European partners, the World Economic Forum proposes to pilot a framework to create locally self-governed networks of female business and innovation leaders who will coach selected women entrepreneurs in digital tech – including peer-to-peer coaching for founders, mentoring from women working for established corporates, and access to corporate and funding circles. This network could complement the European Union's existing effort to promote women's entrepreneurship¹⁶⁷ and leverage existing initiatives in local innovation ecosystems.

European Centre for the Fourth Industrial Revolution (C4IR Europe)

The World Economic Forum aims to initiate an affiliate Centre for the Fourth Industrial Revolution focused on Europe, tasked with identifying and connecting centres for excellence, defining frameworks, for example for innovation sandboxes, and acting as a think tank for smart and agile regulation. It could become a hub for pan-European digital government initiatives and work on proposals for the public sector to stimulate demand for innovation.

European Sovereign Wealth Fund for Innovation

The demand to create a new European sovereign wealth fund for innovation that could combine existing European public and private funds is strong. It could leverage private funding sources from across Europe, including institutional money, such as pension funds, and be able to issue debt. Its key objective could be to provide scale-up capital for start-ups and for cross-sectoral, cross-border integration projects with multiple industrial players. It could resemble Israel's successful Yozma funds¹⁶⁸ in leveraging public money to attract private investment for innovation, but differ in focusing on later-stage large-scale rather than early-stage funding.

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