

Securing Europe's future beyond energy: Addressing its corporate and technology gap

European leaders have shown great resolve in their initial response at scale and speed to the war in Ukraine. They will need to build the same momentum to face the region's slow-motion corporate and technology crisis. An estimated €2 trillion to €4 trillion of annual value could be at stake—six times the amount needed for the net-zero transition—and with it Europe's long-term prosperity and strategic autonomy. A program of 11 actions can turn the tide.

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Europe as it is today has been forged in times of crisis. The European Union (EU) was created in response to the ravages of World War II. The fall of the Berlin Wall marked the start of a period of economic catching up by economies in Central and Eastern Europe. The 2008 financial crisis and the eurozone crisis that followed led to more financial cooperation among European countries. The COVID-19 pandemic then triggered a higher level of fiscal coordination through the NextGeneration EU fund.

Most recently, the Russian invasion of Ukraine not only is a humanitarian catastrophe but has also exposed a range of fragilities, from food security and energy to defense.¹ The war has accentuated the reality that resilience depends on a strong economy with strategic autonomy in these critical areas that has long been taken for granted.

Technology is pivotal, too. Unless Europe catches up with other major regions on key technologies, it will be vulnerable across all sectors on growth and competitiveness—compromising the region’s relatively robust record on sustainability and inclusion—as well as security and strategic strength, hindering long-term resilience. Given seismic events within its own continent, a robust Europe is arguably needed more than ever. Yet to make that a reality will require the region to address a slow-motion competitiveness crisis that has quietly been unfolding for two decades, centered on its corporate and technology gap with other major regions. That is the topic of this article. Confronting this gap will require leaders to show the same resolve and collaboration as they initially displayed in their response to the war in Ukraine.

Although Europe has many high-performing companies, in aggregate European companies underperform relative to those in other major regions: they are growing more slowly, creating lower returns, and investing less in R&D than their

US counterparts. This largely reflects the fact that Europe missed the boat on the last technology revolution, lagging behind on value and growth in information and communications technology (ICT) and on other disruptive innovations.

ICT and other tech sectors have spawned a range of transversal technologies, which are spreading horizontally across sectors and determining competitive dynamics. This research looks at ten transversal technologies and finds that Europe leads on only two of the ten. If Europe is not successful in competing in these technologies, it could also lose its strongholds in traditional industries. To give just one example, Europe has been a leader in automotive but could become a laggard in autonomous driving.

The stakes are high. We estimate that corporate value added of €2 trillion to €4 trillion a year could be at stake by 2040—value that could generate wages, employment, investment, and economic growth to the broader benefit of society.² To put the estimated value at stake into perspective, that would be equivalent to 30 to 70 percent of Europe’s forecast GDP growth between 2019 and 2040, or one percentage point of growth a year; six times the gross amount needed in Europe to achieve net-zero emissions by 2050; and about 90 percent of all current European social expenditure, or €500 monthly universal income for each European citizen.³

Unless tackled, this crisis will handicap Europe on many dimensions, including growth, inclusion, and sustainability, and its strategic autonomy and voice in the world.⁴ Europe can continue to build on its strengths. Its socioeconomic model has served well thus far. But if companies are to play at the scale and speed needed to compete in a world in which technology disruption is spreading everywhere, often with winner-takes-most dynamics, a reevaluation of long-held beliefs and trade-offs may be needed. An integrated package of initiatives

¹ Sven Smit, Martin Hirt, Kevin Buehler, Olivia White, Ezra Greenberg, Mihir Mysore, Arvind Govindarajan, and Eric Chewning, “War in Ukraine: Lives and livelihoods, lost and disrupted,” McKinsey & Company, March 2022.

² *A new look at how corporations impact the economy and households*, McKinsey Global Institute, May 2021.

³ McKinsey research finds that reaching net zero by 2050 would require \$9.2 trillion in annual average spending on physical assets, \$3.5 trillion more than today. See *The net-zero transition: What it would cost, what it could bring*, McKinsey & Company, January 2022.

⁴ The EU defines strategic autonomy differently from the concept of sovereignty. Rooted initially in defense and security, it has, over time, broadened to include economics and technology. The broad concept is that Europe should not aim to do everything within Europe but should never rely on a single source. For instance, see *Why European strategic autonomy matters*, European External Action Service, December 2020.

Europe: Geographic scope of research

Unless specified otherwise, our analysis of Europe comprises the 27 member states of the European Union (EU) plus Norway, Switzerland, and the United Kingdom. We group these economies as Europe 30. This article discusses these economies as a region. However, we acknowledge that this group comprises independent countries, often with very different economic profiles. Moreover, these countries have a number of neighbors to the east, including Ukraine, that are part of the European continent and may in the future forge closer economic ties with the group of 30 countries analyzed in this research. In the final section, on potential actions that Europe can take, many of the measures described would need to happen at the level of the EU, ideally in collaboration and coordination with the other nations in the geographic region.

On sustainability, Europe has 2.4 times lower CO₂ emissions per capita than the United States, and 1.8 times lower CO₂ emissions per unit of GDP.⁶ Both emissions per capita and emissions per unit of GDP have decreased faster in Europe than in the United States since 1990. Europe has also pledged to achieve net-zero carbon emissions before other regions.⁷

On inclusion, Europe leads on most dimensions, including equality and social progress. Income inequality as measured by the Gini index is only 30, whereas it is 41 in the United States.⁸ Europe is also well placed on elements of inclusiveness such as gender equality. In 2019, 28 of the Europe 30 countries had an average score of 10 percent on the Gender Inequality Index published by the United Nations Development Programme, compared with 20 percent for the United States.⁹ Europe overall has the highest life expectancy at birth in the world: the Europe 30 average is 80 years; it is 79 in the United States and 77 in China. Several European economies lead on social mobility. Looking at the number of generations it takes for those born in low-income families to approach the level of the mean income in their country, we find that in the United States it is five generations, but only, for instance, two or three in Scandinavia and four in many continental European countries. All top

ten countries in the Social Mobility Index published by the World Economic Forum are European.

On growth and prosperity, Europe tracked other advanced economies' sluggish growth of per capita GDP at a compound annual rate of 1.2 percent, similar to 1.1 percent in the United States, between 2000 and 2019. However, the United States has been growing in total GDP terms at 1.9 percent a year, compared with Europe at 1.4 percent annually, reflecting higher population growth. Europe's per capita GDP is still some 30 percent lower than that of the United States. Forty percent of this gap is due to consciously different labor choices (for instance, earlier retirement ages and more vacation and parental leave). An additional 30 percent is driven by persistently large divides between different regions of Europe. Still, along the income distribution, earnings are higher in the United States for the first nine deciles, while only the bottom 10 percent of Europeans have higher income than those in the United States.¹⁰

Europe's strong showing on sustainability, inclusion, and aspects of growth is also a reflection of what the region can achieve when it collaborates at its best. The Single Market is estimated to have added 9 percent to long-term European GDP and supported the emergence of leading firms in many sectors such as steel (initially) and aeronautics.¹¹

⁶ Scope 2 (production-based) emissions. Europe has six tons per capita of CO₂ emissions, versus 16 tons in the United States, according to the World Bank.

⁷ *Climate action: 2050 long-term strategy*, European Commission.

⁸ Europe 30 average weighted by GDP; data are from Eurostat.

⁹ Gender Inequality Index, United Nations Development Programme.

¹⁰ Europe's economic performance has been generally more uneven than that of the United States. The standard deviation of growth among EU member states was 1.2 percent between 1997 and 2020, compared with 0.8 percent among US states.

¹¹ Jan In 't Veld, "The economic benefits of the EU Single Market in goods and services," *Journal of Policy Modeling*, volume 41, number 5, September–October 2019.

Amadeus is an example of Europe playing to its scale. This global airline reservations system, formed in 1987 in a collaboration among Air France, Iberia, Lufthansa, and SAS, has become a world leader and one of Europe's largest and most valuable software companies. European direct investment and labor mobility have contributed to rapid growth in Europe's less prosperous regions. Membership in the EU has enabled nearly 22 million people in Central and Eastern Europe to leave poverty.¹² European institutional innovations, from the European Stability Mechanism to the Resilience and Recovery Fund, have also helped absorb some of the largest economic shocks in a century. And Europe has proven that it can innovate effectively and rapidly when necessary, the successful development, approval, and rollout of COVID-19 vaccines being one instance.

Corporate Europe is falling behind as tech weakness permeates sectors

Corporate Europe's long-standing weakness in tech is ever more evident in today's figures. This gap has long been considered a result of specialization and competitive advantage elsewhere—that Europe is strong in other sectors such as chemicals, materials, and fashion, for instance—meaning that the weakness is therefore not something to worry about. However, this is no longer true. Technology is now permeating all sectors via transversal technologies such as artificial intelligence (AI), the Bio Revolution, and the cloud.

Europe's clear and well-known weakness in tech is the source of a large and growing corporate performance challenge

Data show that Europe's corporate performance is underwhelming in aggregate. To understand differences in corporate performance, we used McKinsey's Corporate Performance Analytics Tool (CPAT) to examine more than 2,000 US and European companies with revenue of more than \$1 billion.

Between 2014 and 2019, large European companies were more than three percentage points less profitable (measured by return on invested capital, or ROIC), grew revenues 40 percent more slowly, invested 8 percent less (capital expenditure relative to the stock of invested capital), and spent 40 percent less on R&D than their United States counterparts.¹³ Even though some of this disparity may reflect rising concentration and superstar dynamics in US firms across the board, the numbers are startling.¹⁴

Most of the differences are observable in technology-creating industries, specifically ICT and pharmaceuticals. Together, these sectors account for 90 percent of the ROIC gap, 80 percent of the investment gap, 60 percent of the growth gap, and 75 percent of the R&D gap (Exhibit 2).

Technology is now permeating all sectors via transversal technologies such as artificial intelligence, the Bio Revolution, and the cloud.

¹² Eurostat.

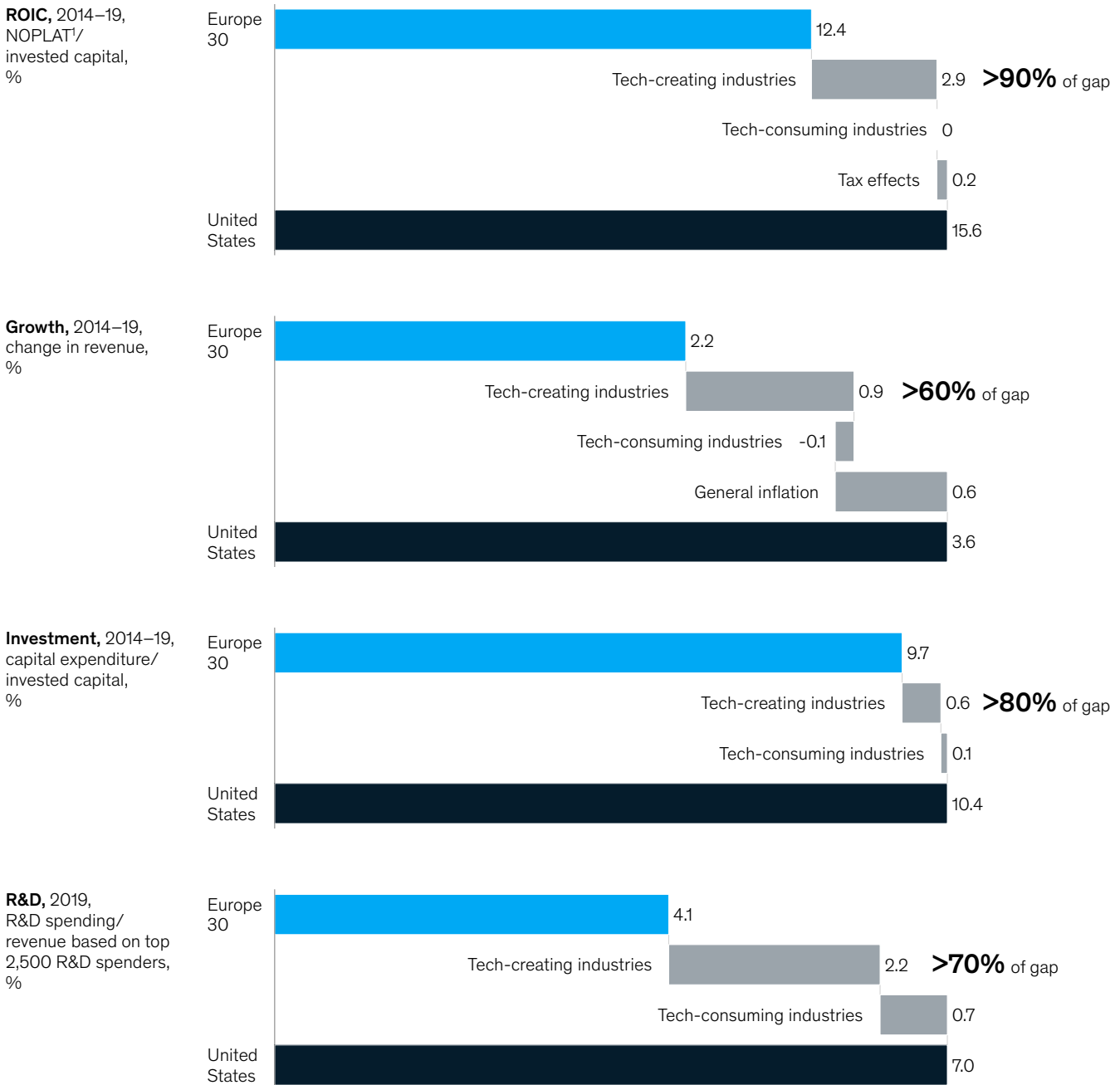
¹³ MGI research has found that in Organisation for Economic Co-operation and Development (OECD) economies, the business sector has provided 72 percent of GDP; that contribution has tripled in relation to per capita GDP since the 1960s. See *A new look at how corporations impact the economy and households*, McKinsey Global Institute, May 2021.

¹⁴ Thomas Philippon, *The Great Reversal: How America gave up on free markets*, Belknap Press, 2019.

Exhibit 2

Corporate Europe’s performance is not on a par with that of US counterparts largely due to tech-creating industries.

US/Europe 30 delta in return on invested capital (ROIC), growth, investment, and R&D, weighted average, 2014–19
 Sample of ~2,200 companies with revenue of more than \$1 billion; financial companies excluded



¹Net operating profit less adjusted taxes.
 Note: Figures may not sum to 100% because of rounding.
 Source: McKinsey Corporate Performance Analytics Tool; R&D Investment Scoreboard, Eurostat 2020; McKinsey Global Institute analysis

The ICT difference is also seen in the enterprise value (debt plus equity) of large, listed firms. The value of large European firms was at par with that of those based in the United States in 2000 (\$7 trillion versus \$8 trillion). However, by November 2021, those in the United States were worth more than twice their European counterparts (\$46 trillion versus \$21 trillion). The six largest US technology firms contributed almost half of that value difference.

Recent signs indicate that Europe's new company formation, including in tech industries, is starting to pick up. Europe experienced the largest increase since 2014 in unicorns (startups valued at more than \$1 billion) in 2021, with 98 new unicorns in that year.¹⁵ In 2021, Europe attracted a record \$110 billion of venture capital funding, exceeding China's tally. Nevertheless, Europe's capital investment is still nearly three times lower than that of the United States, and it is far from clear whether the uptick in investment is sufficient to build the large-scale businesses needed.

As technology permeates all sectors, and corporate scale advantages and winner-takes-most dynamics prevail, Europe's current approach is no longer tenable

ICT used to be a sector; now it is everywhere. The technology base built in ICT has spawned a range of transversal technologies that are spreading horizontally across most vertical sectors. Value creation is shifting to these horizontal areas, with winner-takes-most dynamics and network effects in technology creation and scale advantages in technology adoption (Exhibit 3). The World Economic Forum estimates that 70 percent of the new value created in the whole economy over the next ten years will be digitally enabled, a momentum further accelerated by the COVID-19 pandemic.¹⁶ The fact that Europe did not keep pace with the United States in the first technology wave centered on the internet and software now means that Europe is in a weakened position in transversal technologies across sectors. Our analysis looks at ten such transversal technologies or families of technologies on which Europe's future performance and prosperity hinge. Europe leads on only two of the ten (Exhibit 4).

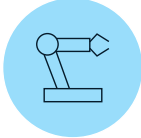

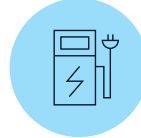
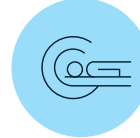


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¹⁵ *State of European Tech 21*, Atomico, December 2021.

¹⁶ *Shaping the future of digital economy and new value creation*, World Economic Forum.

Exhibit 3

Ten transversal technologies are permeating horizontally across almost every sector.

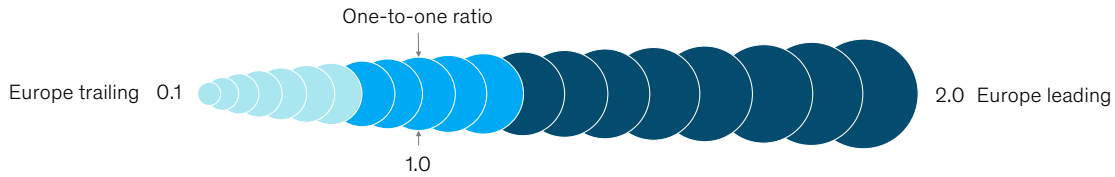
Industrials (incl auto and defense)	Chemicals and materials (incl agriculture)	Transportation, energy, and infrastructure	Pharmaceuticals and healthcare	Consumer and retail	Financials and professional services
					
Next-level process automation					
Robotics, additive manufacturing, drones, digital twins	Virtual development modelling, testing, agriculture next-generation	Modular construction, prefab, additive manufacturing, robotics	Virtual clinical trials, surgery robot, additive manufacturing	Domestic service robot, warehouse automation	—
Future of connectivity					
Industry 4.0, connected cars, connected soldiers	Smart farming	Smart cities, smart power plants/grids, embedded sensors	Remote health monitoring, wearables	Wearables, smart home	—
Distributed infrastructure					
Cloud and edge computing					
Next-generation computing					
Quantum computing					
Applied AI					
Autonomous vehicles	Precision agriculture	Last-mile drone usage, smart power plants/grids	AI imaging and diagnostics, drug discovery	Marketing analytics, speech recognition	Pricing risk analytics, automated operations, tech-augmented advisory
Future of programming					
Software 2.0					
Trust architecture					
Cyberwar	Traceability	Smart contracts	Blockchain in supply chain and records	Smart sourcing	Blockchain, smart contracting
Bio Revolution					
Industrial enzymes, exoskeleton	Next-generation crops, bioroutes for chemicals	Biopolymers, biofuels, engineered produce transportation	Gene and stem cell therapy, tissue engineering, brain-device interaction, neurogenomics, biomolecules	Alternative proteins, microbiome-based products	—
Next-generation materials					
Nanomaterials, new materials, new-generation weapons	Nanosensors, next-generation composites, synthetic materials/chemical design	New materials, new construction materials	Tissue engineering	Personalization, new materials	—
Future of cleantech					
Decarbonization, electric vehicles	Wireless irrigation systems, green cement/steel, recycling	Modular, virtual twins, renewables, CCS, green energy	—	—	—

Source: PitchBook; McKinsey Corporate Performance Analytics Tool; McKinsey Global Institute analysis, McKinsey Global Institute analysis

Exhibit 4

Out of ten transversal technologies, such as AI, quantum computing, and cloud, Europe leads on two.

Relative European position vs leading or second-best region on a range of metrics, multiple¹



Transversal technologies	Keywords	Innovation ²	Production ³	Adoption ⁴	Average
Next-level automation	Industrial, collaborative, and professional robots; additive manufacturing; virtualization	0.6	1.0	0.7	0.8
Future of connectivity	5G, Internet of Things	0.7	0.7	0.3	0.6
Distributed infrastructure	Cloud, edge computing	0.2	0.1	0.7	0.3
Next-generation computing	Quantum computing, neuromorphic software	0.5	n/a	n/a	0.5
Applied AI	Robotic process automation, optimized decision making, natural language processing, computer vision, speech technology	0.5	<0.1	0.8	0.4
Future of programming	Software 2.0, no-code and low-code programming	0.3	<0.1	n/a	0.2
Trust architecture	Blockchain, zero-trust security/cybersecurity	0.3	0.3	0.6	0.4
Bio Revolution	Biomolecules, biosystems, bio-machine interface, biocomputing	0.8	0.4	0.5	0.6
Next-gen materials	Nanomaterials, composite materials	0.7	2.0	1.2	1.3
Future of cleantech	Solar power, wind energy, hydropower, nuclear, electric vehicles, hydrogen	1.3	0.4	1.2	1.0
Average		0.6	0.6	0.7	

1. For instance, if Europe issues 200,000 patents per year related to automation vs 400,000 a year in the United States, the multiple is 0.5 times.
 2. Average number of the ratios based on number of publications, number of patents, and venture capital funding (\$ billion).
 3. Average number of the ratios for top ten companies on market share (%), market capitalization (\$ billion), and corporate or private equity funding (\$ billion).
 4. Average number of the ratios based on public investment (\$ billion), penetration (count per capita), and end-market share (%).
 Source: The top trends in tech, McKinsey Digital, 2021; McKinsey Global Institute analysis

In AI, for instance, the United States captured 40 percent of funding external to companies (such as venture capital and private equity) in 2015–20. Europe captured 12 percent, and Asia (including China) 32 percent. On distributed infrastructure like cloud, the United States accounted for 73 percent of external funding over the same period. For Europe, the figure was 10 percent. European companies also lag on capital spending in cloud solutions. In 2019, four US companies (Amazon, Facebook, Google, and Microsoft) invested \$80 billion of the total \$111 billion globally, and three Chinese companies (Alibaba, Baidu, and Tencent) an additional \$10 billion. No European player has spent more than \$1 billion.

In biotech, Europe has a strong science base and a robust pool of talent, and it proved during the pandemic that it can innovate.¹⁷ However, investment in biotech varies among regions. In 2018–20, the United States spent \$260 billion, Europe \$42 billion, and China \$19 billion.¹⁸

In next-generation computing, including quantum computing, European authors lead in producing publications, but Europe does not match China on public investment or patents, or the United States on private investment.¹⁹ While there is heavy investment in Europe using public funds, China has taken an aggressive stance on quantum technology as a strategic industry in its Made in China 2025 initiative. Meanwhile, the major investors in quantum computing technology are big tech incumbents, which are outside of Europe. Of the top ten companies investing, 50 percent are in the United States, 40 percent in China, and zero percent in Europe. These incumbents are spending several billions of dollars on R&D in quantum computing and on building new quantum computers.

In cleantech, Europe is more ambitious than most other regions on targets for the reduction of carbon emissions by 2030 but is losing ground in the next wave of cleantech. Figures show that Europe

has seen 38 percent more cleantech patents than the United States and more than double the number in China, and has more cleantech installed per capita using mature technologies. Overall, however, Europe's prospects of leading on cleantech are fading, because it is not in the vanguard of pioneering technology and is losing scale advantages in production and adoption. Today, China leads on cleantech production in nearly all areas, often with market shares of more than 50 percent. The United States leads on future breakthrough technologies, including nuclear fusion; carbon capture, usage, and storage; smart grids; next-generation batteries; and long-duration energy storage. The United States accounts for at least 50 percent of the world's top startups.²⁰

Europe's lack of scale in transversal technologies jeopardizes its position in nearly all sectors, including current strongholds like automotive and luxury goods

Europe is being eclipsed on industrial-scale adoption of technology. Take automotive as an example. Two European automotive companies are among the world's top three auto manufacturers. As of 2018, five of the top ten premium cars sold in the United States were European. However, US manufacturers account for close to 70 percent of all kilometers traveled by fully autonomous vehicles, mostly because of Europe's lag in AI, late regulation, and lack of funding.²¹ In the case of materials, the combined revenue of Europe's top three players is double that of the top three US companies, but only one European nanomaterials company is in the global top ten. Similarly, European companies account for 95 percent of the value of luxury brands globally, but Europe lags behind on wearable devices; Apple, Huawei, Samsung, and Xiaomi among them have a market share of almost 65 percent. Europe has some of the most productive retailers but has no online retail platform to match the size of leading US and Chinese online retailers.

¹⁷ *The Bio Revolution: Innovations transforming economies, societies, and our lives*, McKinsey Global Institute, May 2020.

¹⁸ PitchBook. Venture capital funds are a small part of total external funding.

¹⁹ Anika Pflanzner, Wolf Richter, and Henning Soller, "A quantum wake-up call for European CEOs," McKinsey & Company, December 2021.

²⁰ Europe 30 countries are home to seven nuclear fusion companies and the United States to 13. See *The global fusion industry in 2021*, Fusion Industry Association, fusionindustryassociation.org/about-fusion-industry.

²¹ Vehicle autonomy is classified from zero to five. Level 4 vehicles can intervene if things go wrong or there is a system failure. Human interaction is not needed in most circumstances, but the human can still manually override. See *The six levels of vehicle autonomy explained*, Synopsys, synopsys.com/automotive/autonomous-driving-levels.html. Globally, the top three players in miles between disengagement are Baidu, Waymo, and Cruise, with between 12,000 and 18,000 miles. The top European player is Almotive, with less than 250 miles, making it the ninth-ranked player in the world. Data from McKinsey Center for Future Mobility.

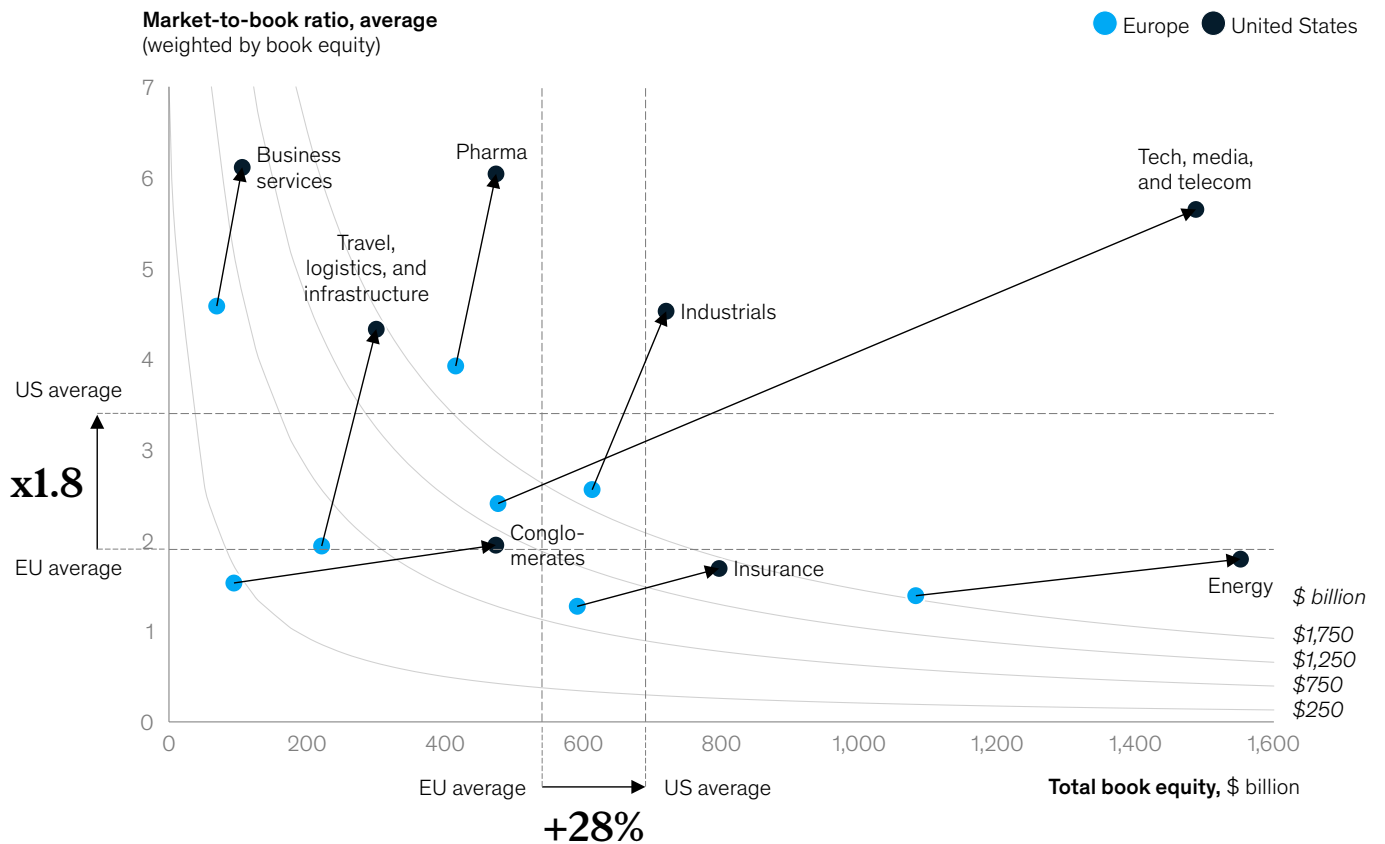
Markets have already internalized this shift. Taking market capitalization shifts as an imperfect proxy for investor expectations of leadership (such shifts are essentially a bet on future profitability and do not reflect only increased productivity), European firms improved their ranking in market cap vis-à-vis US firms in only three of 20-plus sectors from 2000 to 2019: household and personal products, pharmaceuticals, and retail.

As a result, Europe's large companies lack scale and strategic control in comparison with their US counterparts in most sectors. At the end of 2019, US companies had almost double the market-to-book ratios of their European counterparts and nearly 30 percent higher levels of book equity (Exhibit 5).

Exhibit 5

US companies' market-to-book ratios are almost double and equity is nearly 30 percent higher than those of European counterparts.

Market-to-book ratio vs book equity, US and European industries, 2019



Note: Includes companies with revenue above \$1 billion, 2000–20 thresholds; excludes companies that are not listed or do not report asset values or market capitalization. Source: McKinsey Corporate Performance Analytics Tool; McKinsey Global Institute analysis

The value at stake is high, not only for growth but also for sustainability, inclusion, and Europe's strategic autonomy

At stake are not only the performance of Europe's companies, its tech prowess, and its economic growth and prosperity, but also its progress thus far on sustainability and inclusion. Although there are debates over whether lower growth is needed to achieve sustainability and arrest climate change, the opposite argument is compelling: growth strengthens confidence and creates a healthy investment climate to generate sustainability-related innovation and new income streams that are needed to pay for the energy transition. Lagging growth could, moreover, undermine inclusion by limiting the pool of funds available to spend on social programs.

Our analysis suggests that if Europe is not able to improve on transversal technologies, European firms could miss out on a value-added opportunity of €2 trillion to €4 trillion a year by 2040. Two approaches independently lead to this result. In the first, we used a bottom-up analysis of transversal technologies. In the eight transversal technologies where Europe is behind and could be vulnerable, €8 trillion to €21 trillion of value is at stake. Given that Europe's fair share (its current share of global GDP) would be 23 percent, this equates to €2 trillion to €5 trillion at stake. Second, we looked at market valuations of the top 5,000 global companies and translated this into revenue growth expectations assuming constant ROIC. This analysis generated a figure of €3 trillion to €4 trillion less revenue a year for European companies than US companies by 2040, or €1 trillion to €2 trillion lower corporate value added. While we have not modeled the complex relationship between corporate value-added growth and economic

growth, it is clear that the consequences not only for growth and income but also for strategic autonomy would be severe.²²

Value at stake of €2 trillion to €4 trillion equates to 30 to 70 percent of Europe's forecast growth in GDP between 2019 and 2040, or one percentage point of growth a year.²³ For further context, this would be equivalent to six times the gross amount Europe needs to transition to net-zero emissions.²⁴ And it would amount to about 90 percent of all current social expenditure in Europe (Exhibit 6).²⁵

Much discussion has been taking place about energy dependence and autonomy, but geopolitical shifts also accentuate the need for strategic autonomy on critical technologies. Technological autonomy is compatible with open economies and global collaboration. It can be achieved via multiple independent global sourcing options as well as a strong footprint of globally leading firms in Europe. But it will also require capability buildup by, and scaling of, European firms. Today, for instance, semiconductors produced in Europe meet just 9 percent of European demand, and European companies have only about 10 percent of the market across the semiconductor value chain. And Europe has no market player with a market share in cloud of more than 1 percent.

European decision makers and companies need to go on the offensive for a step change on technological capabilities and competitiveness

Europe can, and should, continue to leverage its many strengths. They include its high-quality education systems, which produce leading science, technology, engineering, and math (STEM) talent as well as some of the most productive vocationally educated workers.²⁶ Europe is also the most open

²² We have not estimated the full economic impact of successful competition in those battlegrounds beyond the estimated value at stake for firms. This would require understanding, for instance, the value generated in Europe by foreign subsidiaries, maintaining jobs and income in Europe; the alternative activities European firms and workers would pursue; the split of large corporate versus smaller firm value added; and second-order effects, non-linear effects, or feedback loops. As an illustration, if we assume that only profits shift abroad, the gross value added at stake would lie in the range of €1 trillion to €2 trillion (assuming a weighted average of 43 percent of gross operating surplus); forecast data for 2020–40 from IHS.

²³ IHS Markit.

²⁴ *How the European Union could achieve net-zero emissions at net-zero cost*, McKinsey Sustainability, December 2020; and *The net-zero transition: What it would cost, what it could bring*, McKinsey & Company and McKinsey Global Institute, January 2022.

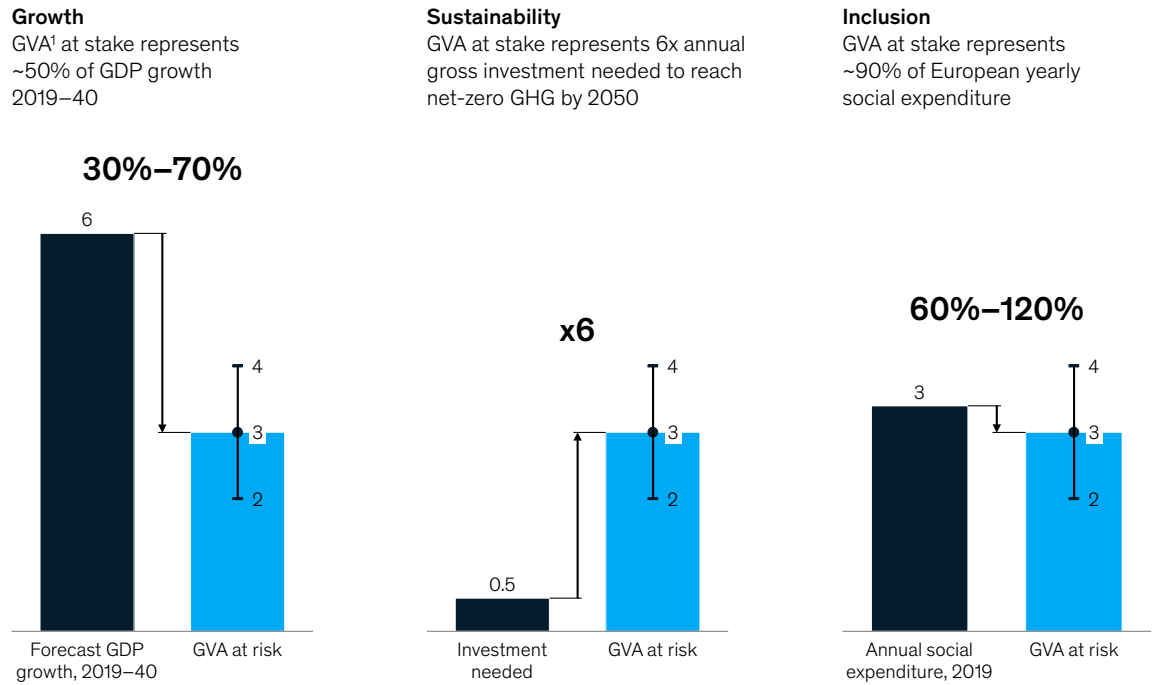
²⁵ European Commission statistical database.

²⁶ Eleven European countries are in the top 20 for the Program for International Student Assessment scores compiled by the OECD; the United States ranks 25th. Europe is home to 43 percent of the world's top 100 universities for life sciences, according to The Times Higher Education World University Rankings 2021; the United States has 34 percent.

Exhibit 6

Value at stake is equivalent to half of GDP growth to 2040, six times the annual expected cost of the net-zero transition, and close to annual social expenditure.

€ trillion



Equivalent to 1pp
GDP compound annual growth rate lost over the entire period

x6
annual gross investment needed to reach net-zero GHG by 2050

€500
monthly universal income for the entire European population

¹Gross value added.
Note: Figures may not sum to 100% because of rounding.
Source: Oxford Economics Base Scenario; European Commission; McKinsey Sustainability; McKinsey Global Institute analysis

Much discussion has been taking place about energy dependence and autonomy, but geopolitical shifts also accentuate the need for strategic autonomy on critical technologies.

and connected large economy, with the most sophisticated supply chains.²⁷ However, the stakes are so high for Europe that decision makers may want to consider breaking new ground and reevaluating trade-offs in a way that has been uncomfortable heretofore.

As winner-takes-most dynamics spread and geopolitics change, Europe needs to play at greater scale and speed and to level the playing field for its firms to compete

As the sources of competition—and growth—shift toward disruptive innovation and intangibles, a winner-takes-most dynamic emerges in which scale, speed, and established tech ecosystems are increasingly vital. A changing geopolitical landscape complicates and deepens that challenge.

In this context, a range of challenges put Europe at a disadvantage. Four challenges stand out and mutually reinforce one another: market fragmentation and lack of economic scale; less developed risk-capital and scale-up funding a complex and slow regulatory environment that could be more supportive of disruption and innovation; and smaller and less established technology ecosystems and firms. Other impediments seem to be consequences more than root causes of these four. Take entrepreneurial talent as an example. If Europe were to fix its scale, venture capital, and ecosystems gaps and its regulatory approach, there is a high probability that this talent would seek and find opportunities in Europe rather than elsewhere.

These challenges are well known among Europe's leaders, who keenly appreciate what needs to be done at the institutional level. Many initiatives are being designed and launched. In the EU, the €95 billion Horizon Europe program, the Smart Specialization initiative, the Important Projects of Common European Interest framework, and the Digital Decade program are but a few recent examples.²⁸

Yet if Europe wants to address its corporate performance gap and avoid a potential slow-motion crisis unfolding over the years ahead, it could usefully consider one question: does the collective total of all the initiatives under way and planned not only match the scale and impact of what leading regions are doing but exceed it, and therefore enable catch-up from today's weaker position?

The implication is not that Europe simply copies the recipes used by other regions, but that it ensures that it enables its firms to compete at scale and speed and on a more level playing field.

To help European firms to compete, Europe could reevaluate trade-offs on 11 policy and regulatory initiatives

As a thought starter, we offer 11 initiatives that could form part of an integrated package to change the rules of the game for European firms and overcome a range of handicaps (Exhibit 7). They would enable firms to build scale and attract scale-up funding, operate at higher speed and with greater degrees of freedom, and level the playing field with other regions and established firms. Many have been topics of long-running debates and come with major trade-offs, yet this diagnostic suggests revisiting the current stance on them. The initial response to the invasion of Ukraine shows that Europe can leverage its scale and move rapidly when faced with a severe challenge. A similar approach will also be needed to address its slow-motion technology and competitiveness crisis. We invite comments and collaboration to progress these initial ideas.

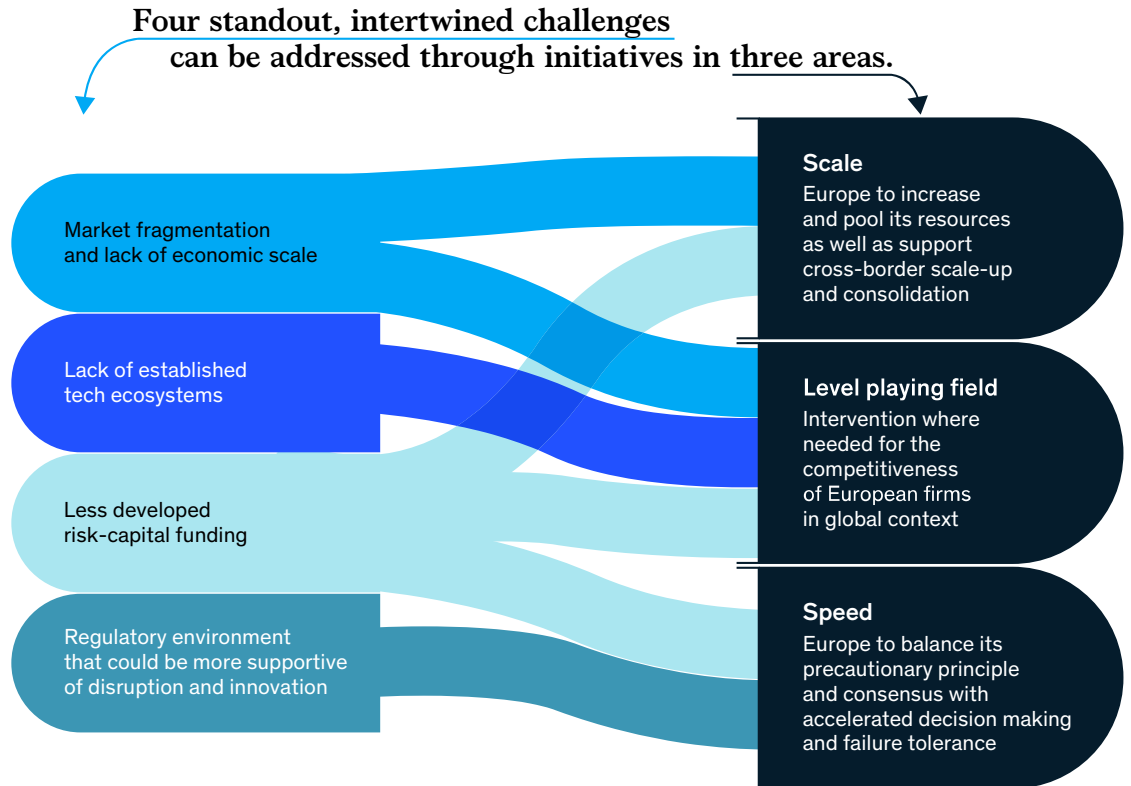
Scale and scale-up funding: In transversal technologies where scale of markets, firms, and investment matters, Europe could increase and pool its resources and support cross-border scale-up and consolidation

European decision makers are bringing forward initiatives aimed at enabling corporates to build scale in key tech areas. In February 2022, France hosted a two-day ministerial conference

²⁷ Gross exports have accounted for 11 percent of Europe's GDP over the past five years; in the United States, the share is 7 to 8 percent. Seven of the top ten countries on MGI's global connectedness index are European. See *The Atlas of Economic Complexity*, Growth Lab at Harvard University.

²⁸ See *Horizon Europe*, European Commission; *What is Smart Specialisation?* European Commission; *Important projects of common European interest (IPCEI)*, European Commission; and Thierry Breton, *How a European Chips Act will put Europe back in the tech race*, European Commission, September 2021.

Exhibit 7



Source: McKinsey Global Institute analysis

on digital sovereignty as part of the Scale-Up Europe initiative, which brings together more than 30 startup and scale-up founders, investors, researchers, and corporations. The aim is for Europe to become home to ten tech giants each valued at more than €100 billion by 2030.²⁹ Also in early 2022, the EU unveiled multibillion-euro plans on satellites and on semiconductors.³⁰ Europe could further consider the following initiatives:

- 1. Develop a common European corporate rule book or 28th regulatory entity for high-growth firms.** Companies scaling up in Europe cite a lack of regulatory harmonization as the second most important barrier to growth. European startups have to contend with the fact that Europe is not a single market but a collection

of countries with their own languages, cultures, regulations, and governments; customer behavior varies; and distribution and marketing are more challenging. The fragmented European value pool means that the region's startups need to deal with cross-border complexity earlier in their journey, and many use the US market to scale before returning to other parts of Europe. About 70 percent of European unicorns have established a global or partly global geographic footprint to reach unicorn status, compared with 50 percent of US unicorns.³¹ Within the Single Market, the streamlining of regulation has been progressing, but full harmonization of standards for taxes (including VAT and employee stock option taxation), regulation, labor rules,

²⁹ *Scale-up Europe spurs collective action to accelerate European tech*, French Presidency of the Council of the European Union, February 2022.

³⁰ Andy Bounds, "EU to take on SpaceX and Amazon with its own satellite internet system," *Financial Times*, February 15, 2022; and Michel Cabirol, "Semiconductors: Europe's mega plan of almost 50 billion to reduce its dependencies," *La Tribune*, February 4, 2022.

³¹ Kim Baroudy, Jonatan Janmark, Abhi Satyavarapu, Tobias Strålin, and Zeno Ziemke, "Europe's start-up ecosystem: Heating up, but still facing challenges," McKinsey & Company, October 2020.

and administrative processes would be all but impossible in short time frames. Europe could therefore develop an additional pan-European 28th regulatory entity that runs alongside the 27 EU member states and affiliated countries. This could be a common European standard on top of national ones and could allow high-growth firms that opt in and comply to operate in all European countries.

2. **Facilitate and encourage cross-border consolidation, including completing the Single Market, revisiting antitrust rules, and removing political obstacles.** More scale also requires more cross-border consolidation of existing large firms—not only to create more globally competitive firms, but to support the development of ecosystems of innovative B2B suppliers around them. Completing the Single Market could help. The respective frameworks and proposals are in place, but the work now needs to be implemented.³² European decision makers could remove political barriers to consolidation of what are often considered “national champions.” Finally, more consolidation would require applying antitrust and concentration rules at a European market level for M&A in those sectors where competition is truly global.
3. **Build European scale-up capital, including a “European DARPA,” venture capital structures, and changes to pension institutions.** Europe’s later-stage growth funding is only about one-tenth that of the United States. The average amount for series D and E raised by European startups is about \$1 billion; the average amount in the United States is between \$10 billion and \$15 billion.³³ Moreover, organizations like United States Defense Advanced Research

Projects Agency (DARPA), the Advanced Research Projects Agency–Energy (ARPA-E), and the National Institutes of Health provide billions of dollars to hundreds of R&D programs for breakthrough technologies. Europe could consider building equivalent institutions, for instance further developing the Joint European Disruptive Initiative. In the United Kingdom, legislation for the creation of a new Advanced Research and Invention Agency with £800 million of funding over four years was going through Parliament in spring 2022.³⁴ Europe could also reduce restrictions and capital requirements to enable asset managers and pension funds to invest more in alternative asset classes like venture capital and private equity. And it could go one step further and build pension institutions that can operate at the scale and level of sophistication of global leaders.³⁵ Finally, it could do more to crowd in private venture capital, building on the initiative of the Venture Capital Funds-of-Funds under the auspices of VentureEU to create a public venture capital fund.³⁶

4. **Pool more public procurement and R&D support among a coalition of the willing, including in defense and healthcare.** Europe pools only 0.2 percent of its total public procurement at the European level, compared with 45 percent at the federal level in the United States. In particular, the United States spends four times the combined budget of European states on defense and space. It is noteworthy that, in February 2022, Germany announced €100 billion of additional spending to modernize the military in response to Russia’s invasion of Ukraine; it should be noted, however, that this funding is a national initiative, not an example of pooled public procurement.³⁷ Similarly,

³² *European industrial strategy*, European Commission; and *Business journey on the Single Market: Practical obstacles and barriers*, European Commission, March 2020.

³³ Kim Baroudy, Jonatan Janmark, Abhi Satyavarapu, Tobias Strålin, and Zeno Ziemke, “Europe’s start-up ecosystem: Heating up, but still facing challenges,” McKinsey & Company, October 2020.

³⁴ John Thornhill, “Britain’s ARPA is an ideological pet project that might yet succeed,” *Financial Times*, February 18, 2022.

³⁵ In 2020, European financial providers spent 0.6 percent of the total assets under management—about \$31 trillion—on venture capital investment. In North America, 1.4 percent of \$54 trillion assets under management was dedicated to venture capital in that year. See *A year of disruption in the private markets: McKinsey Global Private Markets Annual Review 2021*, McKinsey & Company, April 2021; and Pooneh Baghai, Kevin Cho, Ju-Hon Kwek, and Philipp Koch, “Crossing the horizon: North American asset management in the 2020s,” McKinsey & Company, October 2021.

³⁶ Under VentureEU, the EU is providing cornerstone investment of €410 million in independently managed venture capital funds-of-funds.

³⁷ Birgit Jennen, Alexander Michael Pearson, and Arne Delfs, “Germany to boost military spending in latest historic shift,” Bloomberg,

the federal government in the United States spends four times more on public R&D than what is spent at the EU level. For instance, in the case of semiconductors, European states have in the past devoted only a few billion dollars in investment in a fragmented way, but in a welcome move in February 2022, the EU announced new EU-level funding of nearly €50 billion by 2030, much closer to US funding of \$52 billion.³⁸ Moving to joint procurement in innovation-related areas, from defense to healthcare to education technology, would allow for larger bets and more regional focus and would help build an environment for scaling up leading European firms in those areas. At the same time, European leaders could consider increasing compensation schemes for lagging regions.

5. **Increase development and crisis support to European regions in need.** EU structural funds and the Recovery and Resilience Facility are widely respected. Yet fiscal transfers within the United States are four times greater than transfers within the EU. Enhanced support for economically less developed parts of Europe could help them reach their full potential and usefully extend and consolidate the inner market—so long as effective governance can be put in place locally and at the European level. This would include monetary transfers as well as support for economic development.

Speed and simplicity: Europe could balance its precautionary principle and consensus among member states with accelerated decision making and failure tolerance

European regulators have shown that they can become more agile. In response to the need for a rapid reaction to the pandemic, the European Medicines Agency significantly sped up its authorization for COVID-19 vaccines from anywhere between one and two years to only six months. This speed could now be applied to a broad range of innovation-related areas, along with the following measures:

6. **Rebalance the regulatory approach from a precautionary consumer-protection imperative to one that balances costs and benefits of rapid experimentation and disruptive innovation.** In certain breakthrough technologies, Europe could choose to ease requirements for consumer protection, currently grounded in the precautionary principle, to allow faster research on, and rollout of, new disruptive innovation—with the aim of achieving better outcomes for citizens rather than minimizing risks. For instance, EU regulation of data privacy and autonomous mobility may encourage activities in areas like AI and autonomous vehicles, respectively, to move to other regions—and thus for the rules to be made elsewhere. Furthermore, it could also ensure that regulation is consistently outcome-oriented rather than restriction-based.
7. **Develop fast-track regulatory approval and decision-making processes.** In disruptive innovation, speed matters. Yet Europe tends to move more slowly than other regions, from lengthy consensus-based decision making to slower administrative processes, like patenting being half as fast as in the United States. European regulators could take an accelerated approach, similar to the one that unfolded in the case of COVID-19 vaccines, to tech-enabled sectors in which it aims to lead, even if that means occasional failures, setbacks, and adjustments. This could be particularly powerful when paired with a common corporate rulebook.
8. **Embrace faster labor reallocation and reskilling.** As disruptions spread, more workers will need to change occupations or activities. For rapid technology adoption, labor markets will need to be sufficiently flexible. One advantage for Europe in moving swiftly in response to changes in labor markets is the strength of its higher education system and its robust pool of skills. However, labor market rules will now need to be amended to support faster reallocation. Flexicurity principles that protect workers and people rather than jobs, spearheaded by Denmark and now adopted in other parts of

February 27, 2022.

³⁸ Michel Cabriol, "Semiconductors: Europe's mega plan of almost 50 billion to reduce its dependence," *La Tribune*, February 4, 2022.

Europe, are preferable to regulations centered on higher employment protection that slow down labor reallocation in the period of disruption ahead.

Level playing field with established firms and ecosystems: Where might state intervention be needed for the competitiveness of European firms in a global context?

Europe has long promoted competition and has recently instituted strong measures on digital gatekeepers. It could also do the following:

9. **Ensure a level playing field for smaller firms around natural digital monopolies.** The EU has already put in place a digital strategy that includes the Digital Markets Act and the Digital Services Act (both agreed by the approving bodies in early 2022) to ensure that large online platforms that act as gatekeepers in digital markets behave fairly. Europe could consider further stepping up action that allows smaller firms to innovate around and on top of those gatekeepers. This could include a continued strong stance and faster action on service unbundling, but also open or regulated access to platform services and data.
10. **Initiate a debate about how to protect nascent technology-savvy firms before they face the full force of global-scale competitors.** European innovators need more time to scale across a more fragmented market, and they have lower valuations than their US counterparts, making them easy targets. Giving them time to grow could help maximize the innovative power of smaller firms and build capabilities in Europe. In addition, other regions have even gone as far as mandating local operations and capability transfer of global firms. Striking the right balance will not be easy, because cross-border competition and takeovers are also a great source of international learning, scaling, and funding.

11. **Double down on talent as Europe's prime success factor in future markets.** Europe has the second-highest number of STEM graduates of any region in the world, but the region could ramp up skills development, thereby positioning companies and workers to be competitive in an increasingly technology-driven world. Europe is also losing out to the United States on attracting immigrant inventors. About 35 percent of the world's immigrant inventors migrate to Europe, versus about 60 percent to the United States.³⁹ Numerous European countries already have programs to attract talent, including through skills-based immigration systems and talent visas (for example, the United Kingdom's recently announced High Potential Individual Visa). Yet the number of highly skilled workers given EU blue cards in 2018 was nearly 80 percent lower than the number of people given employment-based immigrant visas each year in the United States.⁴⁰ European decision makers could consider greater coordination, increased budgets, and more visibility to attract, develop, and retain STEM and entrepreneurial talent. The recent commitment to a new European Tech Talent service desk in collaboration with the European Startup Nations Alliance is an example of what can be done.⁴¹

Whether the competitive arena improves or not, corporate leaders and owners need to step up their game to take risks and compete

Even if policy and regulation were to create a more enabling environment in which European firms can compete, they, too, need to step up, developing scale and agility to grow and succeed—not only today at the national and regional levels, but globally and for decades to come. Non-executive boards have a strong role to play as they define ambitions, strategies, and guardrails. Hedging will not be enough to succeed. We highlight the following three examples of actions private leaders can usefully take:

³⁹ Carsten Fink and Ernest Miguelez, *Measuring the international mobility of inventors: A new database*, economic research working paper number 8, World Intellectual Property Organization, May 2013.

⁴⁰ In 2018, about 30,400 EU blue cards were issued, about 90 percent of them in Germany. Annually, the United States issues about 140,000 employment-based immigrant visas.

⁴¹ *Scale-up Europe spurs collective action to accelerate European tech*, French Presidency of the Council of the European Union, February 2022.

- **Set stretch long-term targets and adjust incentives.** Given current disruptions and discontinuities, corporations need to set their sights beyond their incumbent business, develop a vision for global leadership ten to 20 years out, and then take risks and deploy capital and R&D investment commensurate with that vision. European companies and their boards could also consider adjusting executive and employee compensation to better align with those visions and the risk-taking needed. Today, only about 5 percent of the private-sector workforce in Europe has some kind of employee ownership, compared with about 20 percent in the United States.⁴² The largest European tech companies have already taken this approach.
 - **Leverage programmatic M&A and alliances to acquire the scale and capabilities needed.**⁴³ This would include cross-border European and global consolidation, including sell-side M&A where global leadership is out of reach. It would also include using vertical and capability-based acquisitions to ramp up the development of innovation strengths and ecosystems, for instance using corporate venture capital. Companies should also be proactive in seeking and developing cross-sector alliances to accelerate the development of transversal technologies, as, for instance, Renault and Valeo are doing on electric vehicles.⁴⁴ Companies and entrepreneurs can also seek to set up new disruptors.
 - **Invest in innovation and technology governance and capabilities at scale and pace.** Companies will need to implement agile and more customer-centric innovation governance able to deal with higher-risk, long-term projects. They will need to find or reallocate funds for long-term innovation and business development on a larger scale than they have previously. And they will need to build skills. Siemens, for instance, enabled 380,000 employees in 200 countries to upskill and reskill in digital capabilities in 2021 through a dedicated learning platform.⁴⁵
- European countries have been leaders on sustainability and inclusion. They are now concerned with the security of supply chains, energy, food, and defense. How much should the region also worry about its corporate and technology gap, which is jeopardizing future growth and strategic autonomy—and when? Can the momentum of common action triggered by war in Ukraine now also provide the impetus to make the trade-offs needed for technology and competitiveness that have long felt difficult?
- More work will likely be needed to determine how to tackle Europe's gaps in corporate performance and innovation in detail and in practice, technology by technology and sector by sector, building resilience into the European model for the long term. This article marks the start of a McKinsey initiative to gather insights across Europe in an effort to make a contribution to addressing these questions.

⁴² National Center for Employee Ownership in the United States; European Federation of Employee Share Ownership.

⁴³ "How one approach to M&A is more likely to create value than all others," *McKinsey Quarterly*, October 2021.

⁴⁴ Peter Sigal, "Renault, Valeo to work together on next-gen e-motors," *Automotive News Europe*, February 10, 2022.

⁴⁵ Prajeet Nair, *Siemens to deploy Infosys digital learning platform to upskill and reskill employees*, Tech Circle, March 13, 2020.

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