STUDY

The 2040 technology game plan

Winner takes most: Europe's strategic options in the global technology race

Roland Berger

The window is open, but not for long

Technology is the primary driver of economic growth, industry leadership, and quality of life. Throughout history, every major economic cycle has been defined by breakthrough technologies that reshape entire systems – and the next cycle is already forming. Thirty emerging trends, from semiconductors and humanoid robotics to medtech and energy storage, will set the technology agenda through 2040. Their combined market will grow tenfold, from EUR 2.5 trillion today to more than EUR 20 trillion by 2040 – during a period when total industrial GDP is expected to roughly double.

Fourteen of these trends stand apart. Combined, the Top 14 will reach EUR 16 trillion in global market value by 2040, with AI systems, semiconductors, and data centers alone accounting for more than half. The technologies split into two groups: Act Now – where markets are already forming and competitive positions are hardening – and Scout & Prepare – where the opportunity is significant but the horizon longer.

Europe's position across the Top 14 is uneven. In the three largest markets – AI, data centers and semiconductors – the US dominates and China is closing fast. In microgrids, quantum technologies, CCUS, and biomaterials, Europe leads. The challenge is converting that research strength into commercial scale before the window closes.

Three pathways define how European companies and policymakers can best engage: Europe for global, targeting international markets where Europe leads; Europe for Europe, focusing on strategically designated domestic demand; and foreign player localized, attracting non-European investment where frontier leadership is not realistic. Together, these position Europe to capture EUR 3 trillion – around 20% of global industrial GDP across the Top 14 technology trends – by 2040.

Getting there requires change on both sides. Policymakers must switch from national to continent-wide industrial policy, shift from pilot funding to large-scale deployment, and provide long-term clarity in nascent markets. Industry must build genuine innovation management capabilities, make long-term technology bets, seek partnerships to set standards, and compete at the system integration layer rather than attempting to own full platforms.

Contents

Cover AI GENERATED

A The technologies that will matter most by 2040

Idenfied from a pool ofmore than 400 candidates, these 30 trends[1] will drive the next wave of global economic growth

Industrial transformation	Additive manufacturing	Advanced propulsion	Data centers	Humanoid robotics	Semi-conductors
Future energy systems	**CCUS** (carbon capture, utilization & storage)	Energy storage	Microgrids & distributed energy resources	Small modular reactors	Sustainable fuels
Digital infrastructure	AI systems & software intelligence	Next-gen connectivity	Next-gen cybersecurity & cryptography	Quantum technologies	Web 3.0
Mobility & transportation	Advanced space technology	Autonomous defense systems	Autonomous mobility	Charging	Next-gen air mobility
Health & bio-innovation	Alternative proteins	Biomaterials	Medtech	Next-gen farming systems	Regenerative medicine
Resource innovation	Advanced alloys & composites	Advanced magnetic materials	Deep-sea mining	Nanomaterials	Water treatment & recovery

1 Trends are organized by category; not ranked by priority

Source: Roland Berger

The future of technology – and Europe's place in it

1

Predicting the future of technology is harder than it looks. For every trend that shapes the way we live – cars, vaccinations, the internet – many more quickly become redundant. Segways, fax machines, recordable discs: plenty of technologies that once looked inevitable simply fizzled out. And even a decade ago, few people predicted AI's rapid rise to digital dominance.

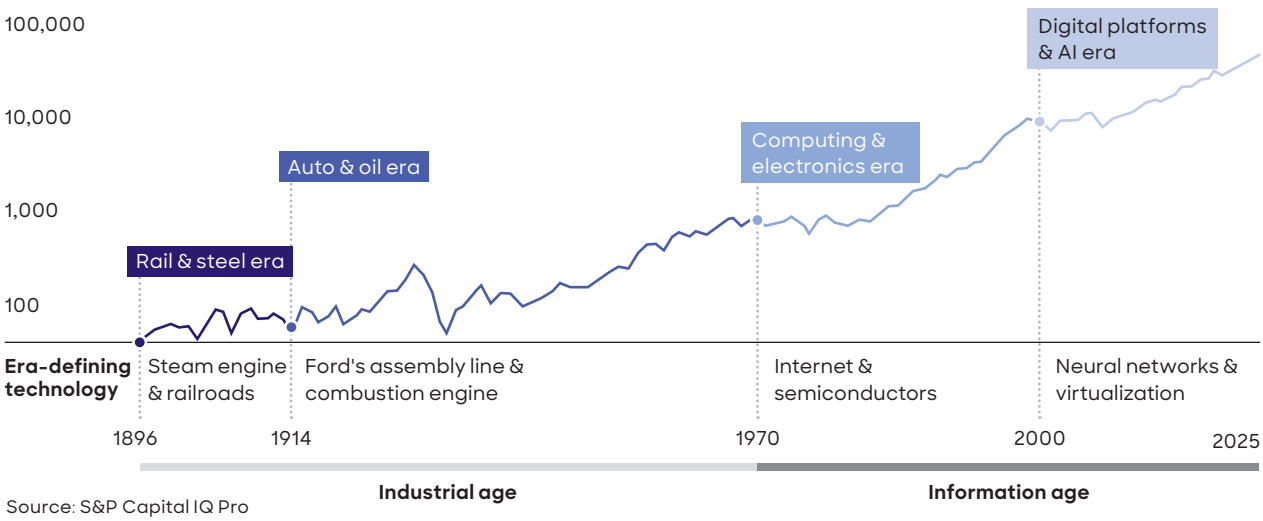
Yet that uncertainty is no reason to stop trying. More than any other factor, technology has shaped the world we live in – and the wealth we have generated from it. Two hundred years ago, global average GDP per capita was less than USD 2,000 per year. Today it stands at around USD 20,000. The global population grew from 1 billion to 8 billion over the same period, driven by new food technologies, medical advances, and rising life expectancies. Every one of those gains was anchored by a cycle of breakthrough technologies that reshaped entire industries and created a new generation of dominant companies.

The Dow Jones Industrial Average tells the story. From the steam engine and railroads, to Ford's assembly line and the combustion engine, to semiconductors, the internet and today's digital platforms – each era produced a decisive step change in market performance. The companies that defined each cycle did so by positioning early, scaling fast, and setting the terms of competition before their rivals caught up. ▶B

B Buy, buy, buy

Breakthrough technologies have long driven stock market performance upward

Dow Jones Industrial Average (DJIA), with eras and key technologies [USD]



Source: S&P Capital IQ Pro

Another cycle is now taking shape. Thirty emerging technologies – from semiconductors and humanoid robotics to medtech and energy storage – are moving from development to market, and their combined commercial weight will be substantial. ▶A

Today, these trends account for roughly 9 % of global industrial GDP. By 2040, that share is projected to reach 37 %, equivalent to a market of more than EUR 20 trillion – a tenfold increase in under 15 years. ▶C

There's real opportunity here for companies and governments alike, but also real risk in getting it wrong. Companies such as Alphabet, Meta, and Amazon have demonstrated the rewards of backing the right technologies and position at scale – but miss the window and the gap only gets harder to close.

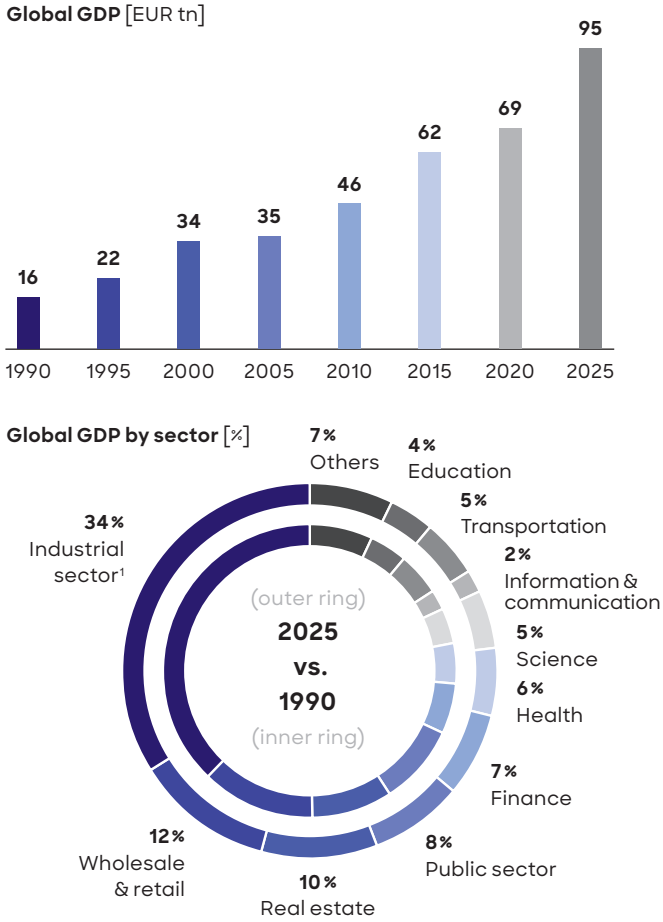
Europe feels this challenge more than most. The continent has genuine strengths: a strong research base, excellent universities, and a track record of invention that stretches from the printing press to the smartphone. But over the past 30 years, a combination of fragmented markets, slow decision-making, and limited access to scale capital has kept those strengths from translating into global technology leadership. North America has pulled decisively ahead. China has closed the gap from the other direction. Europe's share of the technology value being created today undershoots what it should be, given the foundation it started from.

This study addresses both sides of that picture. It maps the global technology landscape – identifying 30 key trends, prioritizing the 14 most commercially significant, and assessing the market trajectory and competitive dynamics of each. It then turns to Europe: where the gap is widest, where genuine leadership positions exist, and what policymakers and industry must do differently to secure Europe's share of a EUR 16 trillion opportunity. That window is open now – but it won't stay open for long.

C Wealth drivers

Nominal global GDP rose sharply, driven by a consistently strong industrial sector

Evolution and composition of global GDP, 1990–2025



1 Industrial sector is defined as global GDP excluding services (except for software)

Source: S&P Comparative Industry

Mapping tomorrow's technology landscape

2

Identifying which of the current wave of technologies will matter most and acting on that judgment before the curve is crowded is the central challenge for any company or government. From more than 400 candidates, we identified the 30 trends that will most meaningfully reshape economic and industrial output by 2040. That starting list was drawn from Roland Berger's Advanced Technology Center – a database built through years of project work with leading technology actors and reviewed annually at expert workshops. From there, AI-enhanced clustering techniques helped us group and filter the candidates, and targeted interviews with industry experts across fields including semiconductors, quantum, and medtech honed the final selection. All 30 are already in development at different speeds and along different trajectories – but each can be expected to reach commercial relevance within the same period

Today, these 30 trends collectively account for roughly 9 % of global industrial GDP. By 2040, that share is projected to reach 37 % – a market growing from EUR 2.5 trillion to more than EUR 20 trillion in under 15 years, during a period when total industrial GDP itself is expected to roughly double. The broader economy will grow substantially. These 30 trends will grow tenfold. ▶ D

The 30 trends span six distinct categories – from the digital layer that increasingly governs how all industries operate, to the physical infrastructure of energy and resources, and the biological frontier where materials science and medicine are converging. Together, they form a complete picture of where industrial value is heading.

NOT ALL 30 ARE EQUAL

Across the 30 trends, there are significant differences in maturity, market size, and the breadth of industries each one will touch. Some – deep-sea mining and regenerative medicine, for example – remain early-stage, with narrow sectoral reach and limited commercial timelines by 2040. Others, such as AI systems or semiconductors, are already reshaping economies and will only accelerate from here.

To identify which of the 30 trends demand the most urgent attention, we mapped each one across three dimensions:

1 Disruption potential
How many industries does it affect, and how fundamentally?

2 Market volume by 2040
How large is the commercial prize?

3 Commercialization timeline
How soon will revenue become meaningful at scale?

The result is a shortlist that covers both the technologies already reshaping markets today and those building toward decisive commercial inflection points in the years ahead. ▶ E

"The 14 technology trends we identified will be worth EUR 16 trillion by 2040 – and the window to position for that is open right now."

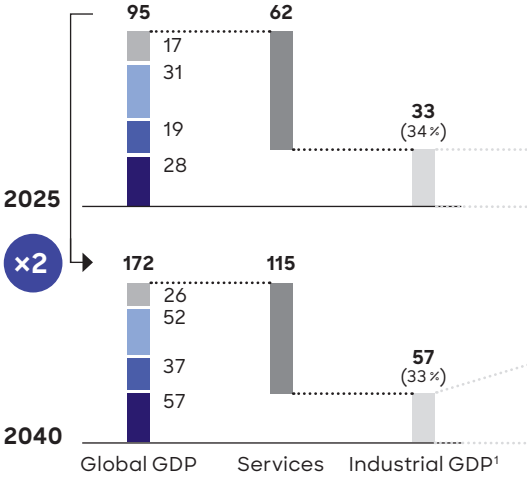
Felix Mogge
Senior Partner

"We mapped 30 emerging technologies, and the conclusion is simple: the market will be ten times larger by 2040 than it is today."

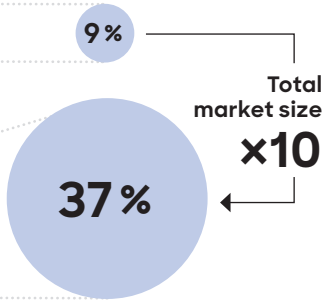
Stefan Riederle
Senior Partner

D Market boom
Industrial GDP will double by 2040, but the 30 key trends will grow 10x

Nominal global GDP by sector and region [EUR tn]



Key 30 trends' share of industrial GDP [%][2]



EU-15 US, MX, CA Greater China RoW

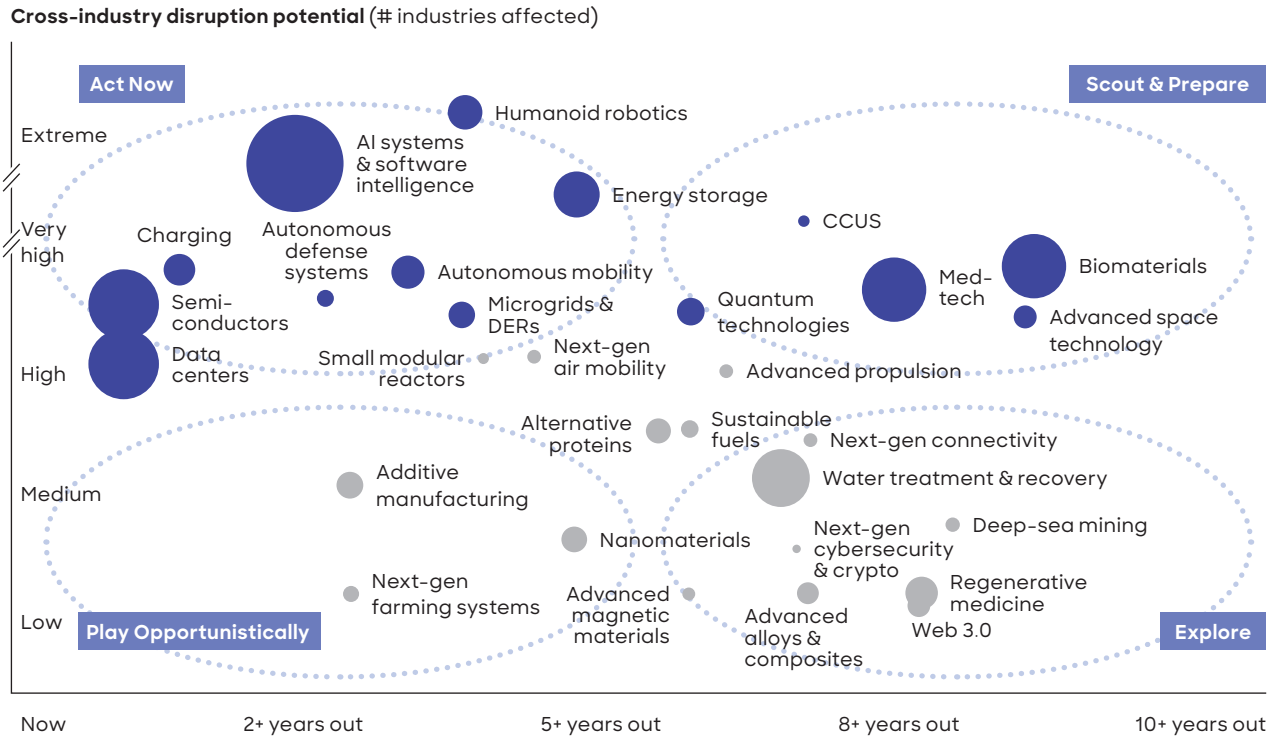
1 Industrial GDP is defined as global GDP excluding services (except for software);
2 Excluding 40% of semiconductor market volume as it is considered supply for other technology trends

Source: S&P Comparative Industry, desk research, expert interviews

E Trend prioritization

Mapping 30 trends by disruption and timeline revealed a Top 14

Prioritization matrix



Technology trends with high to extreme disruption potential split into Act Now and Scout & Prepare groups

- Top 14 prioritized technology trends
- Bubble size indicates market volume in 2035-40 [USD bn] ranging from <5 (smallest bubble) to >4,000 (largest bubble)

Source: Desk research, expert interviews

Combined, these Top 14 trends will reach a global market value of EUR 16 trillion by 2040 – with almost every one posting double-digit growth rates along the way. Three trends alone – semiconductors, AI systems & software intelligence and data centers – will account for more than half of that total, each driven by the compounding demand that AI infrastructure is generating across the economy. These are the markets where strategic positioning today will determine competitive relevance in 2040. ▶F

The Top 14 split into two primary groups based on their development trajectory:

Act Now
Nine of the Top 14 sit here: commercial markets are already forming at scale, capital is moving fast, and competitive positions are hardening. These require immediate commitment – in funding, ecosystem development, and strategic direction. In Act Now trends, delay does not just mean catching up later; it means being locked out entirely.

Scout & Prepare
Five Top 14 trends fall into this group, where the commercial opportunity is significant but the development horizon is longer. The window to build foundational capabilities – talent, IP, partnerships, regulatory frameworks – is open. But it will not stay open indefinitely. Europe's strongest global leadership positions are concentrated here, making this group as strategically critical as Act Now, even if the urgency is less immediate.

The remaining 16 trends call for a different kind of engagement. Two postures define how organizations can stay alert to the full landscape without overcommitting resources:

Explore
A set of trends where early signals are promising but trajectories remain genuinely uncertain. Deep-sea mining and next-gen air mobility, for example, may become significant markets – or may not reach commercial scale within the relevant window. The right approach here is structured monitoring and targeted experimentation, not full capital commitment.

Play Opportunistically
Trends where a proactive leadership strategy is difficult to justify – either because the competitive landscape is already locked, the market dynamics are heavily dependent on external conditions, or the addressable opportunity is too narrow to anchor a primary strategy around. Entry makes sense only when specific conditions align: a regulatory shift, a supply chain disruption, or a partner bringing complementary capabilities. These are not areas to ignore. They are areas to enter selectively when the conditions favor it, rather than building organizational strategy around them.

The priorities are clear: Act Now and Scout & Prepare are where Europe's industrial and policy decisions carry the most consequence. The remaining postures provide a framework for players – both in Europe and beyond – to stay alert to the full landscape without spreading resources too thin.

F Big potential

The Top 14 trends will reach a combined EUR 16 trillion in market value by 2040

Top 14 technology trends	Definition	Market volume 2025 [EUR bn]	Market volume 2040 [EUR bn]	CAGR [%]
Act Now				
Semiconductors	New chip designs and manufacturing methods	670	2,600	10
AI systems & software intelligence	Optimizing operations via advanced AI	210	5,000	24
Data centers	Energy-optimized and modular digital infrastructure	380	2,500	13
Autonomous defense systems	Unmanned systems for surveillance and threat response	16	170	17
Humanoid robotics	Robots performing tasks independently	1	750	57
Microgrids & DERs	Resilient power systems through local generation	24	415	21
Charging	Boosting electrified transportation with innovative charging solutions	40	500	18
Energy storage	Expanding energy systems with battery solutions	240	1,000	10
Autonomous mobility	Vehicles operating without human drivers	60	590	17
Scout & Prepare				
Quantum technologies	Unlocking new computing and sensing capabilities	1	330	44
Biomaterials[1]	Materials designed to interact safely with biological systems	200	1,400	14
CCUS	Reducing emissions through carbon capture	7	51	14
Medtech[1]	Improving health outcomes with innovative devices	490	1,300	7
Advanced space technology	Lowering barriers to space access	34	220	13

1 Including low- and mid-tech applications

Source: Desk research, expert interviews

Trends in focus

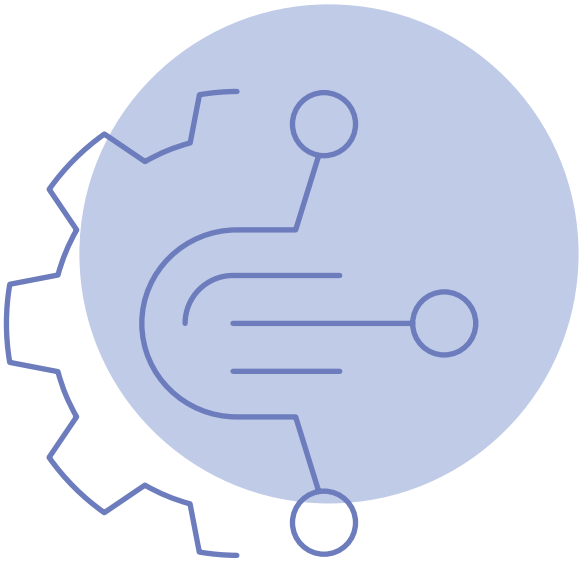
3

3.1/ Act Now trends

Examining a few of these trends in depth provides a snapshot of where the competitive dynamics are shifting, where Europe's specific strengths and weaknesses lie, and what the realistic strategic options are for both policymakers and industry.

"Europe's problem has never been a shortage of ideas or talent. It's been the gap between invention and scale. Too little capital, too slow to decide, too fragmented to build at a size that competes."

Felix Mogge
Senior Partner



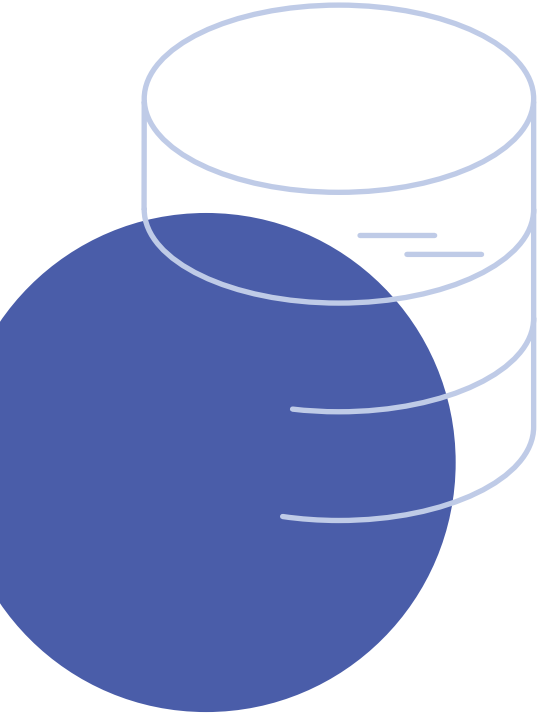
AI systems & software intelligence

AI systems represent the largest technology trend in the Top 14 – and Europe is barely in the race. The market is US-centric, US-funded, and US-led, and the gap is widening faster than most European policymakers have acknowledged. ChatGPT reached 100 million monthly active users in approximately two months – and by early 2026 had surged to 883 million weekly active users. In 2024, 78 % of organizations reported using AI, up from 55 % the year before. Yet despite those investment volumes, 95 % of companies report zero return on their AI pilots, and only 5 % have generated any measurable P&L impact. The gap between AI adoption and AI value creation is real – and closing it is the defining commercial challenge of the next decade.

The US dominates model development followed by China. Europe, by contrast, produces 128,000 ICT university graduates annually, more than the 123,000 in the US, and its AI patents are cited above average – a signal of quality without scale. Europe has the talent base and the industrial application domains. But without concentrated investment and a regulatory environment that enables rather than constrains, European capability will continue to fragment rather than compound. The realistic path forward is not competing head-on in horizontal AI platforms but building specialized, vertical AI applications – in predictive maintenance, fleet optimization, and industrial process control – on top of existing LLMs, where Europe's domain expertise and data richness are genuine differentiators.

"While Europe is falling behind in the data center build-out, its industrial base is a key contributor to the data center supply chain, such as power distribution, cooling and power generation. This presents a significant opportunity for companies in Europe."

Siyi Hao
Principal

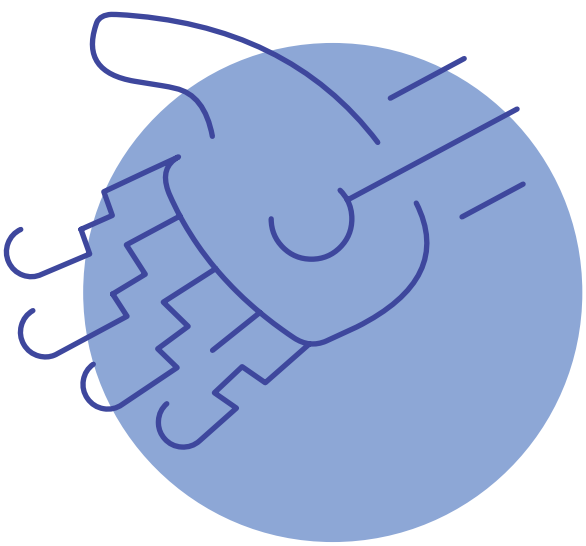


Data centers

Data centers are the physical backbone of the ongoing AI revolution – and demand is accelerating faster than most forecasts anticipated. The Roland Berger Data Center Model projects global installed capacity growing from ~90 GW in 2025 to nearly 350 GW by 2035, with AI's share of total load rising from ~20 % to nearly 60 %.[1] The infrastructure investment being committed today – by hyperscalers, cloud providers, and national governments – will define who controls digital capacity for the next 20 years.

Europe's challenge is structural: energy costs, permitting timelines, and fragmented national frameworks make it significantly harder to build at the speed and scale the market requires. Connecting a new European data center to the electricity network can take up to seven years, compared to one to three years in the US. 69 % of data center professionals expect energy availability to become more challenging by 2035.[2] North America's share of global installed capacity is projected to climb to ~58 % by 2030, while Europe's share declines from ~13 % to ~10 %.[3] While Europe plays an often crucial role in the data center supply ecosystem, for example in power equipment and cooling, it is falling behind in the actual data center build-out – particularly for larger, AI-focused installations. If this trend continues as predicted, Europe will rely heavily on infrastructure built elsewhere and miss out on a significant share of the economic growth linked to AI.

1 Roland Berger, The global build-out race: AI data center study | Part 1, 2026; 2 Roland Berger; 3 Roland Berger



"Humanoid robots are moving from science fiction to reality. It's no longer a technology question – it's a timing question. The key gap is on software and data for AI models."

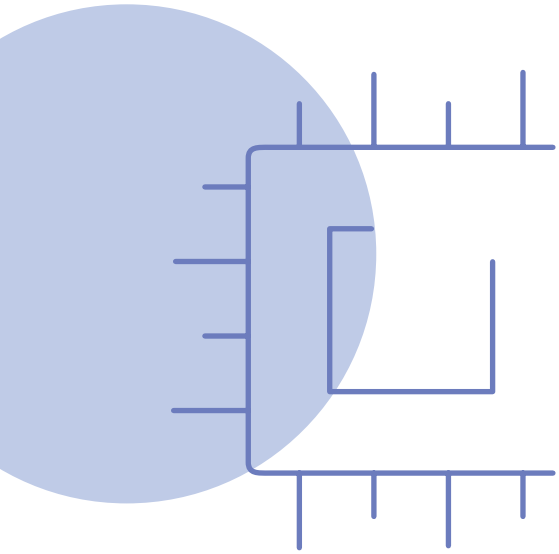
Thomas Kirschstein
Partner

Humanoid robotics

Humanoid robots are moving from prototype to factory floor faster than most industries expected. In high-wage economies facing structural labor shortages, a robot that can operate in an existing factory – without infrastructure redesign – at an estimated cost of USD 20,000–30,000 per unit and operating costs of around USD 2 per hour offers a compelling return on investment. The long-term market potential reaches USD 4 trillion by 2050 – comparable in scale to the entire automotive industry today.

China produced more than 15,000 units in 2025 alone – roughly 30 times the volume of North America and more than 150 times that of Europe – backed by USD 4.1 billion in startup OEM funding versus just USD 0.8 billion in EMEA. The deployment gap is not primarily a technology problem; it is a data and ecosystem problem. Whoever accumulates the most real-world training data fastest will define how these systems learn – and China is building that lead at scale.

Europe's opportunity lies elsewhere: in specialized solutions for high-value use cases such as logistics picking and complex assembly, and in the industrial integration layer – actuators, motion systems, power electronics, and safety-critical components – where European OEM positions are already strong. For Europe, with working-age populations projected to decline by up to 22–25 % in some regions by 2050 and extensive brownfield factories where humanoids can operate without infrastructure redesign, this is not an abstract industrial trend – it is a structural necessity.



"Leading-edge fabs sit in Taiwan, South Korea, and increasingly the US again. Europe's strongholds lie elsewhere – including in equipment, IP/design, and power and automotive semiconductors – areas that have to serve as starting points for future growth and resilience."

Nikolaus Lehmann
Partner

Semiconductors

Semiconductors sit beneath every technology on this list: AI runs on them, humanoid robots depend on them, and defense systems, data centers, and autonomous vehicles cannot function without them. After an inflation-driven downturn, the global semiconductor market has rebounded sharply – reaching approximately 29 % year-on-year growth by October 2025 – driven by AI, data centers, and renewed industrial demand.

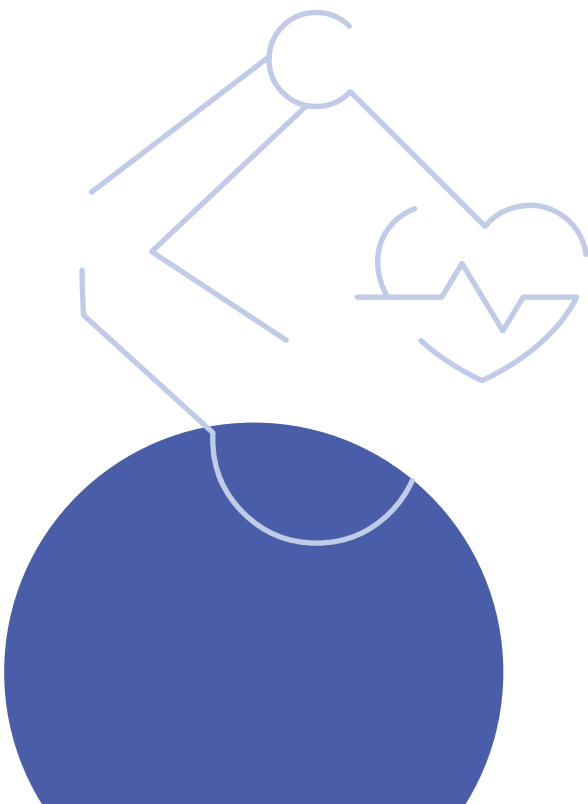
The value chain is highly concentrated: South Korea, Japan, and Taiwan dominate large-scale production; the US leads decisively in chip design; and Europe holds a global monopoly in one critical input – EUV lithography equipment, through ASML, whose tools cost USD 150–200 million each and even as much as USD 300–400 million for the newest versions.

That one position is both Europe's greatest asset and a reminder of how narrow its competitive footprint is. Europe accounts for less than 3% of global semiconductor sales, just 9% of global wafer fabrication, and 5% of assembly, packaging, and testing – and all three shares are on a downward trend. The European Chips Act aimed to reach 20% of global semiconductor market share by 2030 – a target that is already out of reach: available funds from Chips Act 1.0 could largely not be allocated, and a follow-up, Chips Act 2.0, is in preparation. Closing the talent gap – projected at up to 80,000 skilled workers by 2030 – is as critical as closing the capital gap. Europe has several areas of strength to build on – manufacturing equipment, IP/design, and automotive- and industrial-focused semiconductors including power. Policymakers and industry must defend those positions and identify opportunities to build clusters for future growth, value capture, and strategic resilience in this all-enabling industry.

3.2/ Scout & Prepare trends

"Building the best technical product is no longer enough to survive on the market. Chinese manufacturers can now deliver something similarly good for half the price. Europe's advantage sits in high-complexity segments where precision and process experience matter more than unit cost."

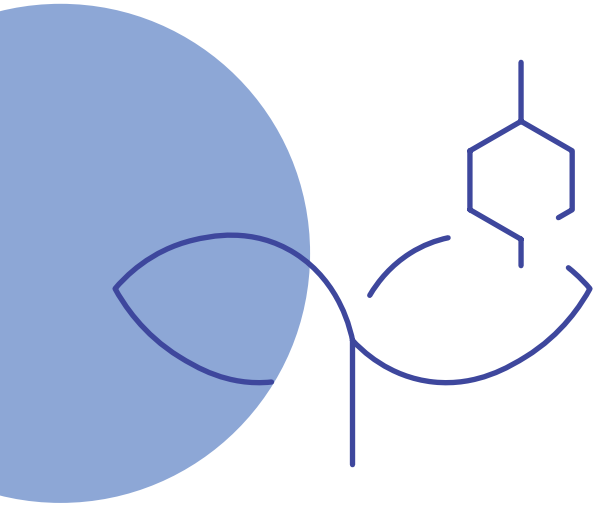
Jonas Lehmann
Principal



Medtech

Medtech is one of the broadest and most structurally resilient trends in the Top 14. It is not defined by a single breakthrough technology but by a sustained rise in system complexity – products are becoming more software-intensive, more connected, and more tightly regulated. In turn, we're seeing longer innovation cycles, higher lifecycle management costs, and the growing importance of cybersecurity across the device landscape. The demand backdrop is favorable and durable: aging populations across Europe and Asia are generating a growing need for diagnostics, prevention, and therapy that no near-term technological or policy shift is likely to reverse. Europe's position in this market is genuinely strong in several areas – high-precision mechanics, electronics, and optics, with recognized leadership in imaging systems and precision instruments, and deep industrial clusters such as Tuttlingen in Germany providing a concentrated base of specialist manufacturing capability.

But European competitiveness is increasingly under pressure. The EU Medical Device Regulation has added compliance costs that weigh disproportionately on small and mid-sized companies without delivering commensurate patient safety gains. China is closing the gap in imaging and diagnostics, competing with cost-effective products backed by strong industrial policy, and volume-based procurement in China structurally disadvantages foreign players without local manufacturing presence. The US retains the dominant global position in revenue terms, driven by scale, capital availability, and faster commercialization cycles. Europe's most defensible ground lies in high-complexity segments where integration expertise, safety-critical design, and process know-how matter more than unit cost. Regulatory modernization – specifically simplifying MDR implementation for incremental innovation and SMEs – is identified as the single highest-leverage policy action available. Without it, Europe risks a slow erosion of positions that took decades to build.



"Biomaterials is a much bigger opportunity than many people assume – it reaches far beyond medical technology into virtually every industry. This is one of the areas where I genuinely believe Europe has the chance to catch up with – and potentially lead – the global field."

Marco Bühren
Partner

Biomaterials

Biomaterials – materials derived from living organisms and biological processes, from agricultural waste streams and mycelium to algae and bacteria – are quietly reshaping the competitive logic of industrial materials strategy. Applications span packaging, textiles, leather alternatives, and food production, with feedstocks ranging from second-generation agricultural byproducts to third-generation non-agricultural sources that place no pressure on food systems. What makes this trend significant is the convergence of two powerful forces: mounting corporate pressure to decarbonize material inputs, and a growing geopolitical incentive to reduce dependence on oil-based supply chains concentrated in politically exposed geographies.

Europe's position here is genuinely strong. In R&D, startup activity and early commercial partnerships, Europe leads globally, with a concentration of innovative companies in Germany and Scandinavia working on waste-based materials, mycelium, and algae feedstocks. Several are already moving from pilot scale toward early commercial agreements with automotive and consumer goods companies.

Capital scale remains the constraint. European biomaterial startups typically raise in the tens of millions of euros per round; the petrochemical incumbents they are displacing operate with capital expenditure in the tens of billions. That funding asymmetry, combined with insufficient demand-side pull from downstream brands unwilling to absorb higher prices or performance risk, is what prevents a world-class research base from becoming a globally competitive industry. Closing all three gaps – funding, cross-industry collaboration, and demand-side commitment – is precisely the structural work that the Scout & Prepare window still allows time to do.

Europe's technology gap

4

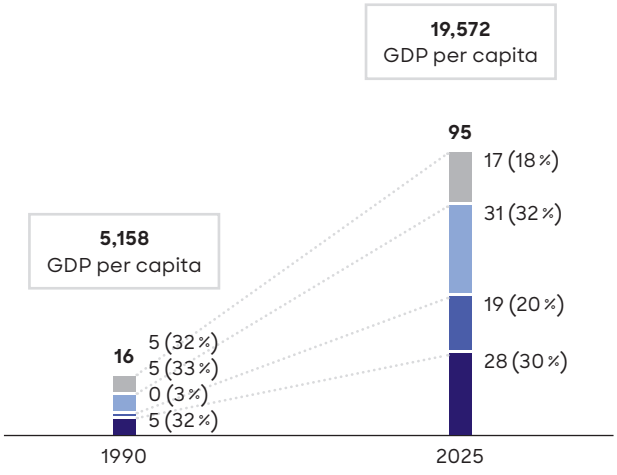
Positioning is everything. While huge value potential exists among the top technology trends, the bad news for Europe is that it is poorly placed to capitalize on it.

Europe's global position has declined over the past 30 years – largely because it has failed to maximize the potential of its technologies. Its main rivals have fared much better, greatly increasing their shares of global GDP. China has grown from a very low base in 1990 to become a tech superpower, with its GDP fast catching up with Europe. But more worryingly, North America has seriously outpaced Europe's. In 1990, the pair had similar global GDP shares and GDP per capita figures. By 2025, North America had a 50 % lead in both. The difference is attributable to the US's focus on scaling and early capitalization – hence the term "Europe's technology gap." ▶G

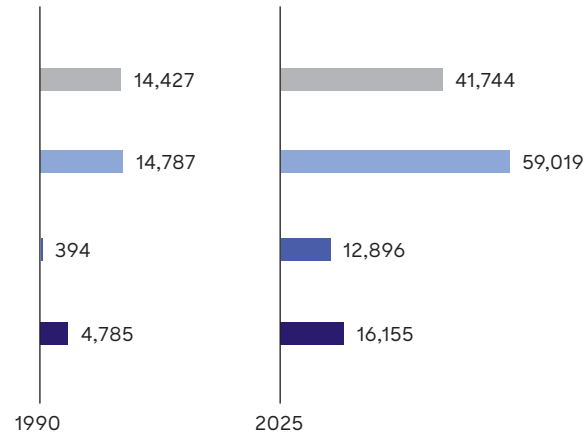
G The technology gap

Europe trails North America since 1990, with China catching up fast

Evolution of nominal GDP distribution [EUR tn, %]



Evolution of GDP per capita [EUR]



EU-15 US, MX, CA Greater China RoW

Source: S&P Comparative Industry

EUROPE'S DIFFERENT PATH

There are numerous reasons for Europe falling behind, but first it is worth looking at its strengths. Historically, the continent has many structural advantages. In particular, it has a strong science and research base, with many excellent universities and an unrivalled track record of invention, from the printing press to the automobile and smartphone. And politically, the European Union has a long history of stability, rule of law, prosperity, progressive thinking, and freedom of movement.

But despite this strong base, in the past 30 years the EU has followed priorities that diverged from those of its more successful global rivals and limited technological growth. Several structural factors stand out. The expansion of the EU from 15 to 28 member states between 1995 and 2013 brought political breadth but also institutional complexity – slowing the speed at which collective decisions could be made and implemented. Regulatory processes that require unanimity across member states have consistently added years between proposal and EU-wide implementation, a pace that simply does not match the speed at which technology markets move. At the same time, significant subsidy flows were directed toward agriculture, crisis mitigation, and decarbonization rather than future-facing technologies, while a sustained focus on social welfare and environmental protection – both legitimate priorities – came at a cost to risk appetite and shareholder value creation. Cross-border barriers within the EU, equivalent to a 44-times tariff on intra-EU manufactured goods, have further constrained the ability of European companies to scale across the continent's nominally single market. Taken together, these priorities weakened companies' ability to commercialize at speed and grow to the scale needed to compete globally.

HOW THE US AND CHINA GOT IT RIGHT

Unhindered by such challenges, the US and China have been able to build on their own – and Europe's – strengths.

US strengths: Scaling and monetizing

The US has developed a very innovation-friendly business environment:

- Mission-driven public research that converts fundamental science into breakthrough technologies aligned with national priorities
- World-leading systems engineering that enables integration of multiple technologies into large, complex, high-performance solutions
- Entrepreneurial capital markets to support high-risk experimentation and rapid reallocation of resources toward winning solutions
- Market leadership achieved through rapid scale, turning technological advantages into de facto global standards.

The success of Nvidia and SpaceX are good examples of US companies that drew on all of these strengths to quickly dominate their markets.

"Europe's problem has never been talent or ideas – it's that fragmented markets and slow capital keep stopping good technologies from reaching scale."

Stefan Riederle
Senior Partner

Chinese strengths: Catching up and optimizing

The strong guiding hand of China's government has helped to foster several structural advantages:

- Fast absorption, localization, and incremental improvement of technologies developed elsewhere at exceptional speed
- World-class industrial scaling and process optimization, driving cost reduction, yield gains and tightly coordinated supply chains
- Rapid commercialization driven by massive domestic demand, compressing time from prototype to mass adoption
- Indirect shaping of global standards through sheer deployment scale and manufacturing dominance rather than original invention.

The rapid rise of Xiaomi and CATL epitomizes these strengths.

Key success factors for the future

Each region's relative strengths and weaknesses have shaped their corporate landscapes. In the US, the biggest publicly listed companies by valuation, including Alphabet, Nvidia, and Apple, are all tech-focused, while a far greater number of young tech firms with market capitalizations above USD 10 billion exist than in Europe and China. Tech players have a huge influence over the economy as a result. Large, young technology players also dominate in China, albeit to a lesser extent. In the EU, however, large, young tech companies must compete alongside more traditional industrial players such as Siemens and Airbus.

As structural growth conditions converge across regions, eight success factors will be key going forward: the ability to scale not just invent; access to capital-intensive ecosystems; software and data-centric capabilities; system integration capabilities; speed and entrepreneurial risk appetite; global talent attraction and mobility; public-private coordination at scale; and standard setting through market penetration.

1 Ability to scale, not just invent
Rapid scaling from prototype to relevant market volumes

2 Capital-intensive ecosystems
Access to growth and late-stage capital for compute, fabs, gigafactories, and infrastructure

3 Software and data-centric capabilities
AI-first mindset, data availability, platform economics, and continuous iteration

4 System integration capabilities
Combining hardware, software, data, services, and regulation into end-to-end systems (e.g., autonomous mobility, which combines sensing, AI, and software, all complying with regulations)

5 Speed and entrepreneurial risk appetite
Fast product cycles, early market entry, and tolerance for failure

6 Global talent attraction and mobility
Ability to attract and retain top global talent in AI, robotics, semiconductors, and quantum tech

7 Public-private coordination at scale
Tight alignment between industry, government, regulation, and strategic investment (for example, semiconductors, energy, sovereign infrastructure)

8 Standard setting through market penetration
Standards today are driven by scale, ecosystems, and platform dominance – not by invention alone

THE QUESTION FOR EUROPE, THEN, IS WHERE DOES IT GO FROM HERE?

Pathways for Europe's technology future

5

The best way to close a gap is to start from a position of strength. Across the Top 14, Europe leads in several trends – particularly those that are further from full commercialization, where the competitive window remains open. In others, including microgrids and quantum technologies, Europe holds a genuine global leadership position today. The picture is more difficult in the trends closest to commercialization at scale. In data centers and AI systems and software intelligence, Europe lags significantly behind the US and China in both infrastructure and frontier model development. Closing that gap entirely in areas such as leading-edge chiplets or large language model development is not a realistic near-term objective. However, that does not mean Europe has no role to play. Within broader trend categories, viable niches exist – in specialized AI applications for regulated industries, in chipmaking equipment, in mature and legacy semiconductor nodes where European players already compete – and these should not be written off. The strategic question is in which segments of each trend Europe can build a credible and defensible position. ▶H

THREE PATHWAYS – AND HOW TO CHOOSE BETWEEN THEM

Europe's options for engaging with the Top 14 do not reduce to a single binary decision. In reality, there are different pathways available, each more or less promising depending on the trend in question, the strength of Europe's existing capabilities, and the nature of local or global demand. The challenge – and the opportunity – is for companies and policymakers to understand which pathway fits each situation, and to back that choice with the right level of commitment. These pathways emerged from mapping Europe's current competitive position against global demand dynamics and regulatory conditions for each trend. They are not prescriptive labels but directional choices that reflect where resources and energy are most likely to generate returns. ▶I

1 Europe for global

This strategy applies to trends where Europe already holds leading capabilities and where the commercial prize extends well beyond European borders. Microgrids and distributed energy resources, quantum technologies, CCUS, and medtech sit here. In these areas, Europe has the foundational strength to target international markets at scale – if it can close the commercialization and funding gaps that have historically prevented strong research positions from translating into global market leadership. The potential European market share across these trends reaches EUR 1–1.5 trillion by 2040.

2 Europe for Europe

This pathway applies where strong domestic demand, EU strategic designation, or security considerations make the European market itself the primary prize – regardless of global positioning. Autonomous defense systems, humanoid robotics, charging infrastructure, and autonomous mobility fall into this group. Regulatory tailwinds, procurement commitments, and the security premium attached to European-origin supply chains all make these markets attractive on their own terms. The addressable share is again roughly EUR 1–1.5 trillion.

3 Foreign player localized in Europe

This is the realistic pathway in trends where Europe's global competitive position is too far behind to pursue frontier leadership – semiconductors at the leading-edge, AI systems, and data centers. Here, the more achievable objective is attracting non-European companies to locate manufacturing or development activities in Europe, ensuring that part of the value creation process takes place on the continent, and maintaining supply chain resilience. This is not a consolation prize – it is a deliberate strategy that preserves European industrial relevance and creates the conditions for capability building over time. ▶J

H Work to do

Europe lags behind the US and China in leadership positions across the Top 14 trends

Global leaders in prioritized technology trends [# companies in global Top 14]

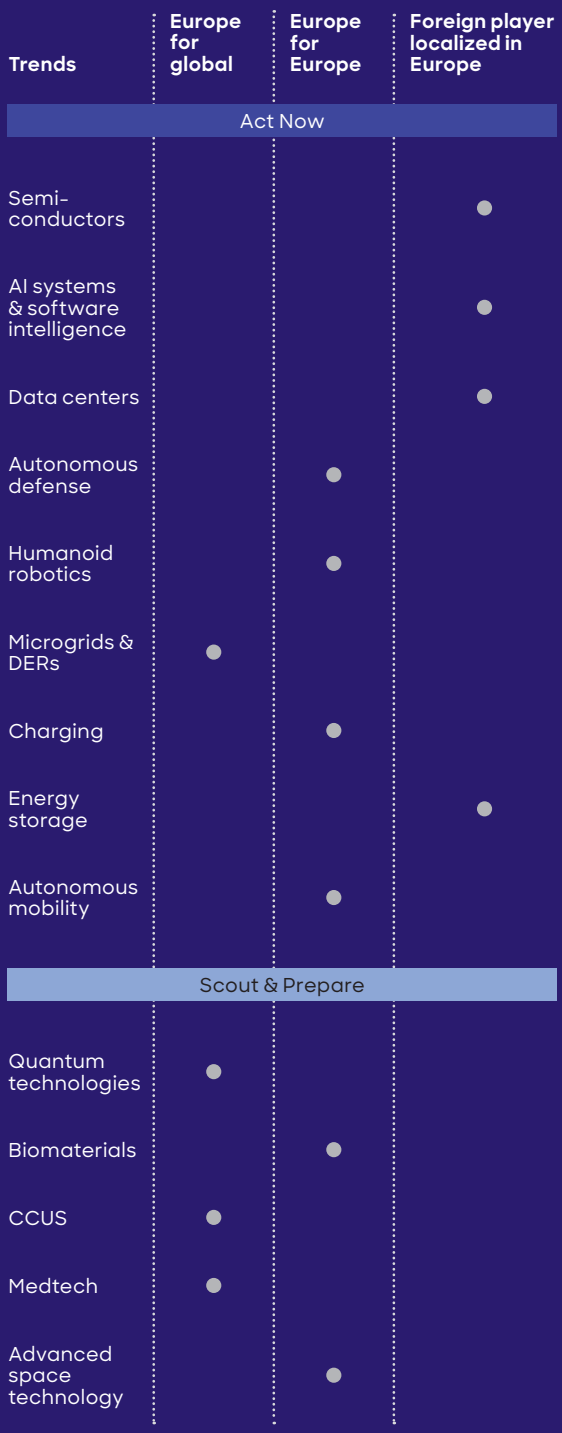
Trends	Current global leader(s) Europe	United States	China
Act Now			
Semiconductors	●	● ●	● ● ●
AI systems & software intelligence	●	● ● ●	● ●
Data centers	●	● ● ●	● ●
Autonomous defense systems	●	● ● ●	●
Humanoid robotics	●	● ● ●	● ● ●
Microgrids & DERs	● ● ●	●	● ●
Charging	●	●	● ● ●
Energy storage	●	●	● ● ●
Autonomous mobility	● ●	● ● ●	● ●
Scout & Prepare			
Quantum technologies	● ● ●	● ●	●
Biomaterials	● ● ●	● ●	●
CCUS	● ● ●	●	● ●
Medtech	● ●	● ● ●	●
Advanced space technology	●	● ● ●	● ●

● Number of companies in global Top 14 by revenue (3 = highest)

Source: Desk research, expert interviews

I How to play?

Different trends, different strategy routes



Source: S&P Capital IQ Pro, expert interviews

THE KEY QUESTIONS FOR EUROPE

Taken together, these three pathways position Europe to capture approximately EUR 3 trillion – around 20 % of combined global industrial GDP across the Top 14 – by 2040. That is a credible and significant share. But it requires Europe to be honest about where it can lead, where it can build, and where the realistic goal is participation rather than dominance. ▶ K

Industries and governments across the continent will have to address two key questions:

1

How can Europe convert its trend strongholds into leading market positions by 2040? After all, it has failed to industrialize emerging technologies before – so what needs to be done differently?

2

In areas where Europe is behind, how can it catch up? In particular, to what extent can political support help?

In the next section we outline potential pathways for both.

"Europe holds real leadership positions in quantum, microgrids, and carbon capture. Positions like these don't maintain themselves – they require investment at scale, and they require it now."

Stefan Riederle
Senior Partner

J Strategy choice

Different pathways offer different levels of promise across the Top 14

Strategic options for Top 14 technologies[1]

Europe for global

Technologies developed and/or scaled in Europe that primarily target international markets and compete globally

- Microgrids & DERs
- Quantum technologies
- CCUS
- Medtech

Europe for Europe

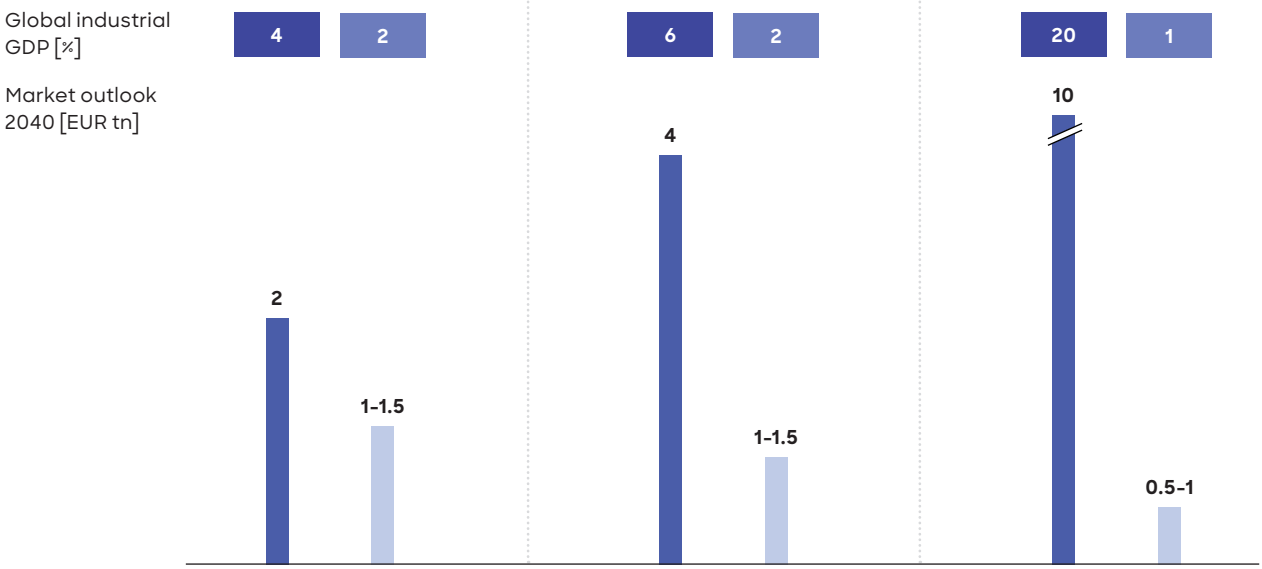
Technologies developed, produced, and deployed mainly to serve European demand, shaped by Europe's specific needs

- Autonomous defense
- Humanoid robotics
- Charging
- Autonomous mobility
- Biomaterials
- Advanced space technology

Foreign player localized in Europe

Non-European companies that locate manufacturing or development activities in Europe to access the local market

- Semiconductors[2]
- AI systems & software intelligence
- Data centers
- Energy storage



1 Assumptions for market outlook: Europe will account for 25 % of global market volume; Europe for global = 75 % Europe and 50 % RoW; Europe for Europe = 75 % Europe and 10 % RoW; Foreign localized = 20 % Europe and 0 % RoW;
2 Excluding 40 % of semiconductor market volume as it is considered supply for other technology trends

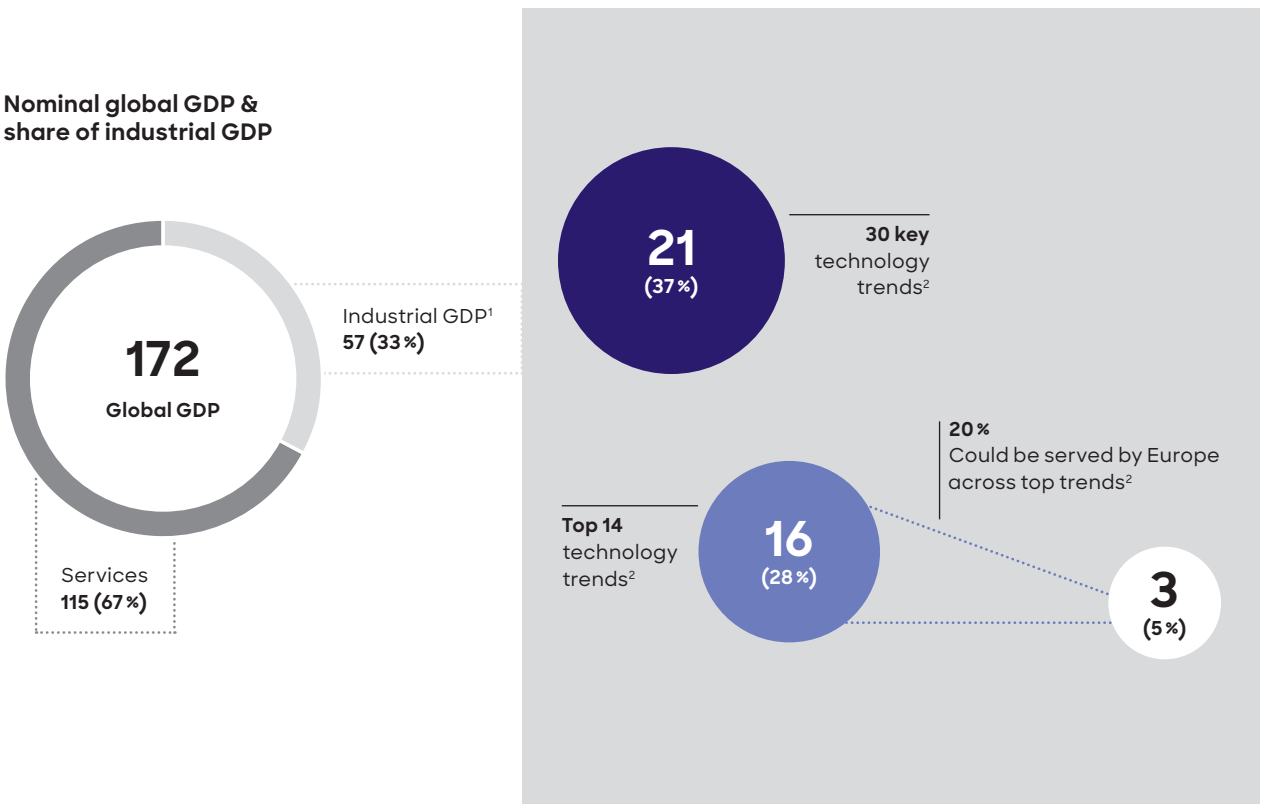
Global market volume European market share

Source: S&P Comparative Industry, desk research, expert interviews

K Attractive opportunity

Europe can capture a EUR 3 trillion share of global industrial GDP

Forecasted value shares, 2040 [EUR tn, %]



1 Industrial GDP is defined as global GDP excluding services (except for software);
2 Excluding 40% of semiconductor market volume as it is considered supply for other technology trends

Source: S&P Comparative Industry, desk research, expert interviews

How Europe can compete in the global tech race

European policymakers and industries hold the keys to the continent's future technological success. Below we look at what each must do to close the technology gap.

POLICYMAKER CALL TO ACTION

Moving the goalposts makes it easier to win. A lack of supportive regulation is a key hurdle to safeguarding Europe's forecasted market share in the 14 top trends, so strengthening EU support is a must-do for policymakers.

There are significant regulatory gaps between Europe and its big rivals. China has already designated seven of the 14 top trends as future or emerging technologies, with the objective of global leadership by 2035. The US has also prioritized many of the Top 14, providing full government support for all but four. ▶L

Europe, on the other hand, lacks an industrial policy in many trends, even where it holds a strong global position. Where formal policies do exist, none of the largest programs – including the AI Act, the EU Battery Regulation, and the European Chips Act – have achieved their stated targets. ▶M

"Europe is genuinely behind the US and China in most tech trends – but in quantum, microgrids, and carbon capture, it's actually ahead. The question is whether it can scale that lead fast enough."

Felix Mogge
Senior Partner

L All change

Securing Europe's market share in the Top 14 trends requires regulatory reform

Trends	Europe	United States	China	Key actions for Europe
Act Now				
Semiconductors	◒	●	● ◉	EU Chip Act 2.0 is not sufficient to reach Digital Decade target of a 20 % EU share
AI systems & software intelligence	◒	●	● ◉	High admin burden (e.g., risk-based classification) – simplification as of May 2026 planned
Data centers	◒	●	● ◉	Shift from fragmented regulations to an EU-wide framework that accelerates approvals
Autonomous defense	◒	●	●	Lack of a single European market due to 27 national defense regimes as a structural constraint constraint
Humanoid robotics	○	◒	● ◉	Lack of centralized European R&D funding and incentives for companies conducting pilots
Microgrids & DERs	●	◒	●	Adoption by member states very uneven despite central EU electricity market design reform
Charging	●	○	●	Very supportive, stronger technology openness favorable (currently strong CCS focus)
Energy storage	◒	◒	●	High compliance requirements such as battery passport, CO_2 footprint, and second-life rules
Autonomous mobility	○	●	◒	EU allows only very narrow and small-series use cases – decisions are made at a national level
Scout & Prepare				
Quantum technologies	●	●	● ◉	Strong EU public investments – legislative anchor expected in 2026/27 in the EU Quantum Act
Biomaterials	◒	●	● ◉	EU Biotech Act is in the proposal stage – stronger for health-related applications than industrial/food/cosmetic uses
CCUS	●	●	◒	Europe already has binding targets and funding – CO_2 transportation infrastructure is a bottleneck
Medtech	◒	●	● ◉	Major EU regulation revision proposed in 2025, as certification creates a major bottleneck
Advanced space technology	◒	●	●	Very fragmented legislation due to national decision-making; first EU-wide proposal under discussion

○ Not supporting ◒ Partially supporting ● Fully supporting ◉ Declared as Future or Emerging Industries by the Chinese government in 2026, with the objective of global leadership by 2035

Source: Desk research, expert interviews

M Wrong rules

Key EU policies have failed on tech trends – no major program hit its targets

Overview of key EU policies & target achievement

AI Act (2024/1689)

- World's first comprehensive horizontal law on artificial intelligence, designed to ensure AI systems placed on the EU market are safe and respect fundamental rights
- In force since August 2024 and rolling out in phases through 2027
- Currently under review to assess simplification options

Cyber Resilience Act (2024/2847)

- Law imposing mandatory cybersecurity requirements on virtually all products with digital elements placed on the EU market – hardware and software, consumer, and industrial
- Adopted in October 2024, with the main obligations applying from December 2027 (vulnerability reporting from September 2026)

European Chips Act (2023/1781)

- Aims for Europe to reach 20 % of global semiconductor market share by 2030, mobilizing EUR 43 bn in public/private investment
- Adopted in September 2023 to address chip supply vulnerabilities
- Chips Act 2.0 is in preparation, as available funds from Chips Act 1.0 could largely not be allocated

EU Battery Regulation (2023/1542)

- Designed to support the green transition and industrial autonomy: introduces a mandatory carbon footprint declaration (from 2025), the Digital Battery Passport (from 2027), and binding recycled content minima for cobalt, lithium, and nickel (from 2031, rising in 2036)
- Replaced the 2006 Battery Directive in August 2023 and applies across the full battery value chain

Medical Device Regulation & In Vitro Diagnostic Regulation (2017/745 & 746)

- Replaced the previous medical device directives to tighten safety, traceability, and post-market surveillance covering the entire medtech lifecycle
- Commission proposed a major simplification in December 2025 and four modules went fully operational in November 2025

European Defense Industry Program (EDIP)

- Designed to overcome 27 fragmented national defense markets, build joint procurement, and scale European production, targeting >50 % of purchases from within the EU by 2030
- The regulation, in force since 2026, is the first ever EU industrial policy instrument for defense
- Proposed EU Space Act complements this by creating the EU's first space law – replacing 13 national space regimes

● Rating on goal attainment and industrial impact achieved
(3 = effective & successful; 2 = partially effective; 1 = ineffective or counterproductive)

Source: Desk research, expert interviews

RECOMMENDATIONS FOR CHANGE

What does Europe need to do to ensure long-lasting relevance in the top trends? We have identified four key areas that European policymakers need to focus on to provide a foundation for change:

- Switch perspective from national-level industrial policies to continent-wide industrial policies – building EU-level centers of scale and industrial gravity rather than 27 parallel national programs
- Shift from pilot funding to industrial-scale deployment – bundling and focusing resources toward fewer but much larger, multi-year programs with real volume commitments
- Reduce regulatory caution and move toward enablement, sandboxes, and faster certification pathways
- Ensure long-term policy clarity to de-risk developing markets in energy, defense, carbon storage, and AI – firm, durable commitments rather than policies that shift with electoral cycles.

In short, Europe needs to switch from engineering excellence at national level to scaling fast as a continent. The EU's existing laws/programs are a start, but it must go further. Below we make specific recommendations to refine existing laws and implement new policies.

1 EU Battery Regulation (existing)

- Bring forward per-kilowatt-hour production support to 2027, not 2028, to mitigate structural cost disadvantage
- Extend the Made-in-Europe rule to incentivize private buyers, not just public ones
- Add binding purchase commitments from European carmakers for European cells
- Ensure a single accountable leader with disbursement authority to avoid funds not being spent
- Include a funding mechanism backed by emissions trading revenues.

2 AI Act (existing)

- One-time approval for products already certified under other European safety rules
- Funded sandbox environments for European developers, with access to public computing power and test data
- Shift compliance burden upstream from European users to non-European model providers
- Provide EUR 10 billion funding line for European frontier model champions conditional on, for example, HQ and/or compute based in EU
- Introduce Made-in-Europe requirement for public sector AI purchases (for example, >40% EU providers).

3 Quantum Act (new)

- Centralize funding programs to ensure prioritization of recipients with commercially ready solutions
- Anchor demand with a guaranteed buyer base from European institutions (for example, commit to >10 quantum computers, public sector switch to post-quantum crypto)
- Provide dedicated scale-up fund to close the late-stage funding gap (series B/C/D)
- Made-in-Europe rule for any project receiving support, and clear KPIs
- Incentivize startups to go public early to enable risk sharing with capital market.

4 Physical AI Act (new)

- Incentivize local ecosystem development by prioritizing European players
- Adapt EU venture capital system to facilitate scale-up where technology is too early-stage for PE-level funding
- Provide targeted support for OEM frontrunners that commit early
- Establish industry roundtables to mobilize a broader stakeholder base
- Redirect funding toward startups and industry rather than universities
- Ensure access to training data and data center infrastructure.

INDUSTRY CALL TO ACTION

Policymakers alone cannot turn around Europe's technological fortunes. Companies must also adapt. Succeeding across the Top 14 will require a fundamentally different approach to how technology is managed, funded, and brought to market. Five shifts are most critical:

- Strengthen innovation focus of companies by building strong technology and innovation management
- Move from short-term safety via incremental product excellence to long-term technology bets to enter future markets
- Actively seek partnerships to set industry standards that enable scale, and accept selective dependencies by co-development rather than building everything alone
- Focus on system integration, control layers, and critical subsystems, as companies often compete at the wrong layer of the value chain by trying to win full platforms
- Compete on cost per effect, uptime, resilience, and lifecycle economics, not technical perfection.

A FRAMEWORK FOR INNOVATION-LED GROWTH

Underpinning all of these shifts is a more fundamental change in how companies organize themselves to innovate. The principles involved are well established, even if they are inconsistently applied.

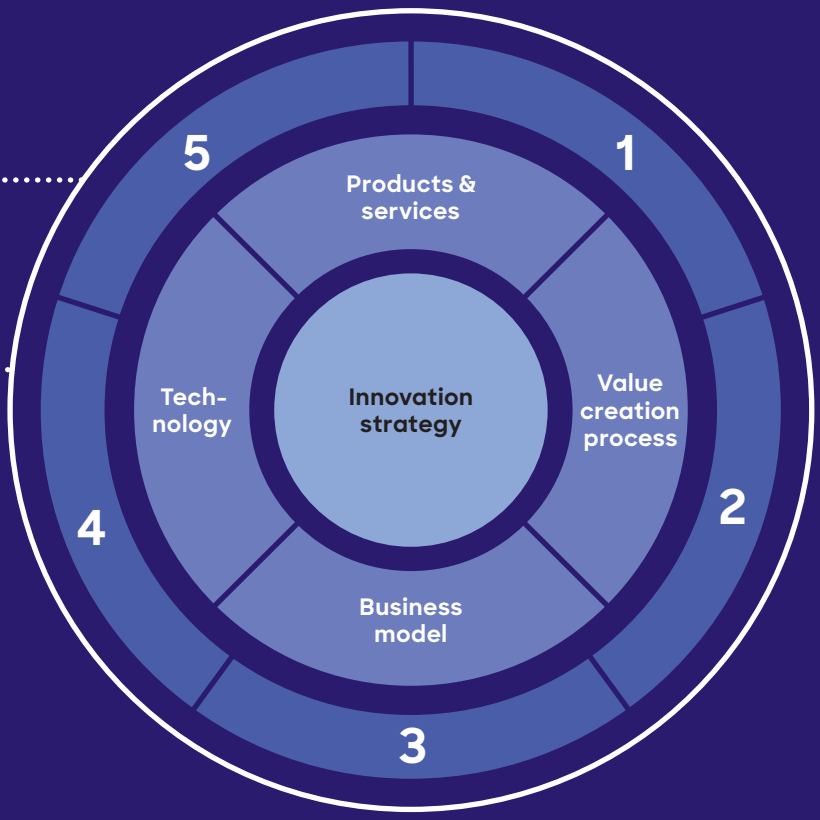
Innovation strategy needs to sit at the heart of the organization – not as a separate function but as a discipline that shapes resource allocation, risk tolerance, and decision-making across the business.

That means establishing clear criteria for where to play and where not to; building in tolerance for failure alongside explicit rules for when to stop; ensuring that funding for innovation is protected from short-term pressures; and placing accountability for outcomes with a central decision-making body rather than diffusing it across functions.

The enablers are straightforward in principle – leadership culture, a stage-gated innovation process, organizational cooperation, methods and systems, and funding discipline – but they require sustained commitment to implement. Companies that make these shifts will be better positioned to take long-term technology bets, partner effectively, and convert research strength into commercial scale. Those that do not will find that even strong underlying capabilities are not enough to compete in the markets that the Top 14 will define. ▶N

Driving tech success through innovation

Innovation framework



	Core enablers	Success factors
1	Leadership, culture & HR	• Top management ownership with clear targets and incentives drive innovation accountability and ambition • High tolerance for failure and willingness to disrupt the core business enable bold, fast decision-making
2	Innovation process	• Stage-gated, learning-focused process with explicit kill criteria ensures disciplined scaling and fast termination • Customer-backwards development and long-term market-first logic prioritize value creation over early profitability
3	Organization & cooperation	• Centralized decision power and clear R&D ownership reduce fragmentation and accelerate execution • Ecosystem co-development and ring-fenced teams extend capabilities while protecting long-term innovation focus
4	Methods & systems	• Advanced digital/AI tools and fact-based dashboards enable faster, higher-quality portfolio decisions • Clear innovation focus ("where to play") avoids dilution and strengthens prioritization
5	Funding & controlling	• Milestone-based funding ensures stability and shields innovation from short-term pressures • Differentiated KPIs and capped exposure per initiative enable disciplined scaling and risk control

Source: Roland Berger

Concluding remarks

While Europe may be behind in the global technology race, it can catch up – and it must. The level of technological development currently underway is too consequential to treat as someone else's opportunity. But policymakers and industry leaders must act quickly, with the right focus and at sufficient scale. When regulators and companies combine clear strategic choices with the ambition to execute them at a continental level, Europe has everything it needs to close the gap and secure its place in the next technology cycle – and the one after that.

To discuss any aspect of this study, or to find out more about Roland Berger's Advanced Technology Center and how we can help your organization, please contact one of our experts. We look forward to hearing from you.

Credits

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Advanced technology

Forbes 2026 WORLD'S BEST MANAGEMENT CONSULTING FIRMS POWERED BY statista

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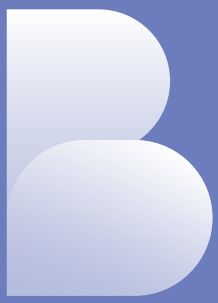

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