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Google

The European AI innovation opportunity

Boosting Europe's competitiveness with AI-powered innovation

An Implement Consulting Group study
developed in partnership with Google

September 2025

About this report

This report has been developed by Implement Economics, the Economics Practice of Implement Consulting Group, and Implement's Digital Transformation Practice. The research has been developed in partnership with Google to explore the opportunities for Europe to accelerate innovation, productivity, and competitiveness with AI.

Innovation and cross-border collaboration based on state-of-the-art technology are essential for European businesses to stay competitive in the AI era. This report includes the authors' assessments of Google's contributions to the European innovation ecosystem through investment and partnerships, and highlights the impact of bringing global technological advancements to businesses and researchers across the continent.

Google offers leading cloud and AI technologies and is among the pioneers in the recent AI breakthrough. Its AI leadership approach covers the full AI stack: infrastructure and computing, research, models, and products that are both deployed in Google's own services and offered to partners and businesses through its cloud platforms. By combining products, expertise, and models, Google provides tools and infrastructure that can support business transformation and improve operations at scale.

The authors of the report are Bodil Emilie Hovmand, Sissel M. Andersen, Anders Thor Lundberg, Alexander Jagd Oure, and Martin H. Thelle. Martin H. Thelle is a senior partner in Implement's Economics Practice, while the other authors are economists in the same practice, all based in Copenhagen.

The authors wish to thank Dr. Antonin Bergeaud from HEC in Paris and numerous Google experts for their contributions to this report.

Disclaimer

Foreword

Europe faces a pressing need to enhance its competitiveness and secure its future prosperity. For over twenty years, the continent has lagged behind major economies due to sluggish productivity growth. The Draghi report emphasises that the key to overcoming this challenge lies in boosting productivity through innovation.

AI offers a pivotal opportunity to accelerate innovation by fostering new businesses, increasing productivity, and speeding up scientific discovery. In the AI era, European businesses and policymakers must embrace a mindset of innovation, and leverage cutting-edge technology to remain competitive.

This report examines how AI can accelerate innovation in Europe, building on last year's findings that estimated an 8% (EUR 1.2-1.4 trillion) GDP boost from AI adoption in ten years. It provides insights into strategic AI initiatives that can revitalise Europe's economic landscape and outlines opportunities across three dimensions:

AI value chain

Producing AI

AI in R&D and science

Inventing with AI

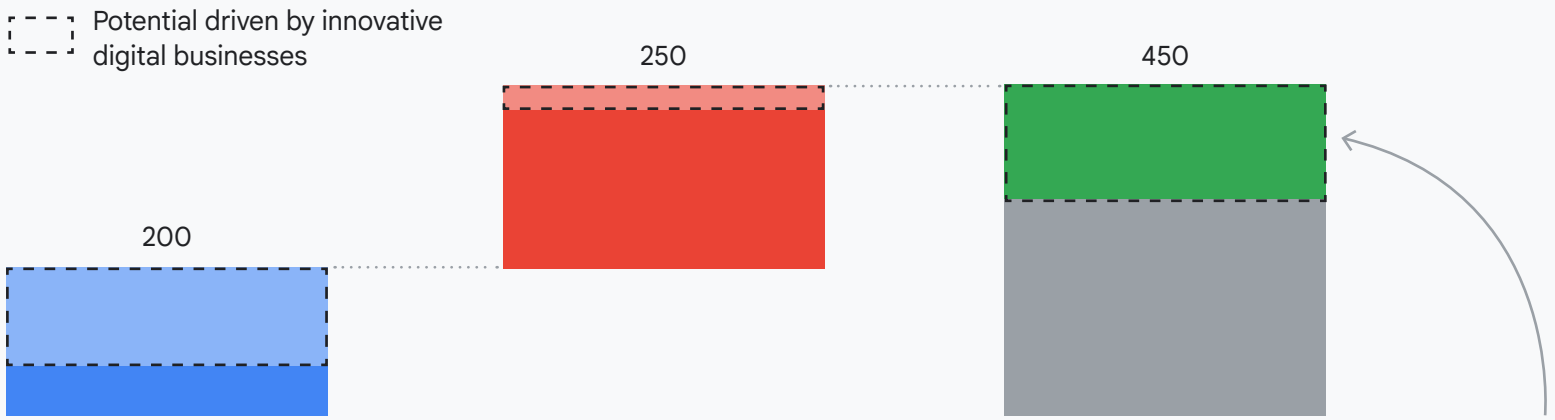
AI-powered
innovative digital businesses

Commercialising AI

Accelerating AI innovation can unlock a EUR 450 billion economic boost for Europe

Europe can both produce more AI and use AI more for inventions. *Producing more AI* in Europe is a **EUR 200 billion opportunity** of which the majority (75%) is estimated to be in AI applications and services. *Inventing more with AI* can unlock another **EUR 250 billion** in annual economic value for a combined EUR 450 billion.

GDP potential in 2034
EUR billion



AI value chain

Producing AI

Europe must take part in building AI models, data centres and AI applications. Expanding the AI value chain in the EU is a **EUR 200 billion opportunity.**

AI in R&D and science

Inventing with AI

AI is already accelerating scientific breakthroughs in the EU. We estimate that AI could unlock **EUR 250 billion in annual economic value** from accelerating R&D innovation. Ideas are getting harder to find, but AI can reignite innovation productivity in Europe.

AI innovation potential

AI-powered innovative digital businesses

Commercialising AI

Growing and scaling more innovative digital businesses in Europe is estimated to drive 30-40% of the AI innovation potential.

Google enables AI production, innovation and commercialisation in Europe

Google contributes to AI-driven innovation in Europe across all three dimensions.

Breakthrough innovation rarely happens in isolation; it results from global collaboration, with researchers building upon each other's discoveries. The development of the internet is a classic example. More recently, the 2017 Transformer paper, which laid the foundation for today's AI breakthroughs, was authored by eight Google researchers—four of whom are from Europe.

This model—combining international R&D with leading European talent—is a powerful engine for progress. It highlights the dual role that companies like Google play: they not only contribute to the local European innovation ecosystem through investment and partnerships but also serve as a bridge, bringing global technological advancements to businesses and researchers across the continent.

AI value chain

Producing AI

Google has contributed to growing the European AI value chain by:

- building seven data centres
- developing 13 cloud regions
- building multiple crucial subsea cables connecting Europe to the world
- providing energy-efficient cloud capacity powered by renewable energy
- building the Gemini family of AI models
- investing in wind, solar and other projects that add new carbon-free electricity to the European grid
- partnering with European companies to provide sovereign cloud infrastructure
- simplifying AI integration for European companies and the public sector using tools like Vertex AI and Agentspace
- deploying Google's Cloud TPUs to provide researchers and businesses with cutting-edge AI computing power

AI in R&D and science

Inventing with AI

Google has contributed to European R&D innovation by:

- saving researchers hundreds of millions of years in research time by making AI solutions like AlphaFold available to all researchers free of charge
- creating strong research hubs, e.g. in Zurich employing 5,000 people
- supporting over 12 million people across Europe to gain key digital skills since 2015
- partnering with research institutions across Europe, such as Institut Curie, to apply AI in e.g. cancer diagnosis and treatment
- publishing over 2,700 AI research papers in 2020–23, advancing global scientific understanding
- developing Co-Scientist, an AI system to accelerate scientific discovery by helping researchers test hypotheses and analyse data
- offering NoteBookLM, an AI tool that supports research and discovery by helping users analyse their own materials

AI-powered, innovative digital businesses

Commercialising AI

Google technologies and activities foster innovation and productivity enhancements for European businesses by:

- providing advanced technologies like Med-PaLM and Gemini through Google Cloud Platform
- contributing an estimated EUR 560 billion in annual worker productivity through tools like Google Search and Workspace
- investing more than USD 500 million in 40 promising European startups through Google Ventures
- helping 1,630 European startups through the Google for Startups programmes and initiatives
- supporting specialised growth programmes in cybersecurity, climate, and health to help founders scale AI solutions
- generating a total economic impact of EUR 179 billion in 2023 and supporting around 3 million jobs across Europe

The three innovation opportunities

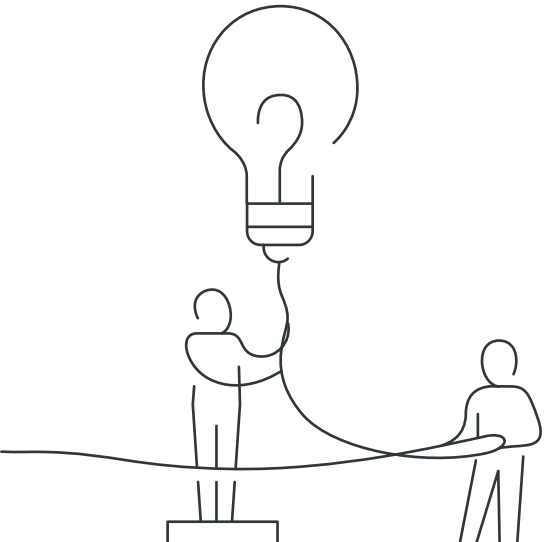
...and the policies that can help make it happen

For over two decades, Europe has not kept pace with other major economies, due to a persistent gap in productivity growth... The root cause is a lack of innovation. Europe is failing to translate its ideas into new, marketable technologies, and failing to integrate those technologies into its industrial base.

The European Commission
in A Competitiveness Compass for the EU

Boosting Europe's competitiveness with AI-powered innovation

This report explores the opportunities for Europe to accelerate innovation, productivity and competitiveness with AI. Innovation is a key driver of productivity which, in turn, drives competitiveness.



Competitiveness is the ability to successfully compete in a global marketplace.

Competitiveness in the AI era will mainly be driven by productivity and less by depressing wages or devaluing currencies.

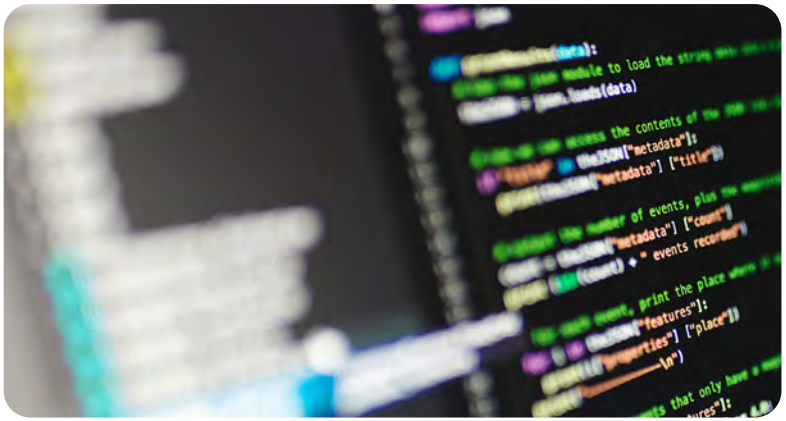
Productivity is the ability to produce more economic value with a given amount of labour and capital.

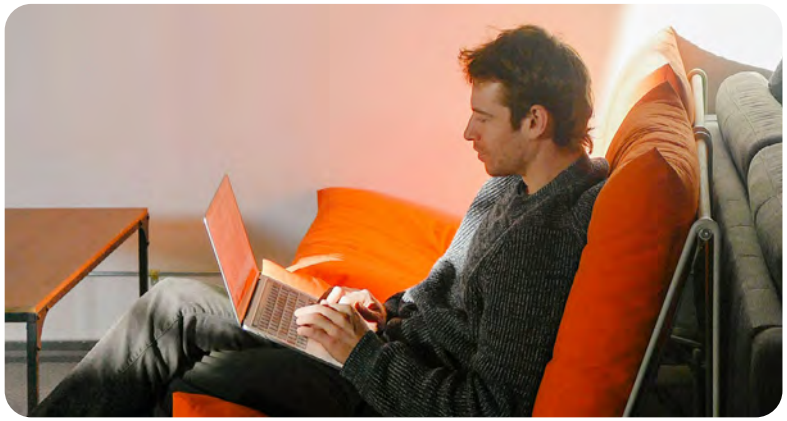
Faster innovation will help raise the EU's productivity growth.

Innovation is the ability to apply new knowledge to improve products or services.

Europe can accelerate innovation with AI both to maintain its manufacturing leadership and to develop new breakthrough technologies.

The AI innovation opportunity has three dimensions





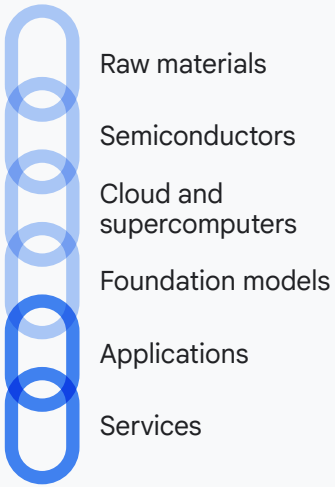
> *For the EU's competitiveness, economic security and defence capacity, it is crucial to closely cooperate with our partners and tech allies to enhance the ability of European tech companies to innovate and grow globally.*
>
> **The European Commission**
> in An International Digital Strategy for the EU

Europe has three interlinked AI innovation opportunities...

AI value chain

Producing AI

Expanding the AI value chain is crucial for innovation. The value chain refers to the industrial and commercial activities required to create and deliver AI solutions, from foundational hardware to end-user services.



AI in R&D and science

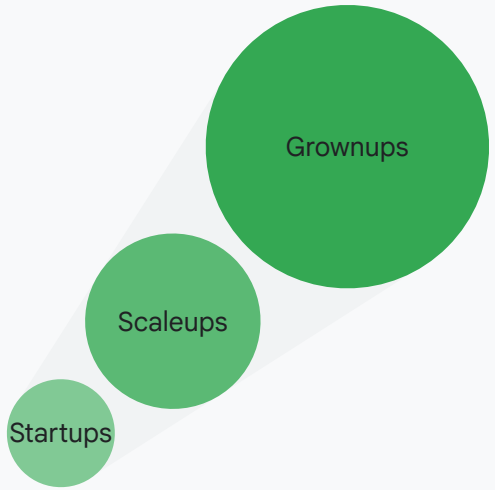
Inventing with AI

AI enables a new way of inventing, offering Europe significant opportunities to accelerate scientific discoveries and enhance R&D efficiency, thereby boosting R&D investments across the continent.

AI-powered innovative digital businesses

Commercialising AI

Innovative digital businesses are pivotal in creating AI applications that address business challenges and diffusing AI innovations across the economy. As they scale, they make an outsized contribution to the economy.



Building more AI models, AI applications, and AI infrastructure can add EUR 200 billion to EU GDP

To seize the AI innovation opportunity, European businesses need strong AI infrastructure and access to use and build on the best AI models.

The AI value chain is an economic framework that outlines how value is generated through the activities required to develop and deliver AI solutions. Expanding the value chain represents a EUR 200 billion opportunity, primarily within AI applications and services. In this report, we analyse three main parts of the value chain:

Contribution to EU GDP by 2034 from expanding the AI value chain

+200 EUR billion

AI infrastructure: EU GDP potential of EUR 35-45 billion

Europe needs 2-3 times more cloud capacity to meet future AI demand.
This is best achieved through open competition among all providers, delivering according to customers' choice. Google provides energy-efficient cloud capacity powered by clean energy and supports advanced AI development with its novel AI semiconductors (TPUs).

AI models: EU GDP potential of EUR 8-15 billion

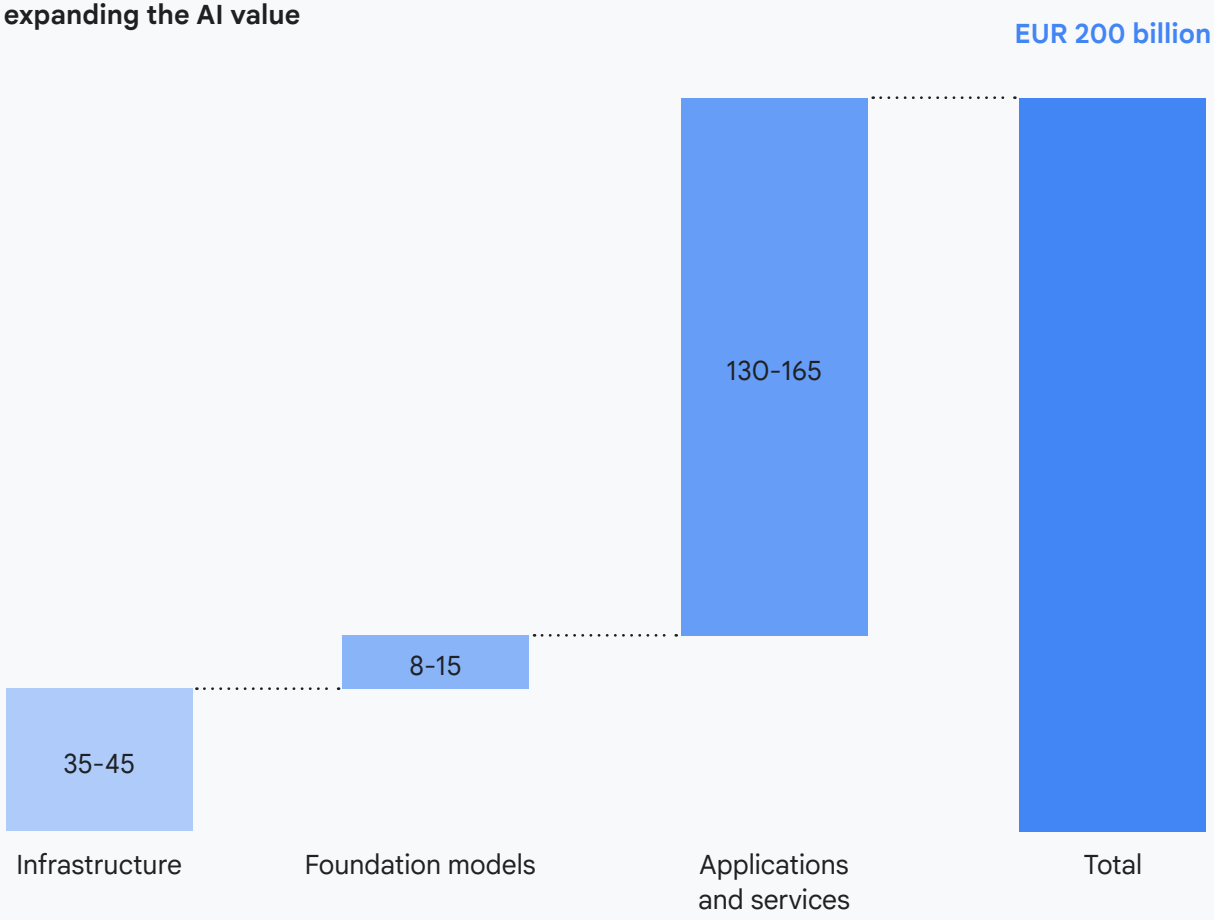
European firms like France's Mistral AI and Germany's Aleph Alpha are pioneering in large-scale AI model development and demonstrating success in specialised sector applications.
Europe's balanced copyright framework is crucial in incentivising the creation of new foundation models, further fostering growth in this area. However, since only 5% of large-scale models originate from Europe, European innovators should make the most of global models to stay competitive. Google contributes to other businesses' innovation and productivity through its AI models.

AI applications and services: EU GDP potential of EUR 130-165 billion

AI applications and services offer a significant growth opportunity for Europe, with global revenues projected to reach EUR 1.4 trillion by 2034. Europe's industrial expertise and its current 19% share of AI application funding positions it well to capitalise on this growth. Google technologies, including Vertex AI, assist European companies in leveraging this opportunity by simplifying the creation and deployment of AI applications.

→ **Read more in part 2 of the report**

Annual contribution to EU GDP by 2034 from expanding the AI value chain
EUR billion



75%

of Europe's AI value chain potential is in AI applications and services

Accelerating R&D and scientific discovery with AI can add EUR 250 billion to EU GDP

Contribution to EU GDP by 2034 from AI's boost to R&D process

+250 EUR billion

AI is not just an invention—it's a new way to invent, offering major economic potential for Europe through R&D integration.

Ideas are getting harder to find. Europe faces a dual challenge: a global slowdown in R&D productivity and 20-25% weaker returns on R&D investments compared to the US.

AI can double innovation quality and boost R&D process efficiency by 10-20%, varying by domain. This is demonstrated by AlphaFold, which has revolutionised protein research and potentially already saved millions of dollars and hundreds of millions of years in research time.

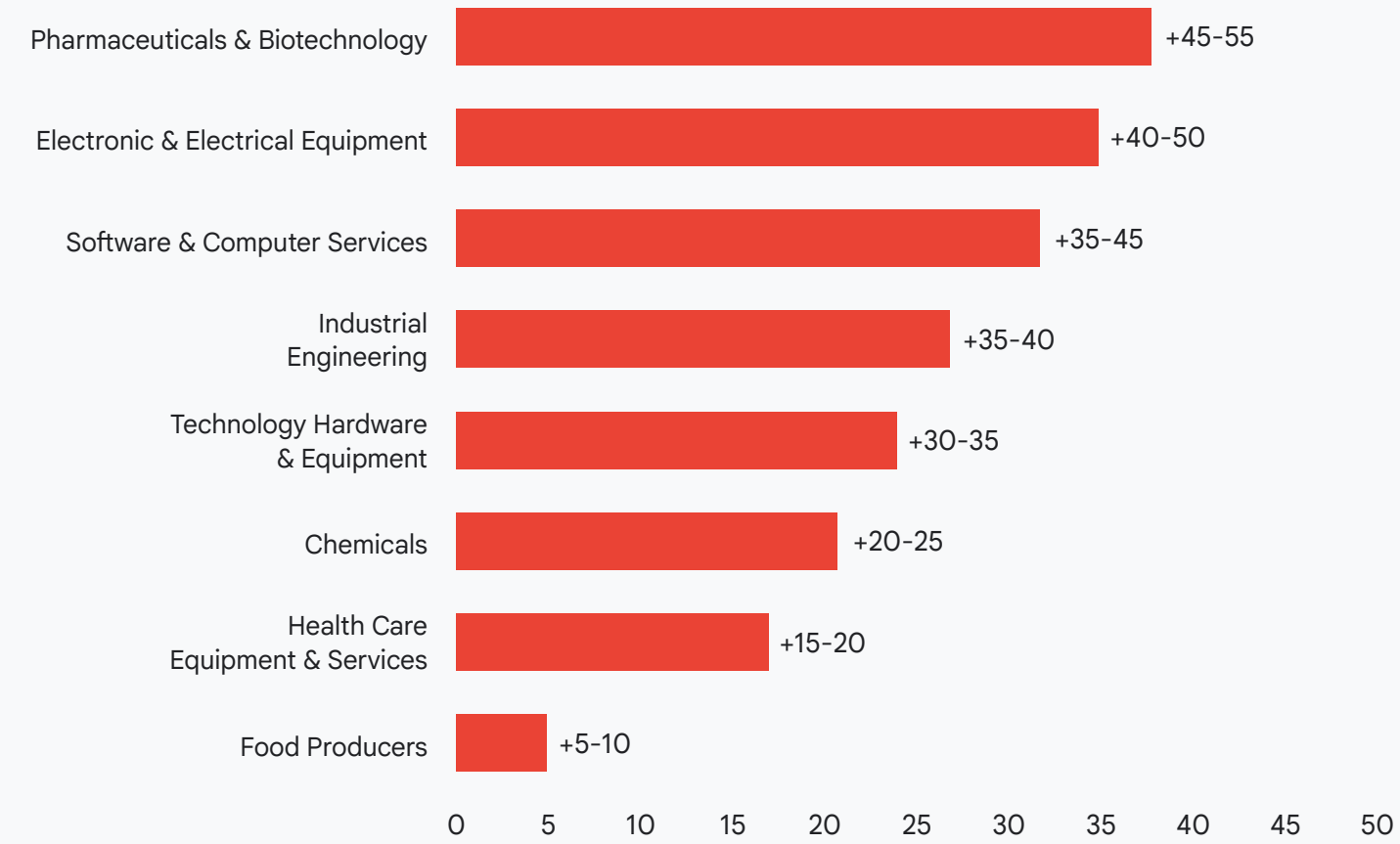
Europe's R&D intensive industries, such as pharma, can benefit from AI's R&D boost. AI can transform drug discovery, as illustrated by Google DeepMind's AlphaMissense, which improves the diagnosis of rare genetic disorders and aids in identifying new disease-causing genes.

AI can significantly enhance R&D efficiency, potentially adding EUR 250 billion to EU GDP by 2034. The wider social returns could be up to seven times larger than the individual firm-level gains. Google boosts research productivity through university partnerships and by supporting R&D organisations such as Materiom, which applies Vertex AI to create alternatives to conventional plastics.

→ **Read more in part 3 of the report**

Annual contribution to EU GDP by 2034 from AI's boost to R&D process

EUR billion



Commercialising AI is key to both the AI innovation potential and the AI adoption potential

> *Once companies reach the growth stage, they encounter regulatory and jurisdictional hurdles that prevent them from scaling-up into mature, profitable companies in Europe.*
>
> **Mario Draghi**
> in The future of European competitiveness

Contribution to EU GDP from growing and scaling more innovative digital businesses

+500 EUR billion

Innovative digital businesses are vital for commercialising AI opportunities in Europe, as they develop the applications and solutions that tackle business challenges and drive AI innovation and adoption across sectors. Successful European startups building on existing AI infrastructure, such as Synthesia (AI video), ElevenLabs (voice AI), Lovable (AI coding), n8n (workflow automation), and Gleamer (AI radiology) demonstrate this potential. For example, Gleamer uses Med-PaLM to serve over 2,500 institutions and process 40 million examinations annually. Google enhances the ecosystem by supporting 1,630 European startups through its Google for Startups programme.

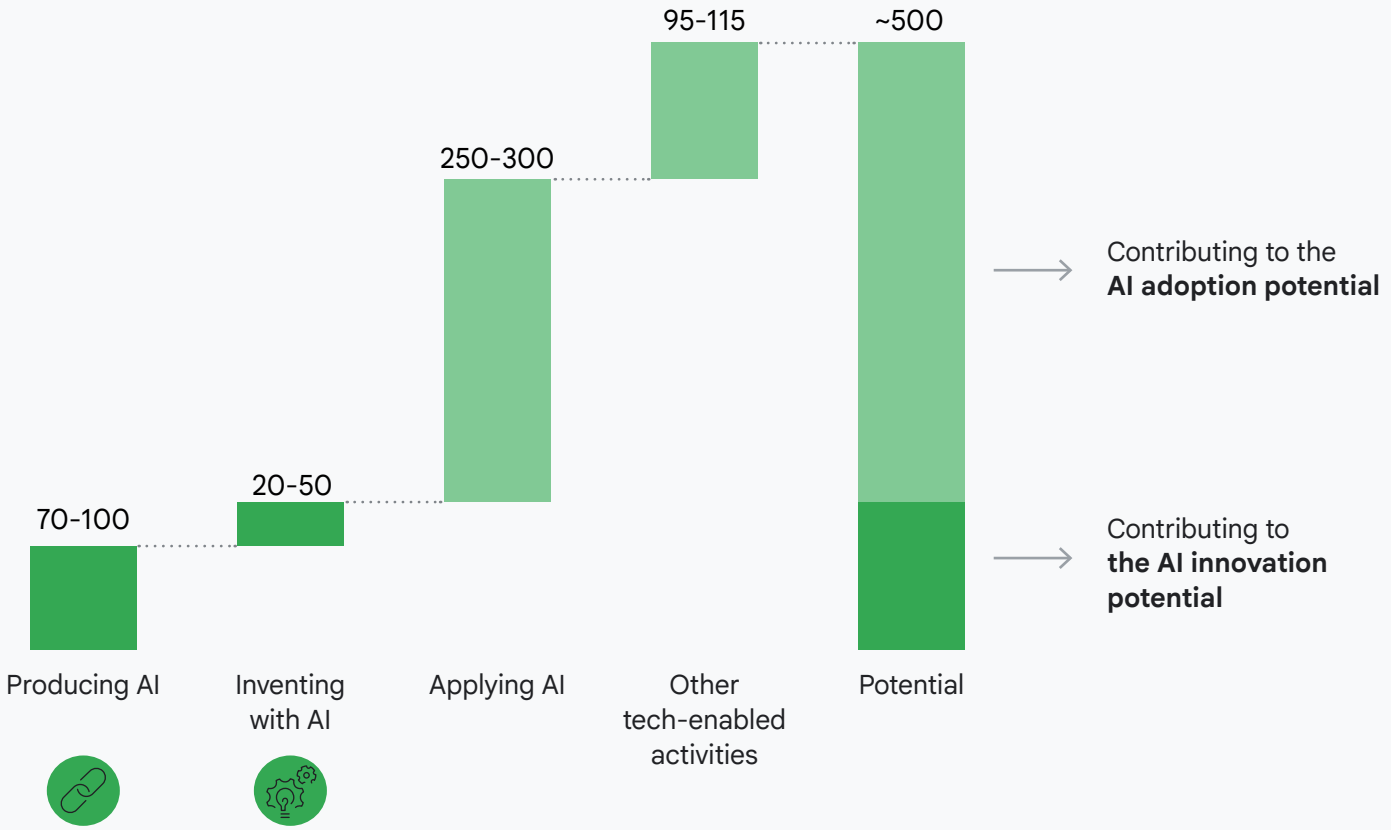
Innovative digital businesses that successfully scale make an outsized contribution to the economy, as they are around 130% more productive than European companies on average. Successful AI startups outperform competitors by combining technical expertise with sector knowledge, such as in healthcare and manufacturing.

Europe needs more innovative digital businesses to harness AI opportunities, but scaling in Europe is hindered by a EUR 148 billion venture capital deficit compared to the US in 2024, regulatory barriers, and a fragmented single market. As a result, many top European founders relocate to the US for better capital access and market growth.

Bringing Europe's innovative digital businesses on a par with OECD leaders would contribute around EUR 500 billion annually to EU GDP. Simplification of regulations, as the Commission is planning, is crucial to invigorating this ecosystem. Growing and scaling more innovative digital businesses in Europe is estimated to drive 30-40% of the AI innovation potential.

→ **Read more in part 4 of the report**

Annual gross contribution to EU GDP from growing and scaling more innovative digital businesses
EUR billion



Harnessing Europe's AI strengths requires open competition, leveraging high-quality data, cutting red tape, and strategic public funding

The European Commission aims to close the innovation gap with the Competitiveness Compass by introducing policies and investments to boost competitiveness. Their AI Continent Action Plan includes initiatives to enhance computing infrastructure, improve data access, stimulate AI development, strengthen talent, and foster a supportive regulatory environment.

Harnessing Europe's strengths is vital to realising the AI innovation opportunity. Open competition among all providers, including non-European ones, enhances innovation and meets customer needs. As the Commission notes in its International Digital Strategy, *"no country or region can tackle the digital and AI revolution alone"*, making collaboration with partners and tech allies crucial for European competitiveness and economic security.

Regulatory simplification should be one of the priorities going forward. According to the Draghi report, EU regulation in the digital domain has become overly complex and burdensome, especially for young and innovative firms. The IMF estimates that the AI Act, data privacy laws and occupation regulation alone could reduce the productivity gains of AI adoption by over 30% (IMF estimate).

In the Policy Framework for Building the Future of Science with AI, Google highlights three focus areas – *the three I's* – to advance AI-driven scientific progress. Part 5 of the report elaborates on the policy recommendations found in this analysis and links them to the Commission's ongoing initiatives to boost competitiveness and innovation in Europe.

Infrastructure

The expansion of data centres is essential for the EU's digital progress. Europe must modernise electricity grids to ensure a reliable and clean energy supply and scale advanced clean energy technologies.

Prioritise streamlining and harmonising permitting processes for data centres, digitalising applications, and clarifying regulatory requirements to overcome current delays.

A rich, interoperable European data ecosystem is vital for the responsible development of AI. Safeguarding the EU's enabling copyright system is essential for fostering innovation and maintaining competitiveness.

Investment

Encourage startups in scientific research through grants and joint public procurement. By leveraging the public sector's 20-25% share of the AI adoption potential, governments can help create a substantial market for startups and innovative businesses to tap into.

Consolidate fragmented public R&D funds to incentivise risk-taking and target 'moonshot' projects in Europe's strategic sectors.

Stimulate private investment by cutting red tape and strengthening the single market. Leverage Europe's savings surplus to invest in future-shaping technologies and companies, crucial for AI innovation and adoption.

Innovation

Implement pro-science legal frameworks with harmonised and interoperable regulations on privacy and cross-border data flows. Further, Europe should maintain a workable copyright regime.

Cultivate Europe's AI talent through interdisciplinary collaboration across Member States.

Specialised tools are essential for European science, especially robust AI models aligned with research priorities like AlphaFold, MedGemini, and their AI co-scientist concept.

Table of contents

Part 1

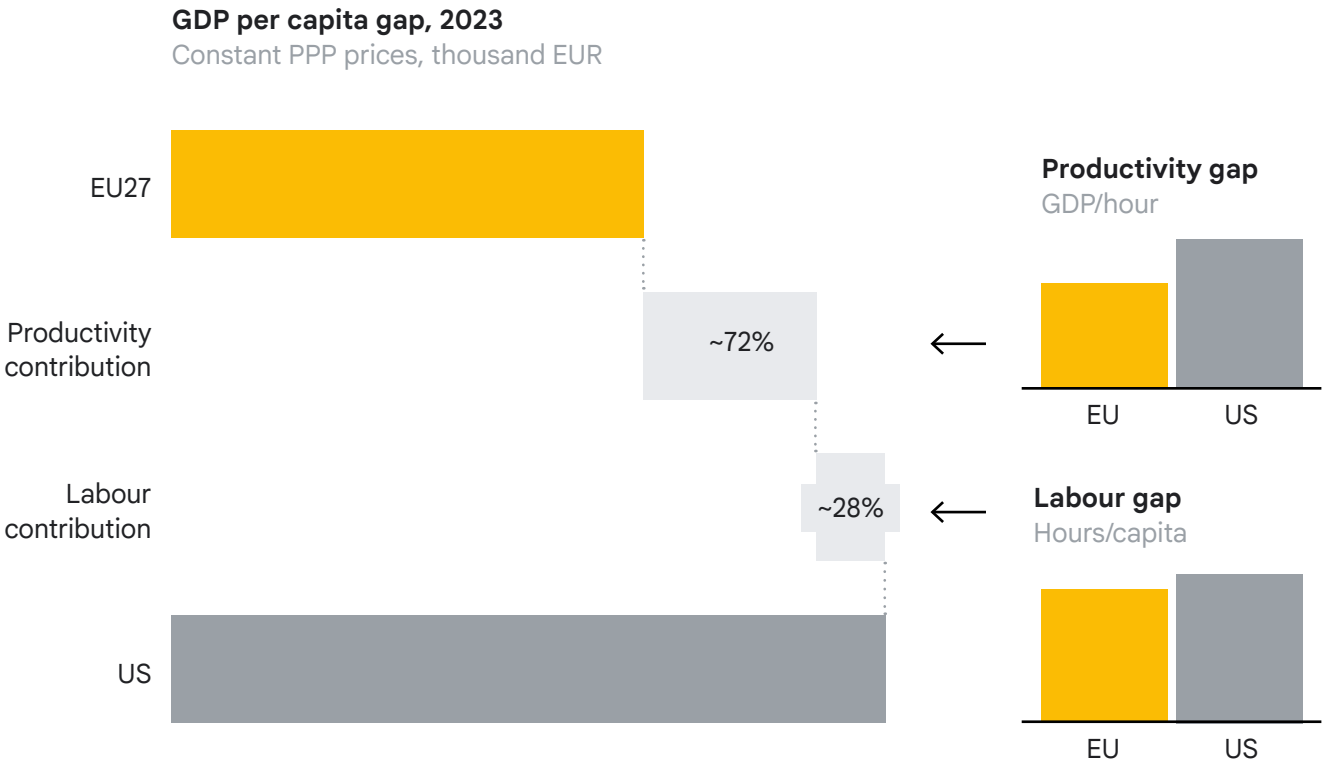
Europe's innovation gap

Europe's competitiveness challenge and the opportunity from AI

> *For over two decades, Europe has not kept pace with other major economies, due to a persistent gap in productivity growth... The root cause is a lack of innovation. Europe is failing to translate its ideas into new, marketable technologies, and failing to integrate those technologies into its industrial base.*
>
> **The European Commission**
> in A Competitiveness Compass for the EU

Europe's lack of competitiveness is driven by an innovation gap

The Draghi report clearly diagnosed Europe's competitiveness problems...



Over the past two decades, EU economic growth has persistently been slower than that of the US, and today, EU GDP per capita is 34% lower. Around 70% of the gap in per capita GDP versus the US is explained by lower productivity in the EU.

> *First – and most importantly – Europe must profoundly refocus its collective efforts on closing the innovation gap with the US and China, especially in advanced technologies.*
>
> **Mario Draghi**
> in The future of European competitiveness

Note: Right figure shows business expenditure in R&D (BERD) measured in percentage of gross domestic product (GDP).
Source: Implement Economics based on Eurostat, Draghi (2024), OECD, World Bank, and Long-Term Productivity Database of Antonin Bergeaud.

...and the primary reason is lagging innovation

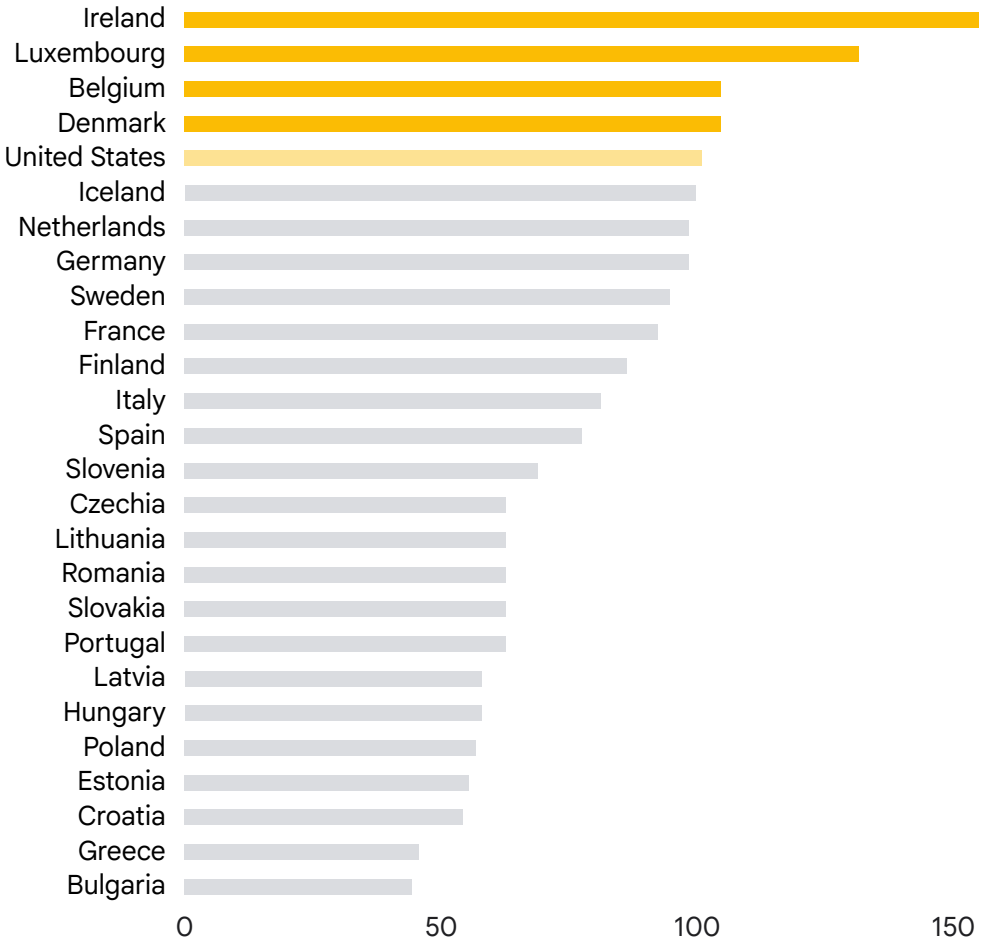
Research and innovation (R&I) drives productivity. The EU's ability to innovate continues to trail behind that of the US, in part due to delayed adoption of digital technologies.

R&I investment and productivity

Source: Implement Economics based on Eurostat, Draghi (2024), OECD, World Bank, and Long-Term Productivity Database of Antonin Bergeaud.

Several small European economies have higher productivity than the US and are highly digitalised despite not developing the technology themselves

Labour productivity for selected countries, 2023
GDP per hour worked, current PPP-adjusted prices (USD)



Note: Ireland's GDP is inflated by multinational companies recording their global profits within the country.
Source: Implement Economics based on OECD and DESI.

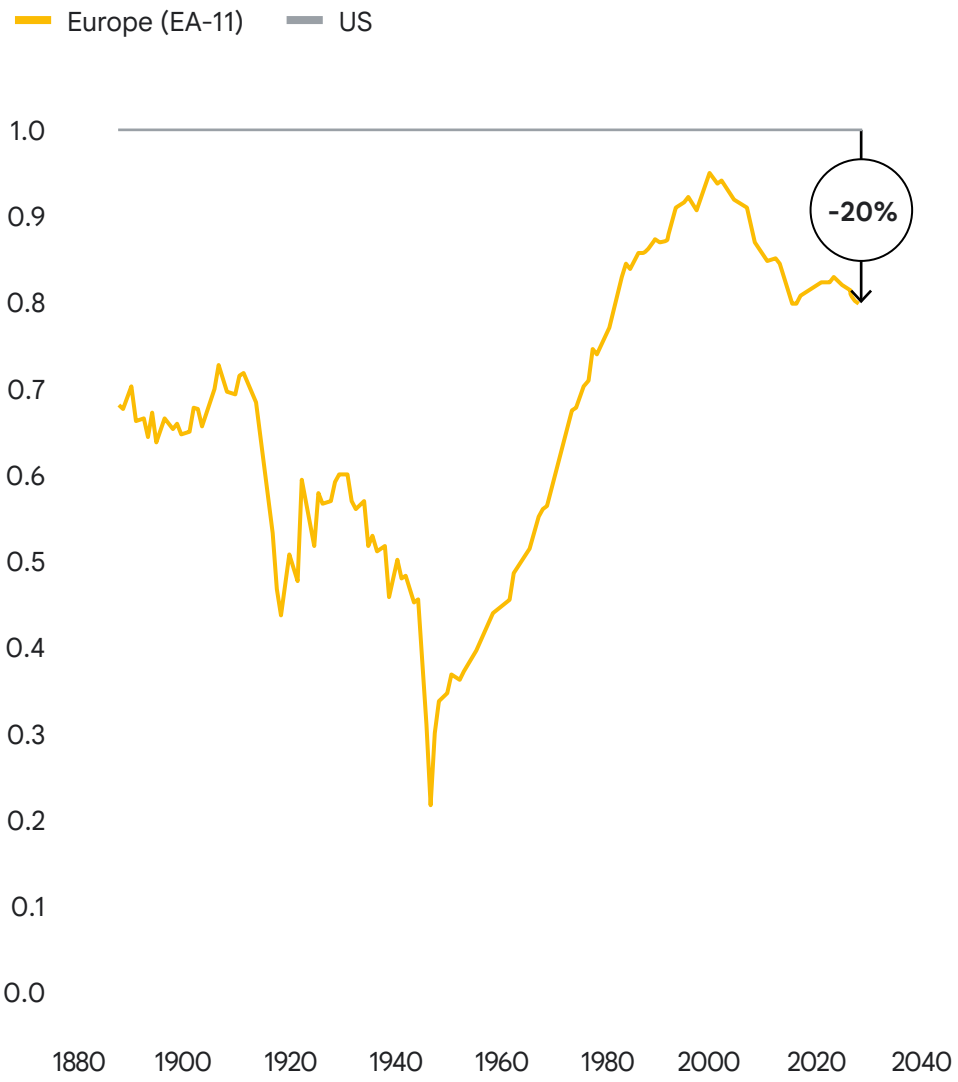
A number of European countries, such as Denmark, have higher labour productivity than the US despite not being major developers of digital technologies.

These countries are highly digitalised. According to the OECD and DESI indicators, countries such as Denmark consistently rank highly in digital public services, broadband coverage, and ICT usage by businesses.

This can largely be attributed to these countries' effective adoption and integration of digital tools, which enhance efficiency and output across various sectors.

This shows that Europe's opportunity lies not only in creating new technologies but also in adopting and scaling them.

Relative labour productivity
Index (US=1), USD 2010 per hour



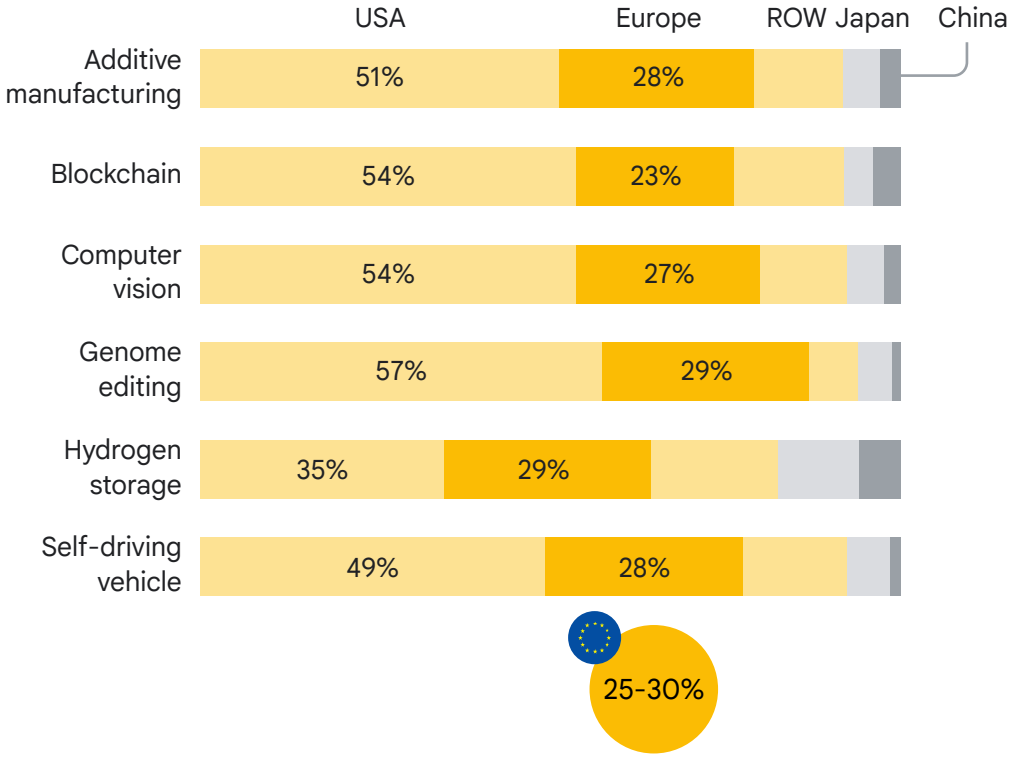
Note: The data for Europe covers 11 of the current euro area countries (EA-11), namely Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, the Netherlands and Portugal.
Source: Implement Economics based on the Long-Term Productivity Database of Antonin Bergeaud.

The innovation gap is not caused by a lack of great ideas in Europe, but by a failure to commercialise ideas and attract investors

A third of ideas in disruptive technologies come from Europe...

Europe's world-leading research institutions are pivotal in scientific breakthroughs across disruptive technologies like computer vision, genome editing and self-driving cars.

Origin of ideas for patents in disruptive technologies, 2020
%



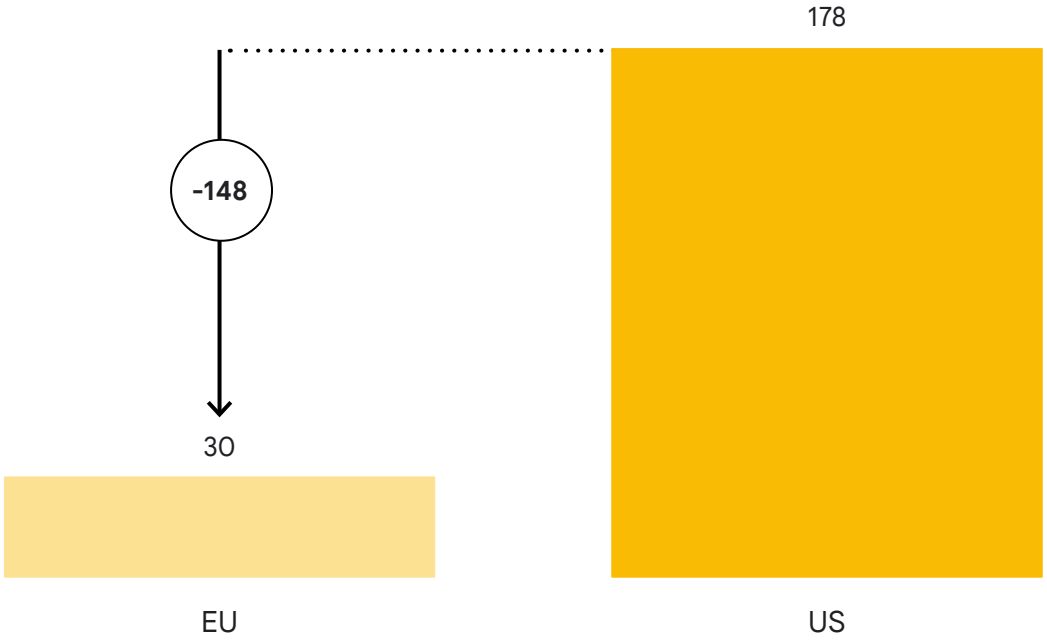
Note: For each technology in the table, this shows what percentage of the patents' references to non-patent literature are to scientific articles written by researchers in the USA, Japan, China, or Europe. We considered the current affiliation at the time of the article publication.
Source: Implement Economics based on European Patent Office (EPO), and Bergeaud (2024).

...but many of these innovations are not successfully commercialised

Europe's universities are insufficiently connected to private businesses and generate less income from research compared to US universities. The EU attracts about EUR 148 billion less in venture capital than the US, which is the main source of financing for innovative digital businesses.

> *Only one-third of patented inventions registered by European universities are commercially exploited.*
>
> **Mario Draghi**
> in The future of European competitiveness

Venture capital investment, 2024
EUR billion



Source: Implement Economics based on CEPR (2009), Dealroom, and Draghi (2024).

The root cause of the innovation gap is a lack of private R&D spending, low returns on R&D investment, and regulatory complexity in the EU

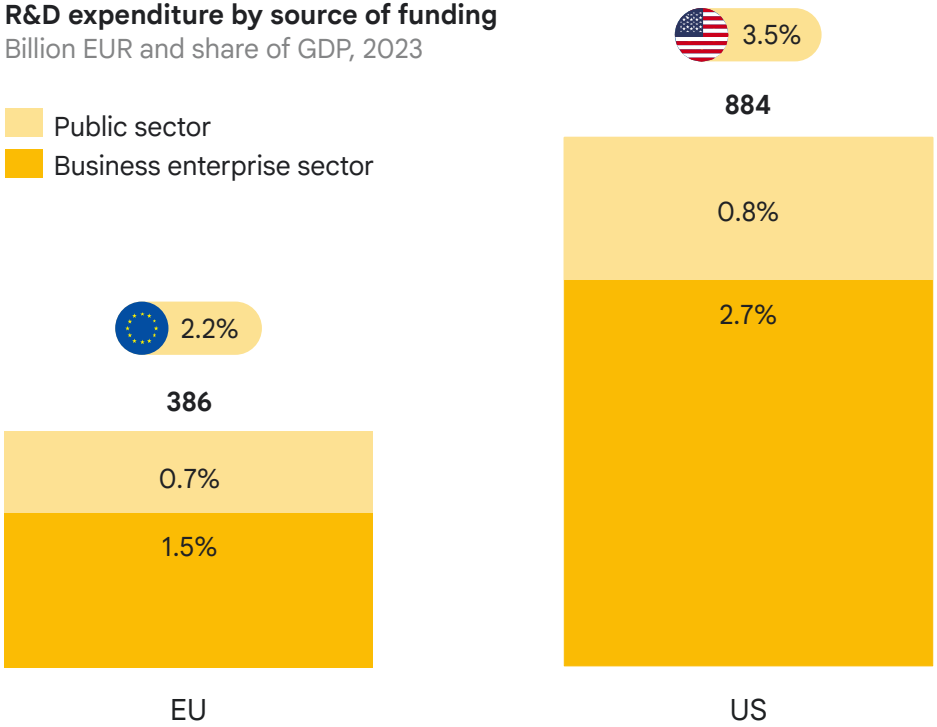
Europe currently spends 2.2% of GDP on R&D, significantly lower than the US and the Commission's own target of 3%. In addition, the EU has significantly lower returns on its R&D investment. Three key barriers are holding back private investment and depressing the returns on R&D:

→ **The complex EU regulation.** The IMF estimates that the AI Act, data privacy laws and occupation regulation alone could reduce the productivity gains of AI adoption by over 30%. Another recent study shows that GDPR's rollout significantly reduced US investor activity in the EU, resulting in fewer deals and investments, especially affecting newer and data-related ventures.

> *Public sector support for R&I is inefficient due to a lack of focus on disruptive innovation and fragmented financing, limiting the EU's potential to reach scale in high-risk breakthrough technologies.*
>
> **Mario Draghi**
> in The future of European competitiveness

Europe spends EUR 500 billion less than the US on R&D...

R&D expenditure by source of funding
Billion EUR and share of GDP, 2023



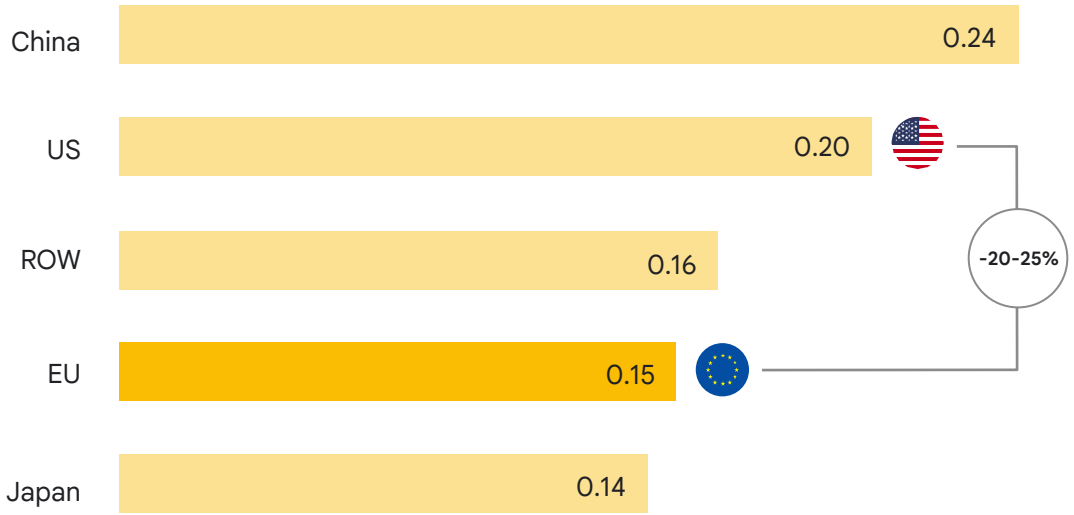
Source: Implement Economics based on Draghi (2024), Letta (2024), Wagman et al. (2025) and Bergeaud (2024).

→ **A fragmented capital market and weak single market** means that Europe's significant savings surplus is not being leveraged, with around EUR 300 billion of it flowing abroad, mainly to America.

→ **R&D investment overly favours "mid-tech" sectors with low productivity,** while high-tech innovation struggles to emerge and scale, unlike the dynamic shifts seen in the US. Hence, there is a misallocation of public R&D funds with fragmented allocation and suboptimal incentives.

...and get 20-25% lower return on R&D investment

R&D returns to productivity
R&D-to-labour productivity elasticities



20-25% sustained lower R&D-to-labour productivity elasticity from the EU's R&D expenditure as compared to the US for the period 2008-2022

Note: R&D-to-labour productivity elasticities indicates how strongly changes in research and development investment are linked to changes in the value of output produced per worker.
Source: Implement Economics based on EU Industrial R&D Investment Scoreboard, JRC (2024), and Eurostat.

Widespread AI adoption is a EUR 1.2 trillion opportunity for Europe and five key sectors drive 75% of the potential

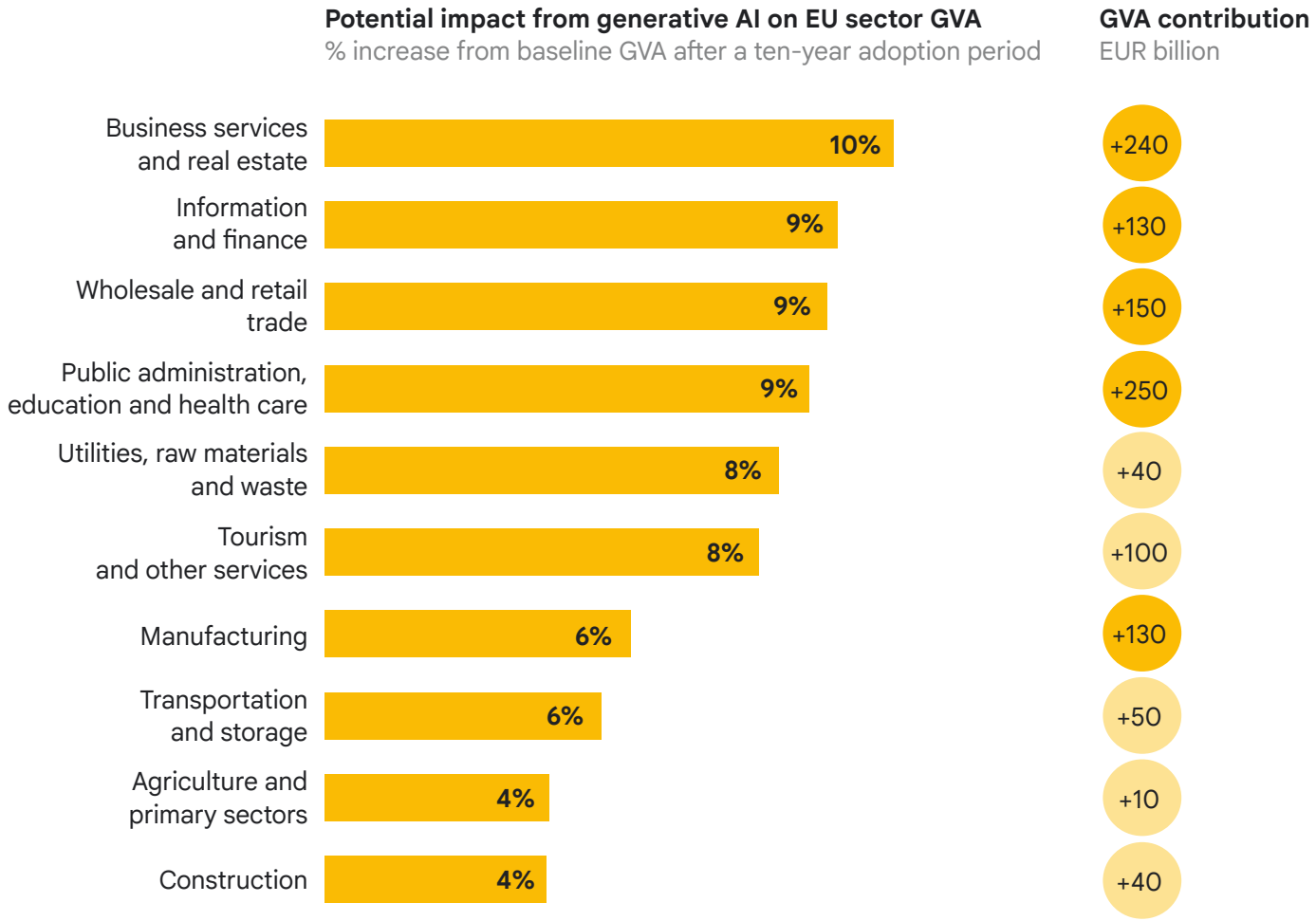
If widely adopted, generative AI could boost the EU's GDP by **EUR 1.2-1.4 trillion** in ten years, which is about 8% of the GDP.

Five key sectors represent 75% of the adoption potential from AI:

- → **Public sector**
- → **Business services**
- → **IT and financial services**
- → **Wholesale and retail trade**
- → **Manufacturing**

Across Member States, the public sector potential accounts for 20-25% of the total potential, as highlighted in the AI opportunity for eGovernment in the EU. Early adoption by governments can accelerate AI uptake across the economy by setting an example within existing regulations.

The upcoming *Apply AI Strategy* aims to enhance AI use in industries like manufacturing, automotive, energy, and pharmaceuticals. While the initiative focuses on industrial applications, the lion's share of generative AI's potential lies in services.



Note: The estimate assumes widespread adoption of generative AI over a ten-year period. There is much uncertainty around the capability and adoption timeline of generative AI. The size of the productivity boost depends on the difficulty level of tasks that generative AI will be able to complete and the number of jobs it can automate. GDP is in 2024 levels. The theory for Baumol's cost disease suggests that if sectors are unable to significantly boost productivity through AI, they will still face upward pressure on wages from the more productive sectors. This 'cost push' means these less productive sectors could grow as a proportion of the economy, even as their efficiency stagnates. It could be an obstacle for gaining competitiveness.
Source: Implement Economics based on Eurostat, Briggs and Kodnani (2024), OECD, and European Commission Competitiveness Compass.

→ Case

Public administration, education and health care

Enabling the Département du Var in France to innovate local government with Google Cloud AI tools

The challenge

The Département du Var in France understands the need to keep pace with residents' constantly evolving expectations.

The solution

They are now using AI to transform their operations, to create a more responsive, efficient, and citizen-centric government. Their focus has been on tools to drive productivity and deliver a better service to citizens, such as chatbot, survey chatbot, and automated transcription of council meetings.

The impact

Their work with Google Cloud has already yielded results, with solutions actively being deployed and more prototypes on their way.

> *Google Cloud's expertise and leadership in AI are pivotal in driving our AI Innovation Hub forward.*
>
> **David Zurowski**
> General Manager in charge of Modernization and Administration Performance, Département du Var

Source: Implement Economics based on Google Cloud.

Lack of access to the most powerful AI tools and innovative applications puts EUR 800 billion in value at stake

European businesses risk missing out on the most advanced uses of AI for more complex tasks, if they have limited access to the most powerful AI infrastructure, models and applications.

In a *limited use* scenario, where generative AI automates only basic tasks (difficulty level 3), Europe's AI potential could fall from 8% to 2% of GDP, putting EUR 800 billion at risk. By contrast, in a *full use* scenario, European AI could take on more sophisticated tasks (difficulty level 4) and unlock the higher potential.

This could be the result of a "made in Europe only" policy, requiring large capital reallocation and the time required to replicate existing models, foreign infrastructure and develop homegrown chips manufacturing.

> *Integrating AI into strategic sectors where Europe has traditionally been strong will be critical to maintaining their competitive edge.*
>
> **The European Commission**

Estimated potentials of generative AI adoption in the EU
EUR billion increase from baseline GDP after ten-year adoption period

AI capable of solving tasks up to...

Difficulty level: 3 → More advanced AI → 4

Task examples:

- → Keep records of employees' attendance and hours worked.
- → Maintain operations data, such as time, production, and cost records.
- → Resolve customer complaints or answer customers' questions
- → Explain tax laws to individuals and companies.
- → Perform statistical analysis of environmental data.
- → Write grant proposals to procure external research funding.

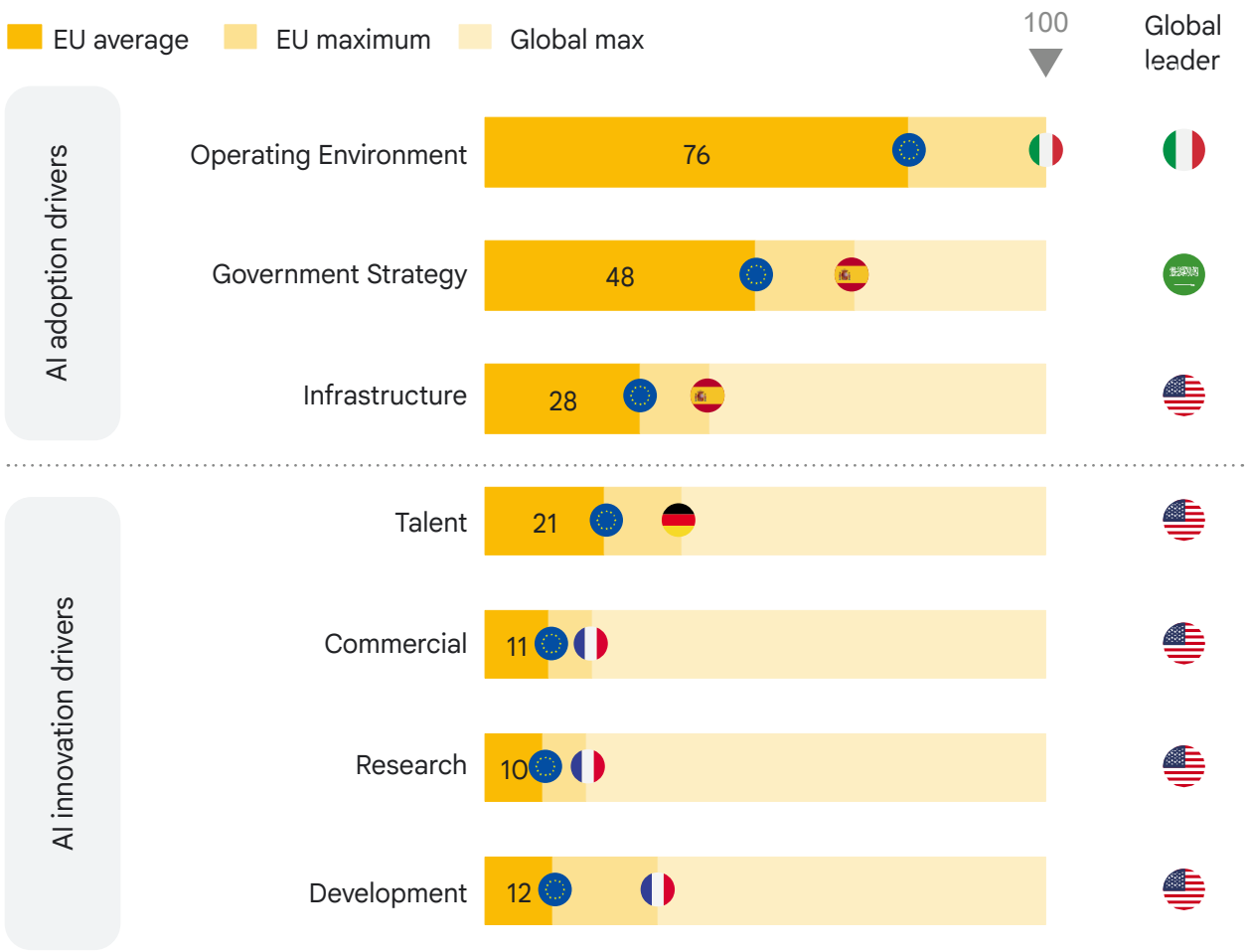
Note: Task difficulty is defined using O*NET's 1–7 scale. In the limited use scenario, generative AI is assumed to automate or assist with tasks up to level 3. The full use scenario (aligned with previous modelling) includes tasks up to level 4. The estimate assumes widespread adoption of generative AI over a ten-year period. There is much uncertainty around the capability and adoption timeline of generative AI. The size of the productivity boost depends on the difficulty level of tasks that generative AI will be able to complete and the number of jobs it can automate. GDP is in 2024 levels.
Source: Implement Economics based on Eurostat, and Briggs and Kodnani (2023).

The EU lags behind on drivers for AI adoption and innovation

The EU ranks below world leaders on the foundational drivers of AI adoption that ensure a safe and reliable AI-ready environment: operating environment (e.g. trust, data governance), government strategy, and infrastructure (e.g. supercomputing, download speed). Possibly more concerning, the EU is trailing even further behind on the drivers of AI innovation: talent, commercial activity, and R&D.

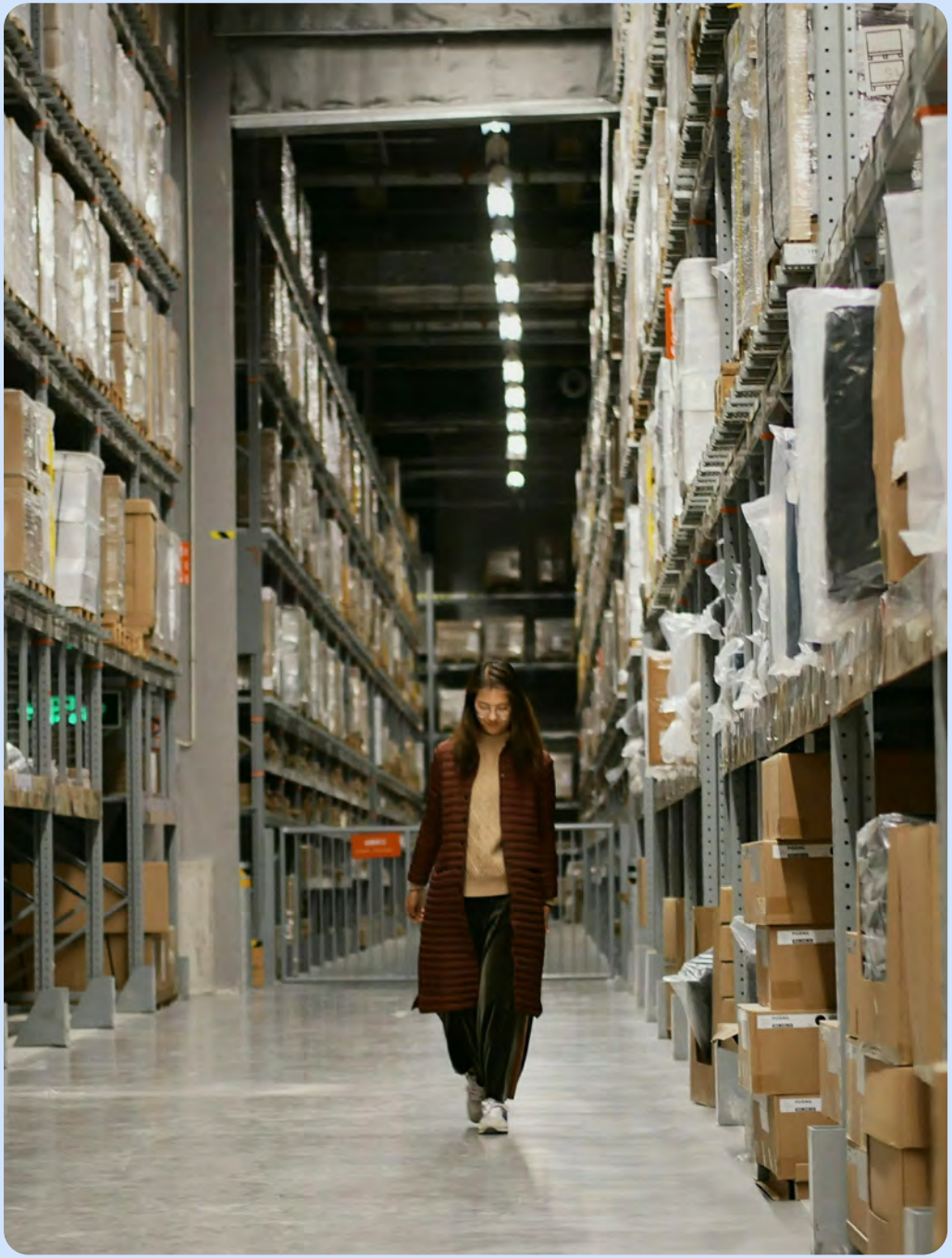
To unlock the full economic potential of AI, Europe will not succeed by simply adopting existing AI models, it must also actively adapt and shape them.

The EU's AI capacity according to the Tortoise Global AI Index, 2024
Global AI Index, score out of 100 (global leader)



Note: The Global AI Index looks at seven sub-pillars for AI capacity: talent (availability of skilled practitioners in AI solutions, including IT and STEM graduates, data scientists, AI professionals etc.), infrastructure (download speed, supercomputing capabilities etc.), operating environment (regulation, cybersecurity etc.), research (AI publications and citations etc.), development (fundamental platforms and algorithms etc.), government strategy (national funding commitments to AI etc.) and commercial ventures (AI startup activity, investments etc.). The EU average is weighted by EU country's GDP share.

Source: Implement Economics based on Tortoise Media.



Part 2

Producing AI

Europe must build on its strengths and seize opportunities along the AI value chain to support AI innovation

Too often, I have heard that we should replicate what others are doing and run after their strengths. I think that instead, we should invest in what we can do best and build on our strengths here in Europe.

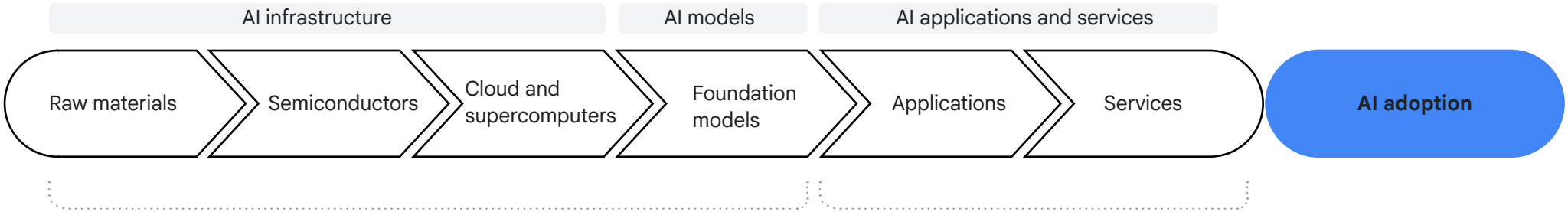
Ursula von der Leyen
at the AI Action Summit, 2025

Europe must build on its strengths and seize opportunities along the AI value chain to enable and support AI innovation

The AI value chain

The AI value chain represents the complete lifecycle of AI from infrastructure and models (technical bedrock) to AI applications and services (diffusion channel).

To seize the AI innovation opportunity, the entire European AI value chain will need to be expanded. In this part of the report, we assess Europe's strengths and opportunities in the AI value chain, where the EU holds a particularly emerging strength in applications and services.



AI's technical bedrock

The AI supply chain is a globally integrated, and no region or country has the capacity to be self-sufficient or independent. Innovation knows no borders and ground-breaking innovations often result from global research collaboration.

AI's diffusion channel

Broad AI adoption requires building and rooting the technology into the specific context, often best done by local businesses close to the integration problem.

To seize the AI innovation opportunity, European businesses need strong AI infrastructure and access to use and build on the best models.

Google contributes to AI innovation in Europe across the value chain

Examples of Google contributions along the AI value chain

The EU is one of Google's most important engineering and development hubs, with **42 offices located across 25 countries**. Google Cloud has launched **13 cloud regions** in Europe since 2015, helping European businesses run mission-critical services with reduced latency, meet local data-residency rules, enact digital transformation and stay in control of their data.

Google in the EU - Google's products generated a EUR 179 billion economic impact in 2023 with Google tools like Google Search and Workspace together contributing an estimated EUR 560 billion in worker productivity in a single year.

Data centres & connection – Google has built 7 data centres and developed 13 cloud regions in Europe, and built multiple crucial subsea cables connecting Europe to the world – all in partnership with European companies like Orange, T-Systems and TIM.

Vertex AI – Google Cloud's all-in-one platform helps European businesses build and deploy AI-powered applications easily.

Cloud TPUs – Google's specialised chips have significantly contributed to the computational advancement that has accelerated large-scale AI.

Gemini – Google's cutting-edge foundation model is fuelling innovation at scale, and the Gemini app now has over 400 million active users.

Google Cloud Consulting – Google's unified services portfolio brings together AI strategy, custom model development, integration support and training.

The global AI market is set for massive growth, with the biggest growth opportunity for the EU being in AI applications and services

> *Overall, a weak AI ecosystem would represent an obstacle to EU companies digitalization and productivity gains [...].*
>
> **Mario Draghi**
> in The future of European competitiveness (2024)

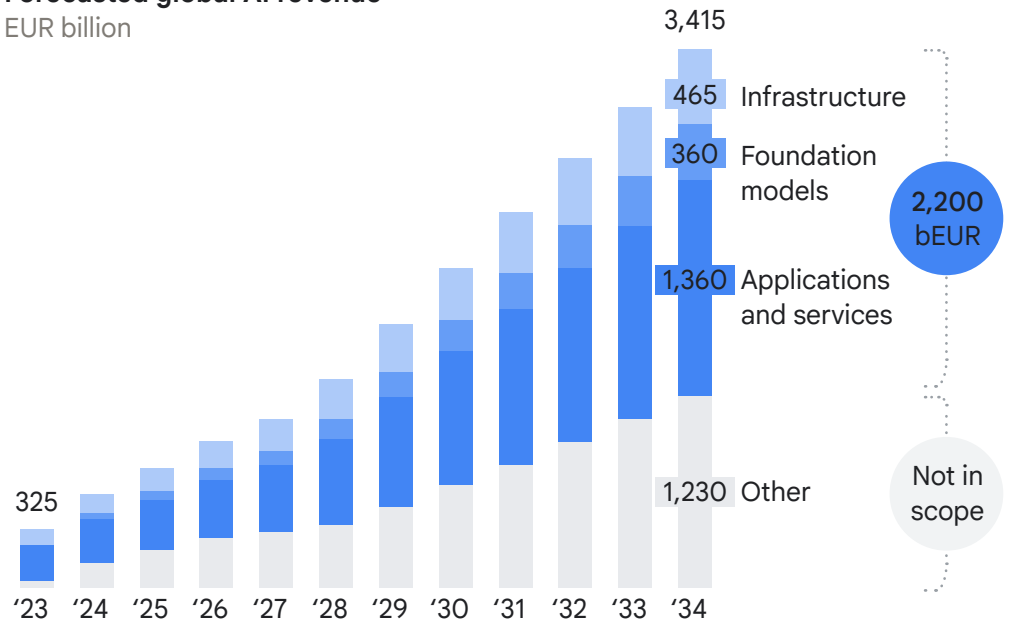
The global AI market is projected to grow 25% annually and reach around EUR 3.4 trillion by 2034. Some forecasts go even further. The UN estimates that AI revenues will reach EUR 4.2 trillion in 2033. Most revenue today comes from non-generative AI systems (85% of the total), while generative AI's share is expected to rise to nearly half of the total AI market by 2034.

The global AI market related to the AI value chain revolves around three core segments: infrastructure, foundation models, and applications and services. Together, these three segments are projected to generate EUR 2.2 trillion in revenue globally by 2034. Over time, the focus will shift from infrastructure and training to inference and applications as computing becomes more efficient and models become more capable.

These projections point to a broad set of potential openings for Europe to lead in AI solutions. Among these, applications and services represent the largest by far, growing to almost EUR 1.4 trillion, or 60% of the total market.

In the following three sections, we explore the EU's position and economic opportunities across the AI value chain's three core segments - and how the EU can ensure its ecosystem fully supports the benefits of AI adoption and innovation.

Forecasted global AI revenue
EUR billion



Note: The forecasted global revenue in the AI value chain excludes revenues from devices, digital ads and gaming (around EUR 1,200 billion in 2034). Foundation models relate only to generative AI. Gen AI estimates from Bloomberg are extended from 2032 to 2034 while non-Gen AI estimates are extended from 2030 to 2034.
Source: Implement Economics based on Bloomberg, FTI delta, and United Nations.

Part 2

AI infrastructure

Europe must make a rapid, efficient and sustainable build-out of a powerful AI infrastructure and ensure high data security and control

> *[...] the EU must find a middle way between promoting its domestic cloud industry and ensuring access to the technologies it needs.*
>
> **Mario Draghi**
> in The future of European competitiveness (2024)

The WTO emphasises that international trade, partnerships and cooperation are vital for AI development worldwide, as all countries are interdependent in some part of the value chain.

Companies worldwide occupy distinct roles in the advanced chip value chain: NVIDIA, Intel and AMD compete in chip design, ASML (Netherlands) has a unique position in chip manufacturing equipment, and TSMC (Taiwan) handles most fabrication of the most advanced AI chips.

The cloud market is more dispersed but still heavily centred around the three US hyperscalers. Many US-owned companies operate data centres and partner with European firms to provide sovereign cloud infrastructure and solutions. European companies typically construct these facilities and lead the global market in electrical systems for data centres. The recent AI boom has added over EUR 150 billion to the market cap of four of Europe's oldest industrial companies.

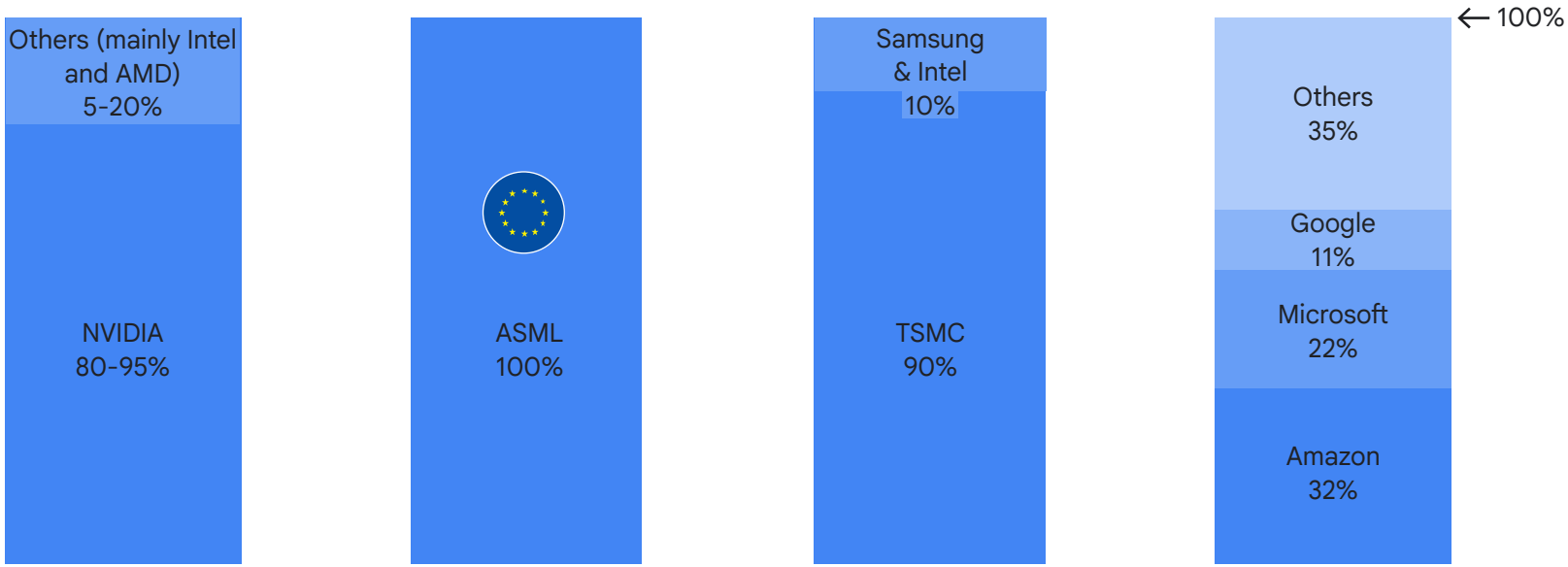
Recognising this intricate global dependency, Europe's strategic approach, reflected in the EU Chips Act and Chips Act 2.0 discussions, aims for resilience, not isolation. The EU International Digital Strategy reinforces this perspective by promoting close collaboration with "partners and tech allies to enhance the ability of European tech companies to innovate and grow globally".

The AI infrastructure value chain is globally integrated and interdependent, requiring global cooperation and partnerships

> *The rise of AI is likely to require an increased international trade in goods and services related to that value chain.*
>
> **World Trade Organisation**
> in Trading with intelligence (2024)

Global share of leading companies in AI infrastructure subsegment
%

Specialised leadership within subsegments, e.g. Europe in EUV lithography machines, increases value chain control/sovereignty by preventing single nations from fully controlling chip production.



Design of AI chips

2023 data: Excludes AI chips unavailable for purchase

Chip manufacturing equipment

2023 data: ASML is the sole producer of EUV lithography machines

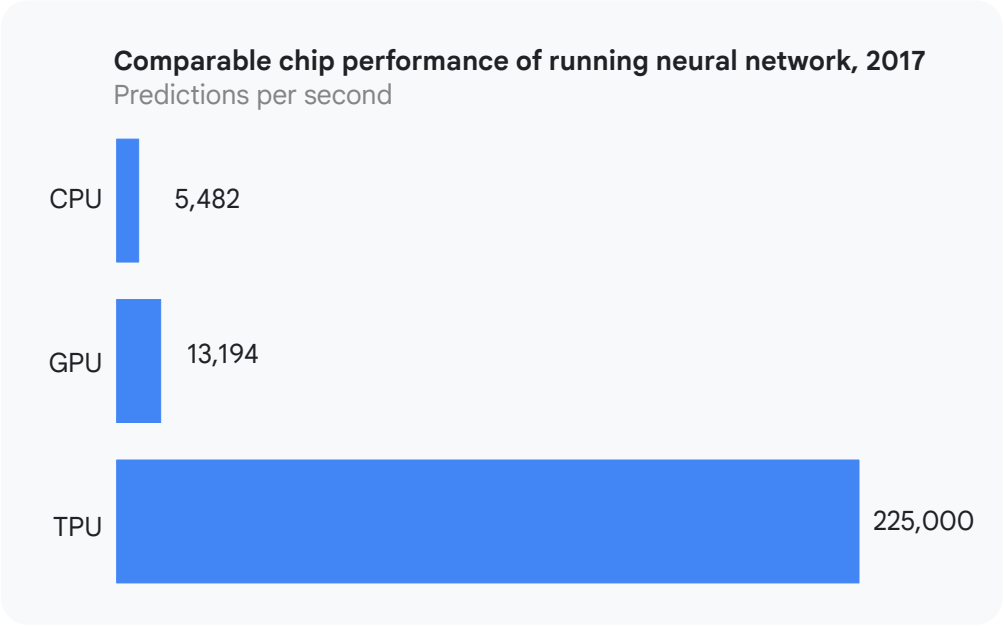
Fabrication

2022 data: Covers logic chips that are <= 7nm

Compute provision

This covers the entire cloud market and is not specific to AI compute

Source: Implement Economics based on World Trade Organisation (WTO), Ipnest, Gartner, and Sastry et al. (2024).



→ Case

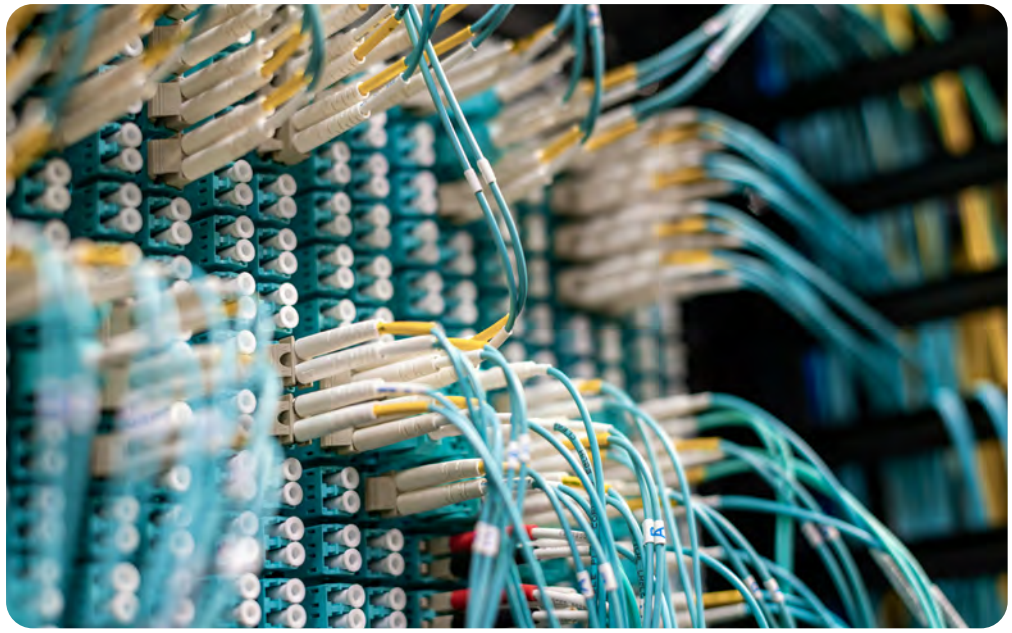
Cloud TPU Accelerators contribute to enhanced AI innovation in Europe

Google's invention of Tensor Processing Units (TPUs) in 2015 has significantly contributed to the computational advancements that have accelerated large-scale AI. These specialised chips are designed for large-scale AI evolving around complex matrix computation.

The first TPU could deliver 15-30× more output than CPUs and GPUs when generating machine learning predictions. Google has since continued to innovate and improve its TPUs, most recently with the Ironwood release, which is nearly 30 times more power efficient than the first Cloud TPU.

Google's TPU chip technology is used by Generali, one of Europe's largest insurance companies, through Google Cloud's AI-optimised infrastructure. Generali leverages these advanced chips to power its computer vision–based claims automation system, which analyses vehicle damage photos and estimates repair costs in real time. By utilising Cloud TPUs, the company has accelerated model training and enabled a production-ready workflow, supporting its mission to deliver faster, more efficient customer service.

Note: Complex matrix computation refers to performing large numbers of mathematical operations on grids of numbers (matrices), such as multiplying or transforming them. These operations are the foundation for many AI tasks, including recognising patterns, processing images, and training neural networks.
Source: Implement Economics based on Google Cloud.



→ Case

Google's AI Hypercomputer allows organisations to train and deploy AI applications cost-effectively

The challenge

Development and deployment of AI applications present a core challenge: achieving high computational performance while managing hardware innovation and controlling costs.

The solution

Google's AI Hypercomputer directly addresses these needs with solutions designed for flexibility and optimization:

Choice of hardware: Offering a range of performance-optimised hardware, including TPUs and NVIDIA GPUs.

Choice of software: Combining AI-optimised software like Kubernetes Engine and popular open-source frameworks such as Jax and Pytorch.

Flexible use: Providing flexible consumption models, such as the Dynamic Workload Scheduler and Google Distributed Cloud.

The impact

Organisations have cheaper access to train, deploy and scale AI applications using frontier AI technology and their preferred tools of choice. The Dynamic Workload Scheduler, for example, saves customers more than 50% on AI workloads versus on-demand.

Source: Implement Economics based on Google Cloud.

Europe needs 2-3 times more cloud capacity to meet future AI demand, and this is best achieved in an open market

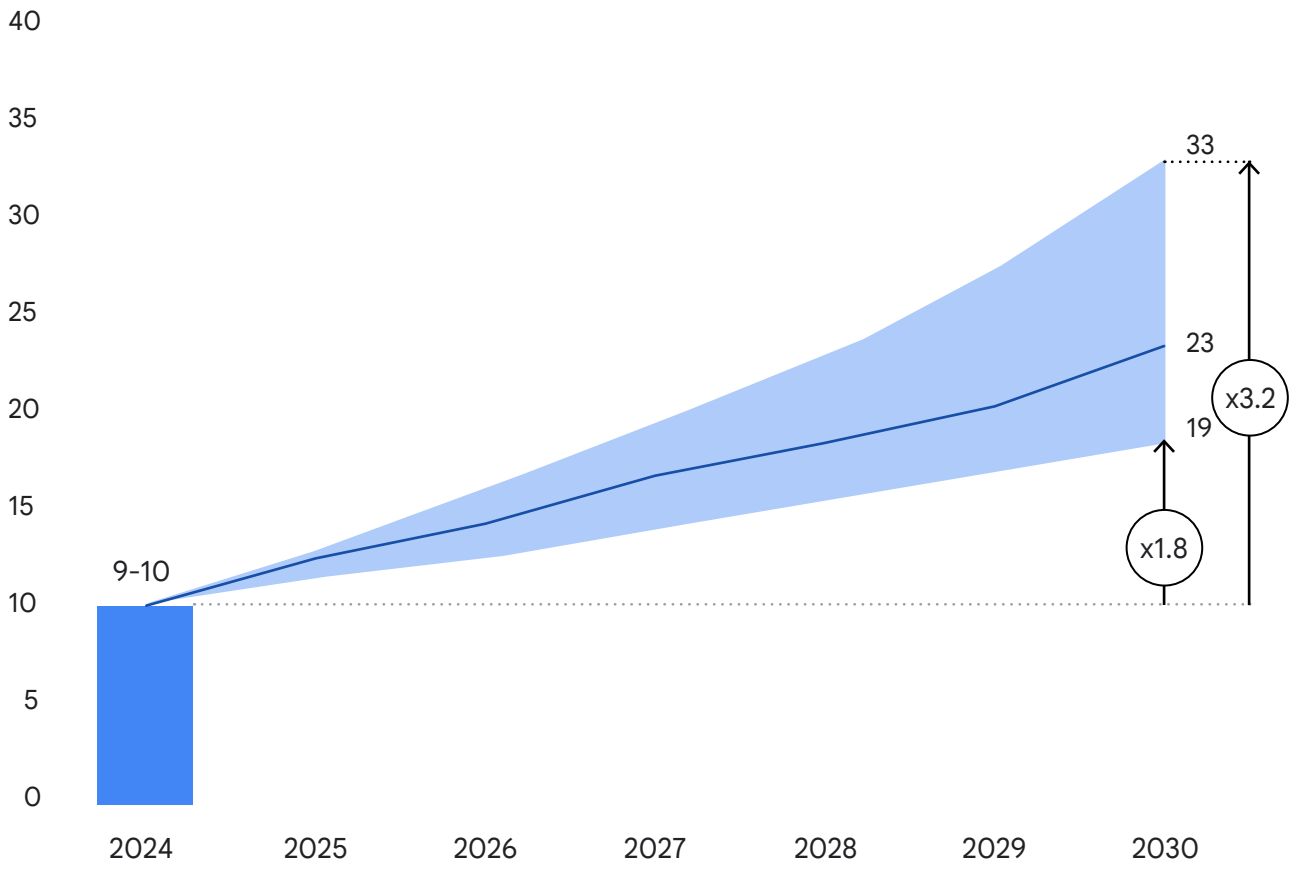
Europe currently hosts about 10 GW of data-centre capacity (~18% of global total). Forecasters project that European data centre capacity will need to double or triple towards 2030 to meet future demand. Not all new capacity is expected to be used for AI. By 2030, 25-30% of European data centre capacity is expected to be consumed by AI, compared to less than 5% today.

To expand capacity, Europe must leverage the best available and most cost-effective solutions and set clear rules, allowing all market participants to contribute to the capacity expansion and compete on transparent and fair terms.

This aligns with the EU's Cloud and AI Development Act, which aims to close the data centre gap with the US and China by tripling the EU's data centre computation capacity in the next five to seven years.

European data centre capacity

GW



Note: There is uncertainty around the precise amount of current installed data centre capacity in Europe as of 2024. Estimates range between 8.5 and 10 GW.
Source: Implement Economics based on Draghi, European Commission, Statista, EIA, ICIS, Mordor Intelligence, Goldman Sachs, IDC, Financial Times, and McKinsey.

Sovereignty offerings from Google Cloud

Google Cloud Data Boundary	Customer data, access, and sovereignty controls in public cloud
Google Cloud Dedicated	Regional operational sovereignty from local independent partners
Google Cloud Air-Gapped	Fully air-gapped running in customer's environment

→ Case

Sovereign Cloud from Google gives European users choice and security in the cloud without compromising functionality

The challenge

European businesses face a core challenge: adopting AI and cloud technology while ensuring data sovereignty and complying with EU regulations.

The solution

Google is actively addressing these needs with solutions designed for stringent European requirements:

Data Boundary within the public cloud lets customers store data in a chosen region and control the encryption keys.

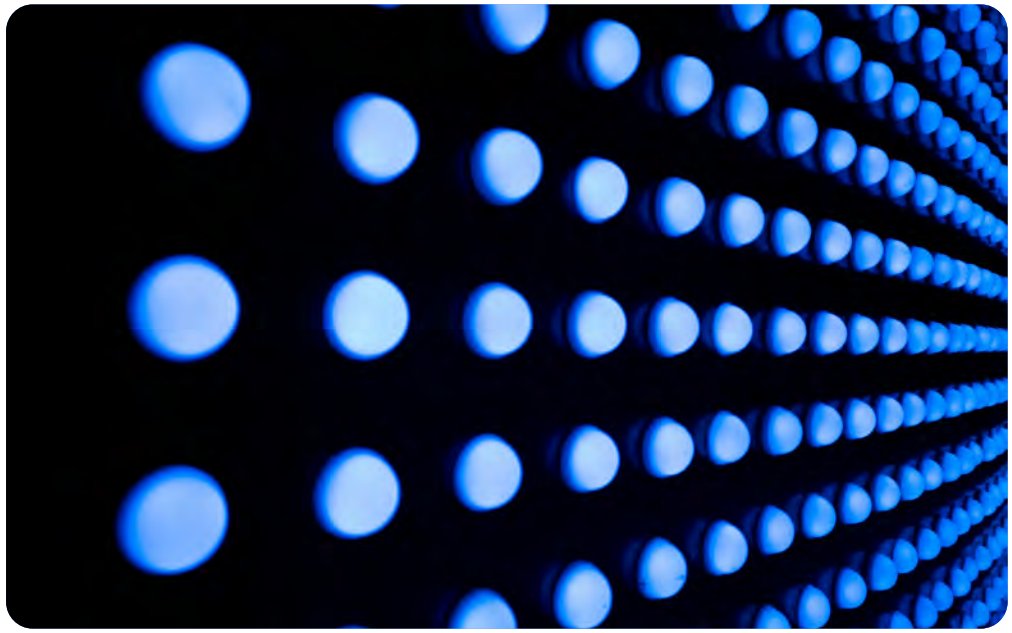
Dedicated where Google collaborates with European entities like S3NS (France) ensuring local operation and compliance.

Air-Gapped offers solutions for highly sensitive workloads.

The impact

Google's commitment empowers European organisations to confidently accelerate digital transformation and allows Europe to innovate at the highest speed while ensuring local compliance and autonomy.

Source: Implement Economics based on Google Cloud.



→ Case

Google's data centres in Europe bring crucial cloud and sustainable compute capacity to European businesses

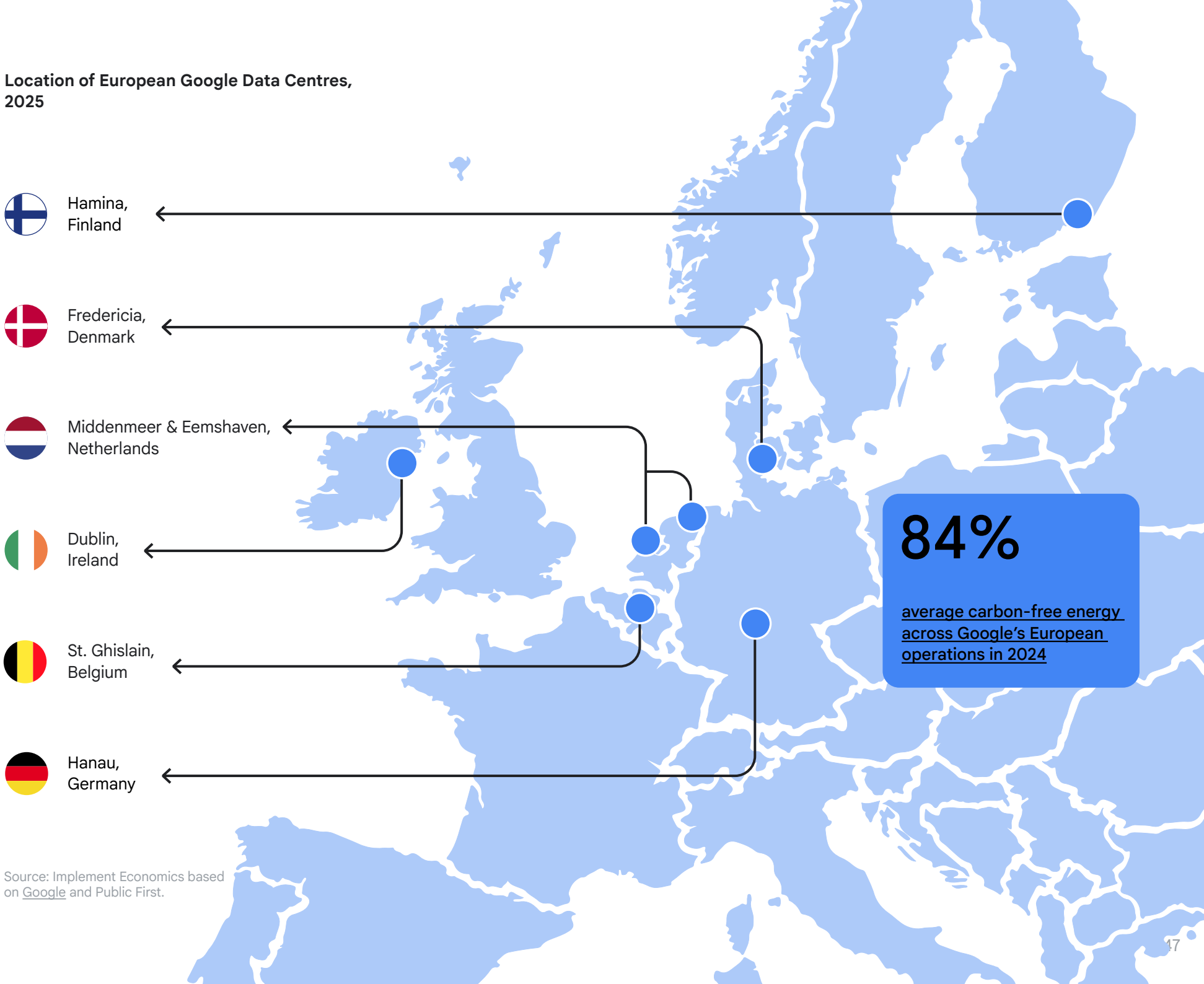
Google owns and operates seven data centres located across the EU in Ireland, Germany, the Netherlands, Denmark, Finland and Belgium, providing customers with highly secure digital infrastructure. Several additional EU data centres are currently under development.

These data centres help meet the growing demand for AI and cloud services, bringing crucial compute capacity to people and businesses across Europe.

On average, Google-owned data centres deliver approximately 6x more computing power today for the same amount of electrical power that they used five years ago.

Google data centres in Europe are powered by renewable energy, with investments in wind and solar adding new carbon-free electricity to the European grid. Google estimates that the new clean energy agreements signed in 2024 could generate nearly 4x more electricity than the incremental load growth from 2023 to 2024.

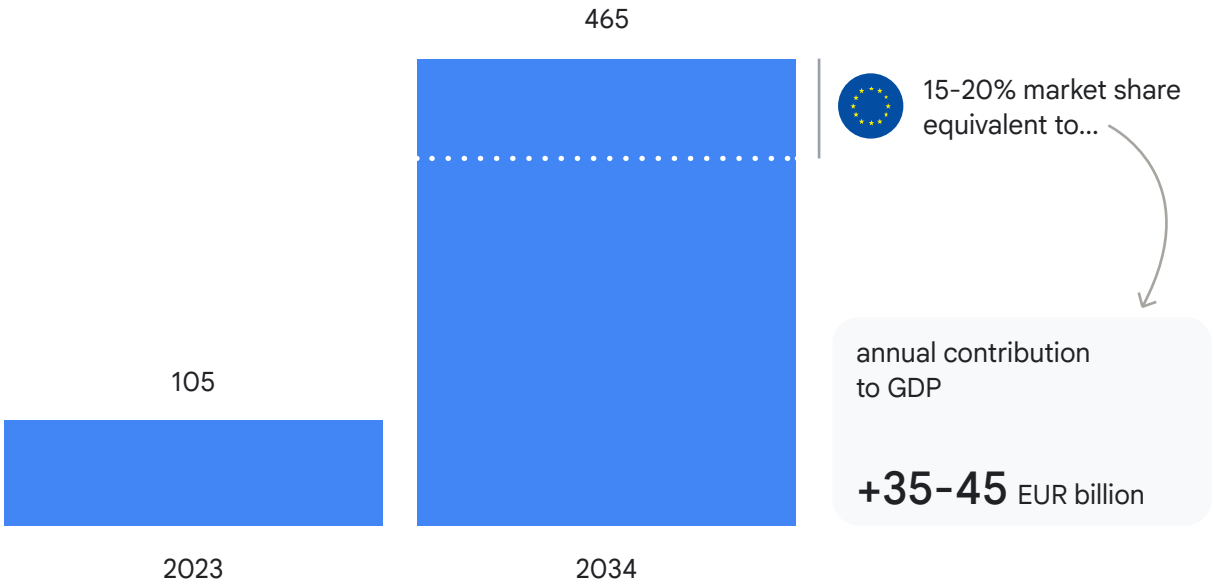
Location of European Google Data Centres, 2025



Source: Implement Economics based on Google and Public First.

Growing the AI infrastructure in Europe could contribute EUR 35-45 billion annually to the economy by 2034

Forecasted global revenue in the AI infrastructure segment
EUR billion



Note: EU market shares are estimated according to the EU's share of global ICT revenue, its share of global data centre capacity, its share of the global GenAI market, and its projected share of global data centre capacity by 2030. Revenue numbers are converted to GVA using the latest available data (2022) for the ratio between value added and net turnover for the EU27's *Computer programming, consultancy and related services sector* from Eurostat. Economic effects are calculated on a Gross Value Added (GVA) basis and then converted to Gross Domestic Product (GDP) using the EU27 GVA-to-GDP ratio from 2024. GDP equals GVA by adding net product taxes.
Source: Implement Economics based on Bloomberg, Draghi (2024), Goldman Sachs, and Eurostat.

Global revenue in the AI infrastructure segment is projected to increase from EUR 105 billion in 2023 to around EUR 465 billion in 2034.

Based on Europe's expected market share of 15–20%, a conservative estimate shows that growth in the European AI infrastructure could contribute EUR 35–45 billion to the EU's GDP annually by 2034.

This uplift would mainly be driven by investments in domestic data centres, where the capacity is expected to grow between 2-3x towards 2030. More data centres in the EU will generate economic activity within the region, regardless of whether they are built and operated by EU or non-EU companies.

Data centre capacity is essential to pursuing the AI innovation opportunities and Europe needs to have access to frontier compute technology to drive innovation of the most advanced AI applications.

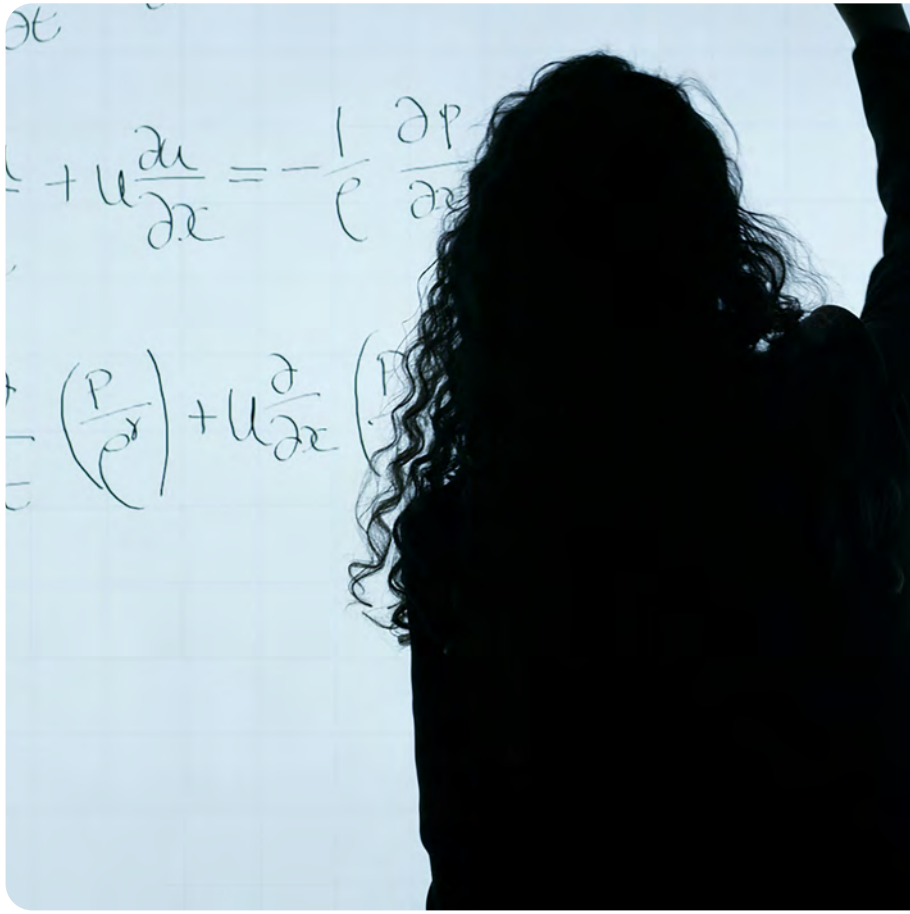
Note that GDP contributions are obtained from revenue estimates based on the ratio between revenue and GDP from Eurostat (see full details in the note).

Part 2

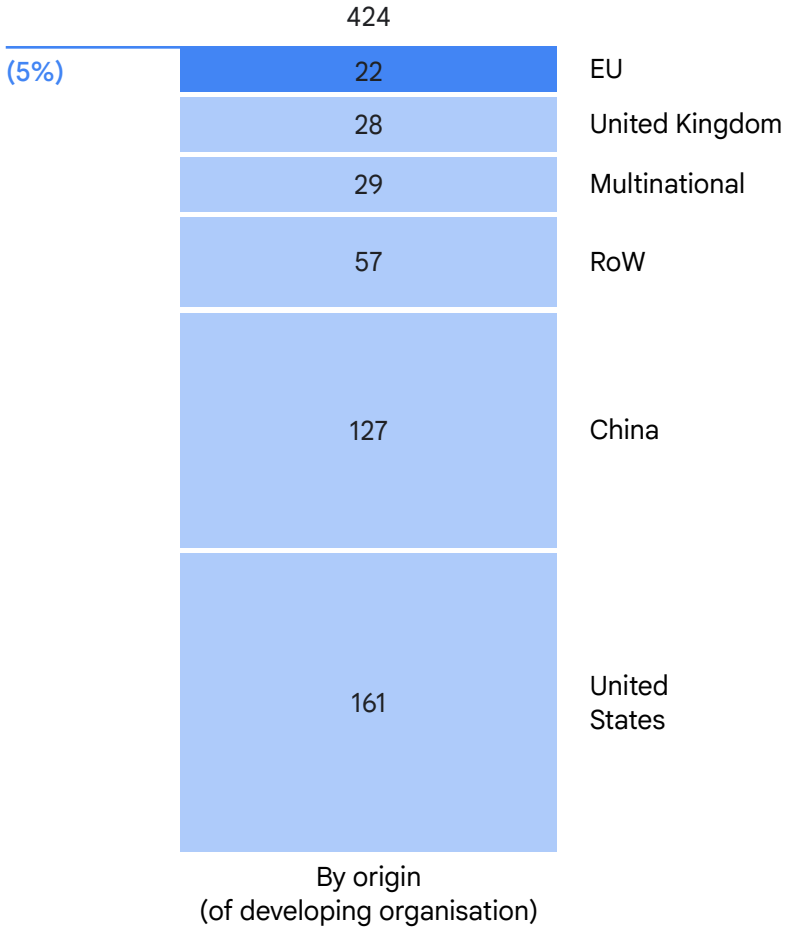
AI models

Give better opportunities for European AI models to flourish, and ensure access to the best AI models

European innovators want to have the choice to leverage the best AI models for innovation



Large AI models by origin
Number of models



Foundation models are the technological bedrock of the AI innovation opportunity. Foundation models are AI systems trained on massive datasets. Some excel at language tasks, others at vision or code. They are developed by various suppliers, including European firms such as France's Mistral AI and Germany's Aleph Alpha.

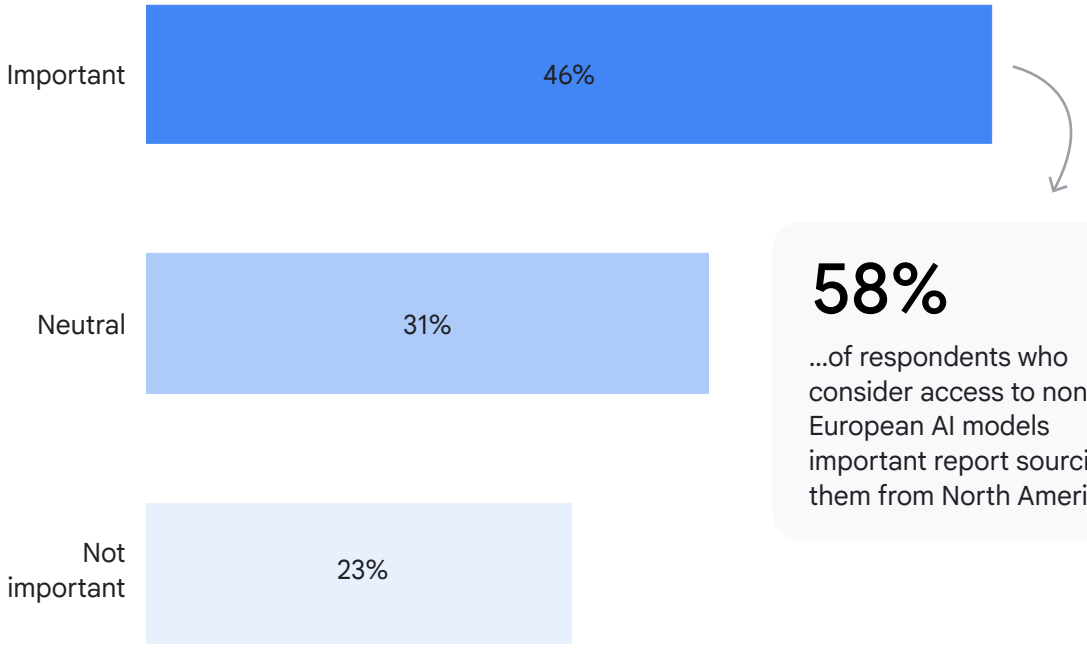
Of the more than 400 large-scale AI models available globally, only 22 models originated from Europe (5% of the global total). In 2024, 68% of foundation models were available either through an API or with open weights, making them accessible for a wide range of uses.

Note: Large-scale AI systems built since 2017 as of 2025 Q1.
Source: Implement Economics based on Epoch AI.

A recent survey shows that access to the global pool of AI models is important for EU innovators. Nearly half of European startups and scaleups (46%) say that access to AI models from outside Europe is important to their business.

Perceived importance to European businesses of AI built outside of Europe
% of respondents

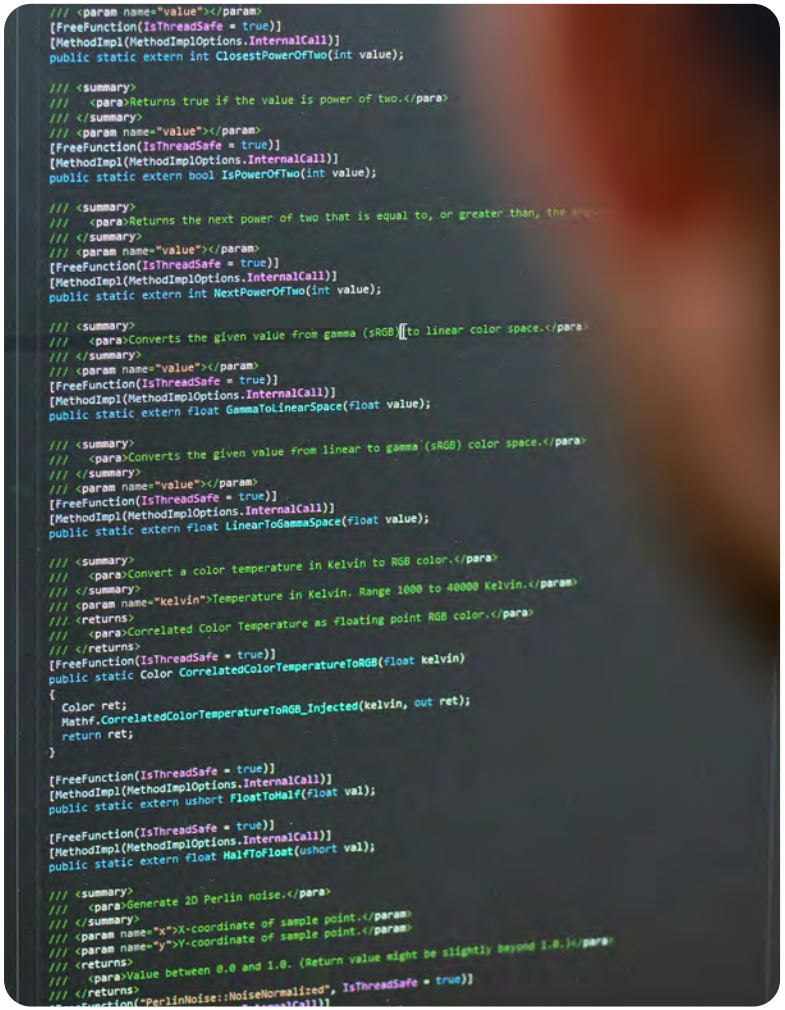
"To what extent is access to cutting-edge AI technologies built by companies outside of Europe important to your business?"



58%

...of respondents who consider access to non-European AI models important report sourcing them from North America.

Source: Implement Economics based on Notion Capital survey (2024).



New foundation models are being launched in a highly competitive market

The market for AI models is growing, with firms continually developing and refining models to enhance capabilities in text, image, audio, video, and specialised areas such as protein and DNA sequencing.

Model releases are frequent; the Stanford AI Index reported that 61 notable models were launched in 2024, and their size continues to increase.

Although training these systems can be costly, with GPT-4 exceeding USD 100 million, DeepSeek recently claimed to have trained its R1 model for just USD 5.6 million, achieving comparable performance. Building new generalist foundation models comes with immense financial and computational challenges, with large pools of money having already been invested. Instead, Europe's strategic advantage lies in creating specialised, fine-tuned models for narrower applications, where European companies such as Mistral in defence and Aleph Alpha in government and enterprises have already demonstrated success.

The OECD has assessed the competition risks within AI foundation models using indicators such as barriers to high-quality data access and economies of scale. The OECD finds those risks to be speculative and sees no evidence they are impeding effective competition in foundation models, suggesting the market remains open to newcomers and innovation.

Examples of generative AI models shows that there are many options available for each modality

	Text	Image	Audio or music	3-D	Video	Protein structures or DNA sequences
OpenAI	GPT-4.1	GPT Image 1	Jukebox	Point-E	Sora	
Google/ DeepMind	Gemini 2.5	Imagen	MusicLM	DreamFusion	Imagen Video	AlphaFold 3
Meta	LLaMA 2	Make-A-Scene	AudioGen	Builder Bot	Make-A-Video	ESMFold
Microsoft		NUWA-Infinity	VALL-E	NUWA-Infinity	NUWA-Infinity	BioEmu-1
Stability AI	StableLM	Stable Diffusion XL	Dance Diffusion			LibreFold
Amazon	Amazon Titan		Deep Composer			
Apple				GAUDI		
NVIDIA	MT-NLG	Edify		Edify	Edify	MegaMol BART
Cohere	Command R					
Anthropic	Claude 3 Sonnet					
AI21 Labs	Jurassic-X					
Mistral	Mistral Large 2	Pixtral Large				
Aleph Alpha	Luminous	Luminous				

Source: Implement Economics based on Stanford University, OECD, Wired, McKinsey, and the listed companies' official documentation.

→ Case

Gemini helps over 400 million monthly users and is the foundation for new AI solutions

Gemini has become a central AI platform within Google, integrated into products such as Search, Workspace, Chrome, Android XR, and the standalone Gemini app. As a foundational model, Gemini also unlocks new innovations in areas such as Robotics, helping robots perform tasks with greater accuracy.

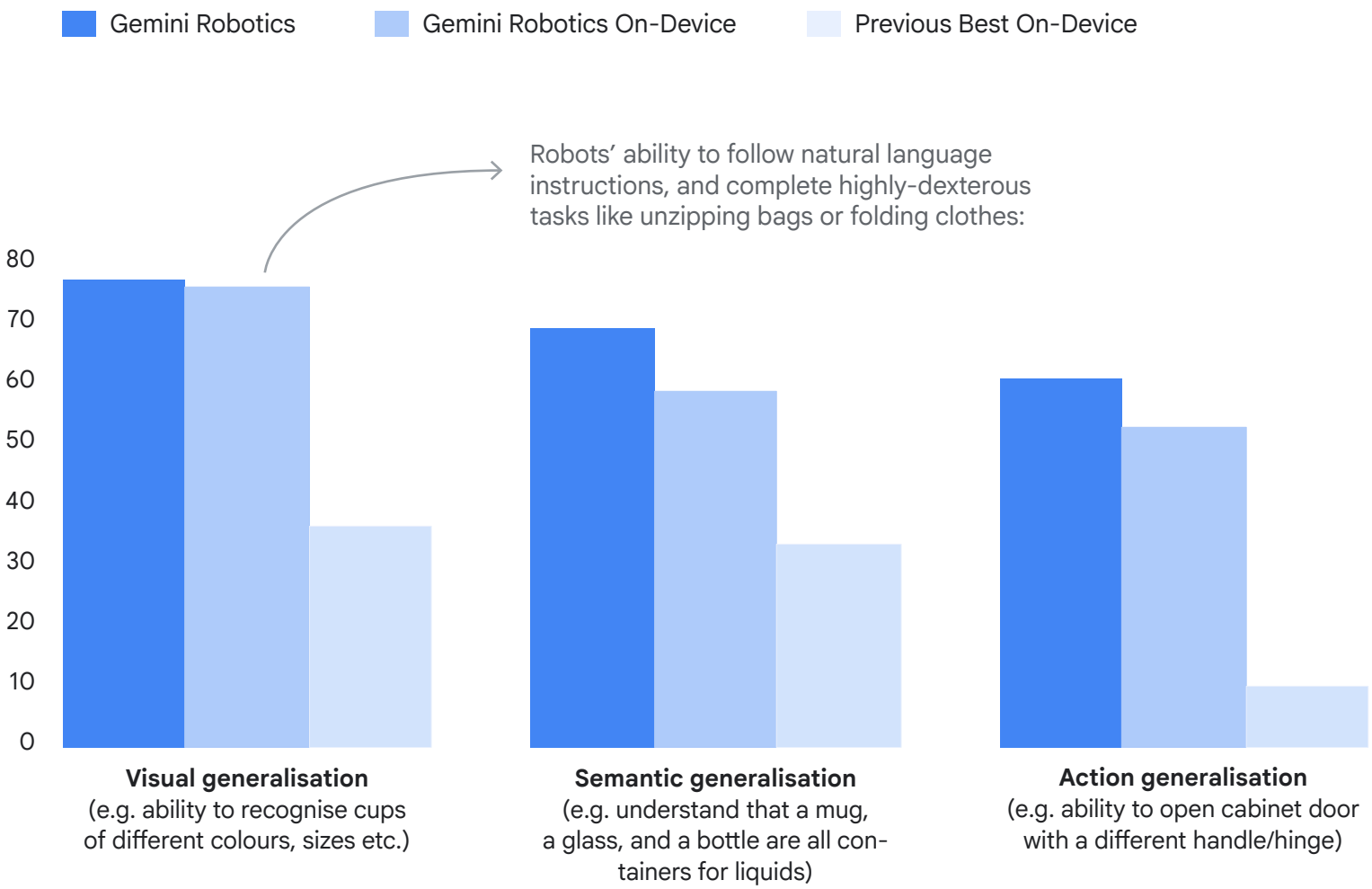
Across Google's AI systems, more than 480 trillion tokens are now processed each month in prompts and responses, powering applications from rapid prototyping to data-driven research.

Within this ecosystem, the Gemini app has grown to over 400 million monthly active users, reflecting its broad adoption and role in enabling new ideas and access to advanced AI capabilities.

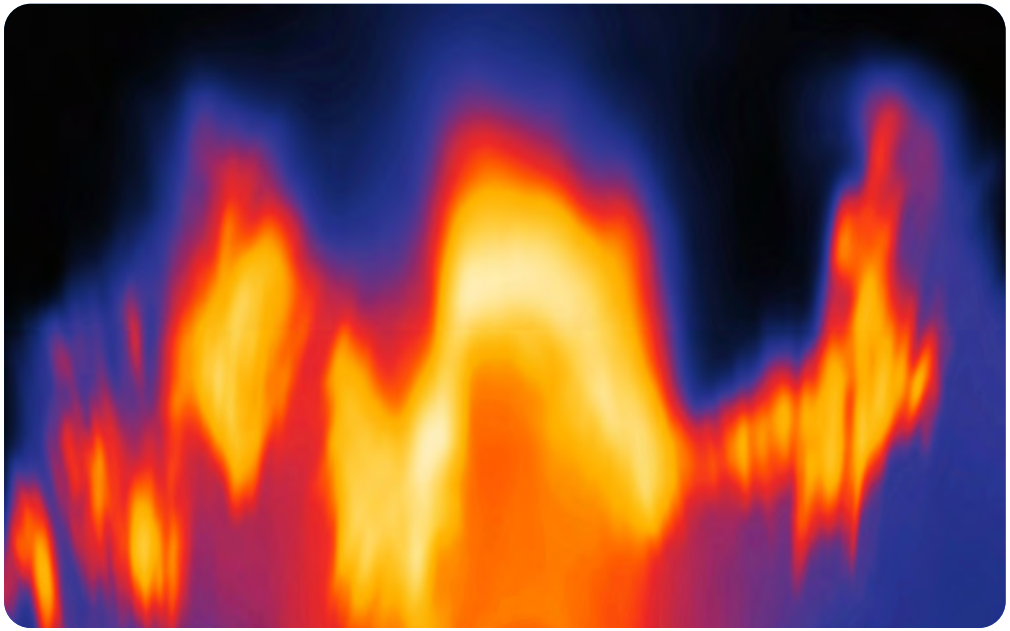
According to a Google survey, enterprise customers using Gemini for Google Workspace report an average time savings of 105 minutes per user per week, with 75% of daily users noting improved quality of their work.

Success rate across nine different robotics tasks using different models

%



Source: Implement Economics based on Google DeepMind.



→ Case

The Transformer model architecture was a result of multinational research collaboration

The Transformer architecture was introduced in the 2017 paper *Attention Is All You Need*, authored by eight Google researchers. It is widely regarded as one of the most important technological breakthroughs of recent decades.

Transformer models are at the heart of many of today's leading generative AI systems. They drive much of the progress we see in applications such as large language models, image generation, and other AI tools that can produce text, code, images, and more.

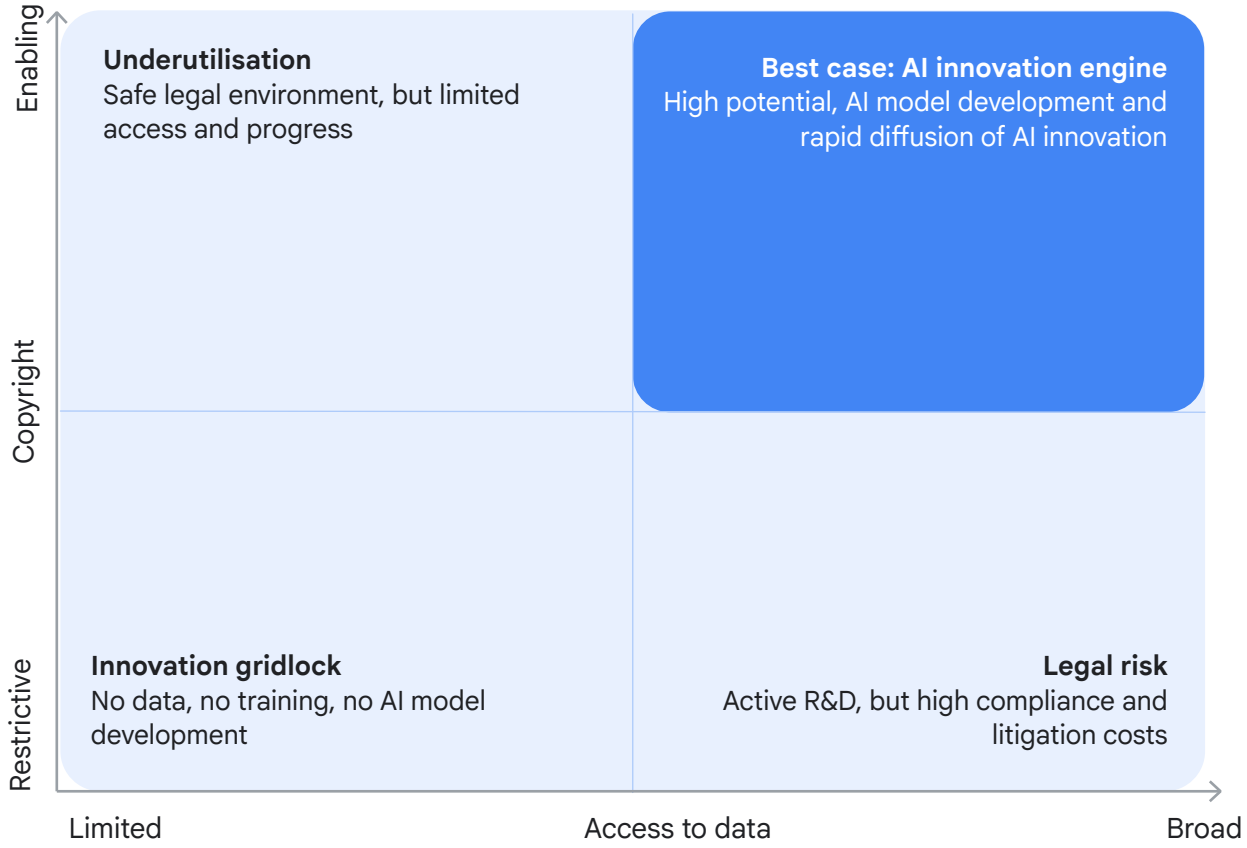
As of 2025, the paper has been cited more than 189,000 times, placing it among the top ten most-cited research papers of the 21st century.

Six of the eight authors were born outside the United States, with several having studied at European universities—making this breakthrough a result of truly international collaboration with a substantial European contribution.

Source: Implement Economics based on Vaswani et al. (2017) and Bloomberg.

Protect Europe's workable copyright regime to further unlock Europe's AI model potential

To foster an innovation engine for AI model development in Europe, it must preserve its commercial data and text mining rules and avoid creating new caveats to its use.



Source: Implement Economics based on Article 4 of the EU copyright Directive (EUCD), Bruegel (2024, 2025), and Draghi (2024)

> *[EU investment and innovation] calls for developing simplified rules and enforcing harmonised implementation of the GDPR in the Member States, while removing regulatory overlaps with the AI Act.*
>
> **Mario Draghi**
> in The future of European competitiveness (2024)

The quality and reliability of AI model responses depends on large volumes of data used for training the model.

Google makes AI model training more accessible by providing a search engine, Google Dataset Search, that indexes millions of datasets, while also directly publishing hundreds of curated datasets through its Google Cloud Public Datasets and Google Research platforms.

The EU Copyright Directive was beneficial in providing much-needed legal clarity on data use, paving the way for AI development. However, this clarity is now being challenged by some policymakers. Combined with the fragmentation of copyright laws across the 27 Member States, this creates increasing complexity for AI developers. Furthermore, the additional rules and obligations under the Artificial Intelligence Act (AIA) also risk hindering AI development.

Growing the AI foundation models segment in Europe could contribute EUR 8-15 billion to GDP annually by 2034

Global revenue in the foundation models segment, which covers generative AI, is projected to rise from EUR 10 billion in 2023 to EUR 360 billion by 2034.

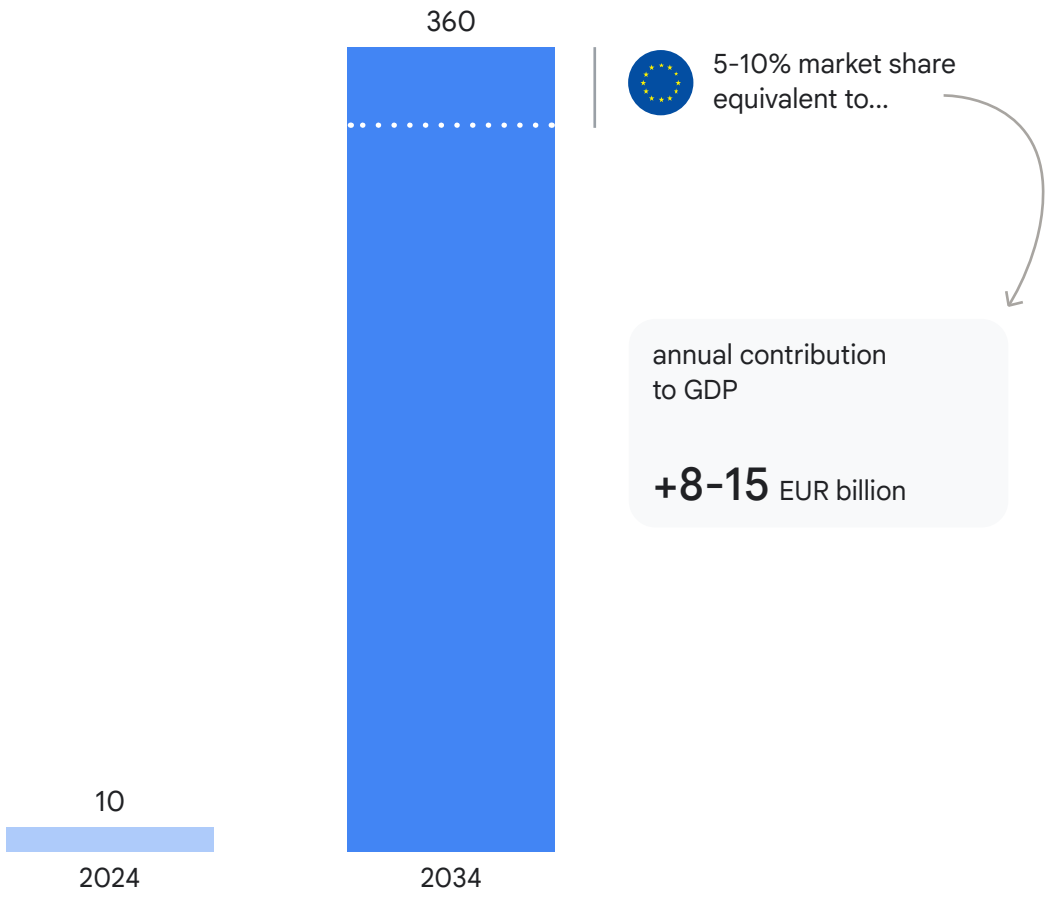
European firms such as France's Mistral AI and Germany's Aleph Alpha are already active in developing large-scale AI models and laying the groundwork for a continental specialisation in this segment.

If Europe secures 5–10% of the market for foundation models—reflecting its current share of global AI model development and venture capital investment in model creation—regional revenues would amount to EUR 20–35 billion by 2034.

A conservative estimate shows the growth of Europe's AI foundation model segment could contribute EUR 8–15 billion to the EU's GDP annually by 2034.

Just as important as these direct contributions are the broader spillover effects. Strong model clusters attract talent and financing while enabling innovation across many other sectors. Building such clusters in Europe is therefore core to competitiveness, with Paris and Berlin already emerging as hubs and London showing it can be done outside the United States.

Forecasted global revenue in the AI foundation models segment
EUR billion



Note: EU market shares are estimated according to the EU's share of total notable AI model developed in 2024 and its share of global venture capital investments in AI model making. Revenue numbers are converted to GVA using the latest available data (2022) for the ratio between value added and net turnover for the EU27's *Computer Programming, consultancy and related services sector* from Eurostat. Economic effects are calculated on a Gross Value Added (GVA) basis and then converted to Gross Domestic Product (GDP) using the EU27 GVA-to-GDP ratio from 2024. GDP equals GVA by adding net product taxes.
Source: Implement Economics based on Bloomberg Intelligence, Eurostat, Stanford, and Dealroom.

Part 2

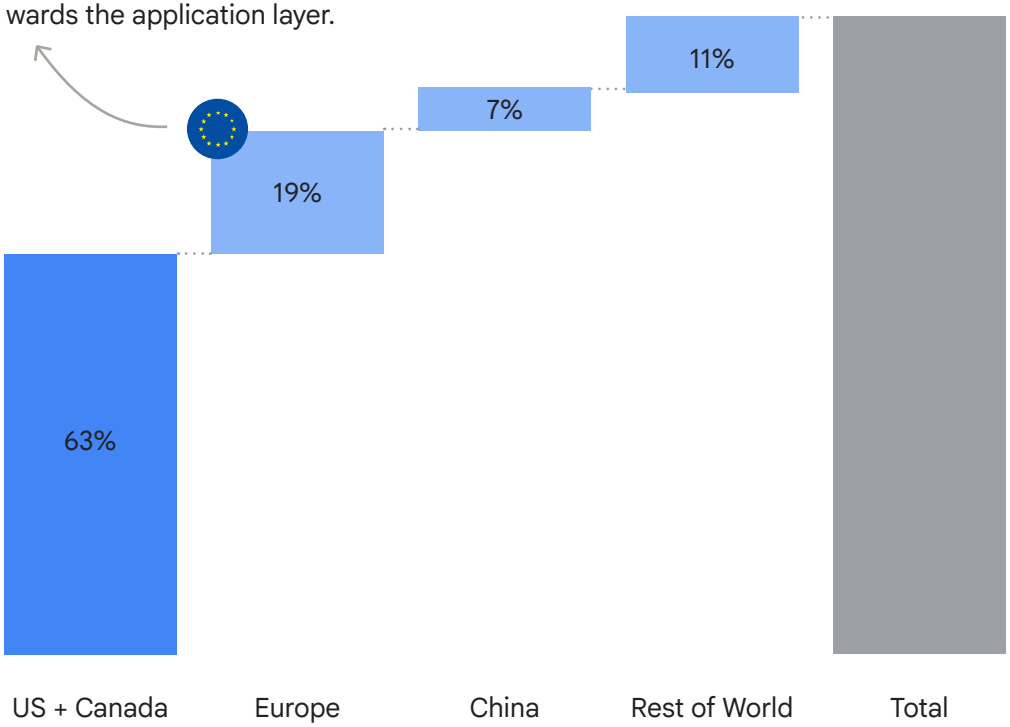
AI applications and services

Europe has an opportunity to lead in AI applications and services

AI applications and services turn technology into practical solutions, and Europe is well-positioned to capture market growth

Global venture capital funding share in AI application layer by region, 2023-2024
%

85% of all European AI venture capital funding is directed towards the application layer.



Source: Implement Economics based on Dealroom.

AI applications and services, or vertical AI, transform AI technologies into sector-specific solutions that drive productivity through industry-specific or company-specific applications.

This area is where we estimate Europe's greatest opportunities within the value chain lie, and it is also the fastest-growing segment of the market.

Europe's industrial expertise and domain knowledge, particularly in automotive engineering, pharmaceuticals, and luxury goods, offer significant opportunities for AI application and service development.

Europe attracts 19% of global AI application funding, signalling European strength and momentum in this part of the value chain.

Innovative digital businesses with specialised capabilities and close market proximity are key to customising these applications into real-world adoption and innovation. By tailoring solutions to specific needs and processes, they are key to realising Europe's collective AI potential.

→ Case

Google Agentspace empowers employees with autonomous AI agents

The challenge

Knowledge discovery tools often don't offer personalisation, answer generation, or deep retrieval. Many businesses therefore struggle to obtain internal knowledge or execute workflows due to the complexity of development and the significant time investment required to create an AI agent.

The solution

Google Agentspace is a platform for building, deploying, and managing AI agents. It lets businesses and employees create custom agents with a no-code designer to automate specific tasks. The platform also supports agents developed by third parties. Additionally, the platform works as an AI search agent that enables information discovery across enterprises' data, unlocking new levels of knowledge sharing and access.

The impact

A recent study commissioned by Google suggests that Agentic AI, such as that provided through the Agentspace platform, represents a USD1 trillion opportunity globally. One example of concrete savings is Google's internal research suggesting a three-minute saving per search.

Note: An AI agent is an autonomous software program that uses perception, reasoning, and planning to achieve a specific goal such as instantly handling customer support from start to finish (check order, approve a replacement, update records, and reply), or automatically restocking store shelves by tracking sales in real time.
Source: Implement Economics based on Google Cloud.

→ Case

Vertex AI helps businesses build and deploy AI-powered applications easily

The challenge

AI solutions are critical to business strategy, but many firms struggle to deploy, monitor, and govern AI models in production applications.

The solution

Vertex AI is Google Cloud's unified machine learning (ML) platform designed to streamline the entire ML workflow. It provides the infrastructure, tools, and pre-trained models needed to build, deploy, and manage businesses' ML and generative AI solutions. Additionally, Vertex AI offers access to 200+ pretrained models, providing users with the right tools for the job.

The impact

With Vertex AI, organisations experienced a 64% time saving per model, including a 70% boost in productivity around data preparation, and a 60% decrease in time spent on model monitoring, enabling data scientists to focus on innovation.

Source: Implement Economics based on Google Cloud and Forrester/Google.

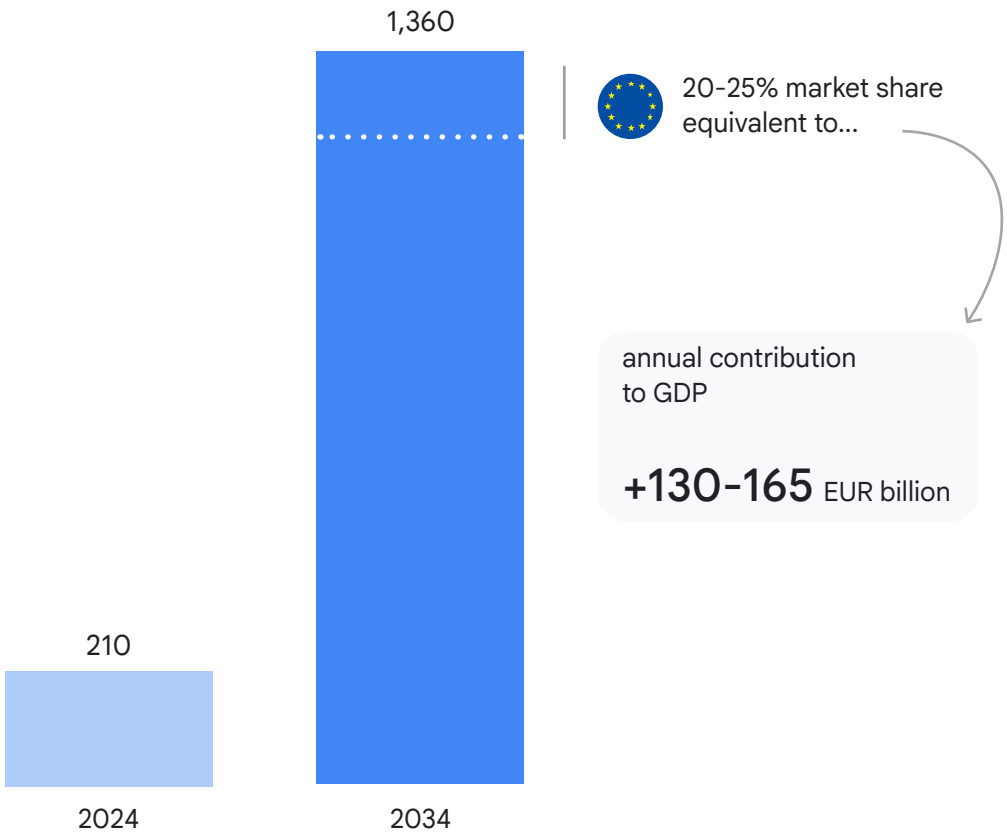
Europe has potential within AI applications, and success can boost GDP by EUR 130-165 billion annually

Global revenue in the AI applications and services segment is projected to reach EUR 1,360 billion by 2034, driven by firms integrating AI into tailored solutions across industries.

The European AI ecosystem and startups are already demonstrating success in leading within narrower verticals by building on top of existing AI infrastructure.

A conservative estimate shows that the resulting growth in Europe's AI applications and services layer could add EUR 130–165 billion to the EU's GDP each year by 2034.

Forecasted global revenue in the AI applications and services segment
EUR billion



Note: EU market shares are estimated according to the EU's share of global software revenue, share of global venture capital investment in AI applications, share of global AI services and share of IT services. Revenue numbers are converted to GVA using the latest available data (2022) for the ratio between value added and net turnover for the EU27's *Computer programming, consultancy and related services sector* from Eurostat. Economic effects are calculated on a Gross Value Added (GVA) basis and then converted to Gross Domestic Product (GDP) using the EU27 GVA-to-GDP ratio from 2024. GDP equals GVA when adding net product taxes.
Source: Implement Economics based on Bloomberg Intelligence, Eurostat, Dealroom, Statista, and the European Commission.

Building on EU strengths in the AI value chain could contribute EUR 200 billion to GDP annually

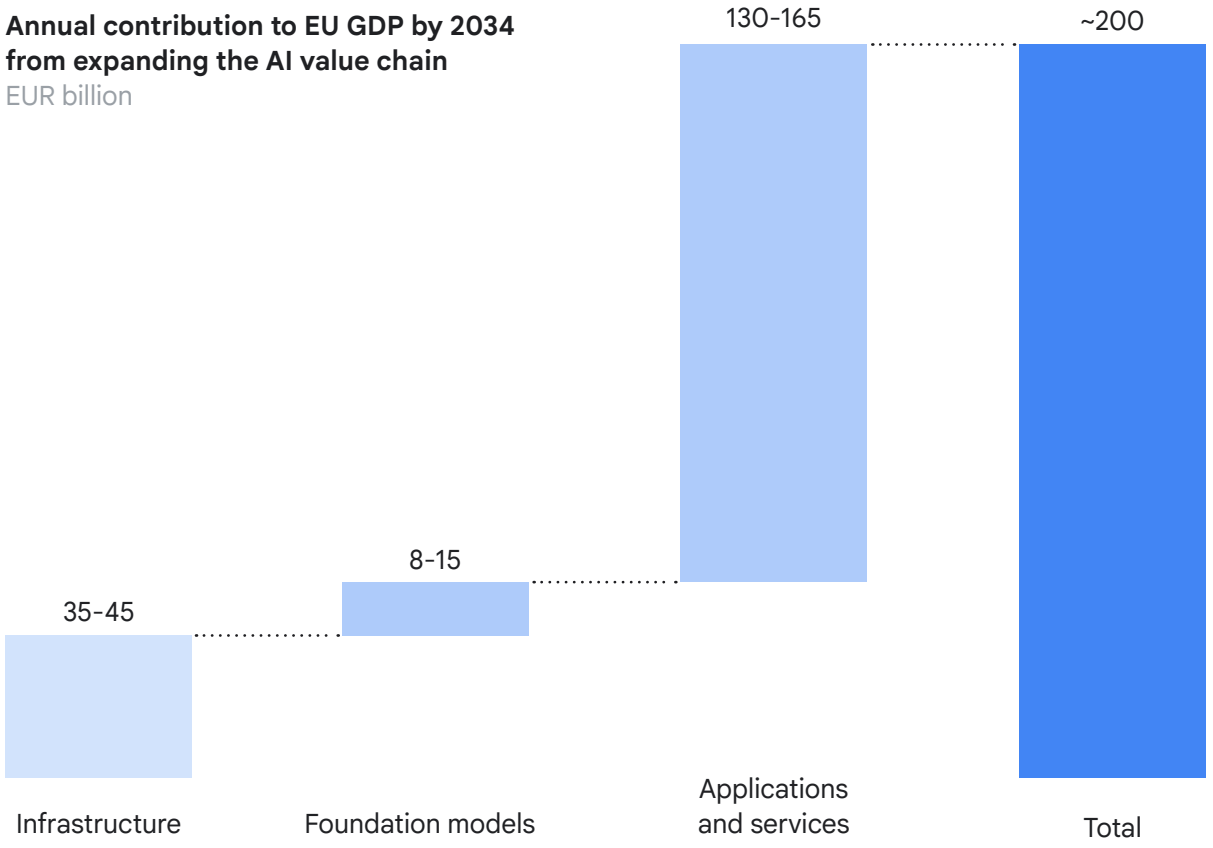
Expanding the AI value chain in the EU could add around EUR 175–225 billion to GDP annually by 2034. This includes the potential from AI infrastructure, AI models, and applications and services, where the greatest potential lies. The modelled GDP potential figure assumes that Europe has access to all available AI providers and the best solutions in an open and competitive market.

Developing these segments can help close Europe's AI innovation gap and strengthen its global competitiveness. A stronger AI value chain will not only drive direct economic value but also accelerate AI adoption across sectors, unlocking broader productivity, innovation, and long-term growth.

This estimate does not fully account for the rapidly evolving field of Agentic AI, which represents a new paradigm where AI systems operate with minimal human intervention. Their ability to set goals, plan, execute complex tasks, and continuously learn and adapt could increase the economic impact of AI.

> *[...] the AI race is far from being over. We're only at the beginning. The frontier is constantly moving. Global leadership is still up for grabs.*
>
> **Ursula von der Leyen**
> at the Artificial Intelligence Action Summit (2025)

Annual contribution to EU GDP by 2034 from expanding the AI value chain
EUR billion



Note: The economic potential for expanding the AI value chain is considered a gross impact because it does not account for the possibility that workers in these expanding industries may have been employed elsewhere. Revenue numbers are converted to GVA using the latest available data (2022) for the ratio between value added and net turnover for the EU27's *Computer programming, consultancy and related services sector* from Eurostat. Economic effects are calculated on a Gross Value Added (GVA) basis, and then converted to Gross Domestic Product (GDP) using the EU27 GVA-to-GDP ratio from 2024. GDP is equivalent to GVA by including net product taxes
Source: Implement Economics based on Bloomberg, Dealroom, Stanford University, Statista, Draghi (2024), Goldman Sachs, European Commission, and Eurostat.

Inventing with AI

AI is the invention of a new method of invention, and Europe has much to gain from this R&D acceleration

> *Scientific breakthroughs enabled by AI could help solve societal challenges and create entirely new industries.*
>
> **OECD on AI Principles**

R&D spending is delivering less innovation than previously as ideas are getting harder to find

Economic growth arises from people creating ideas.

These ideas are typically developed through research and development (R&D) — a process that has driven technological and economic progress for decades.

Even though R&D spending has increased, it is leading to fewer breakthroughs.

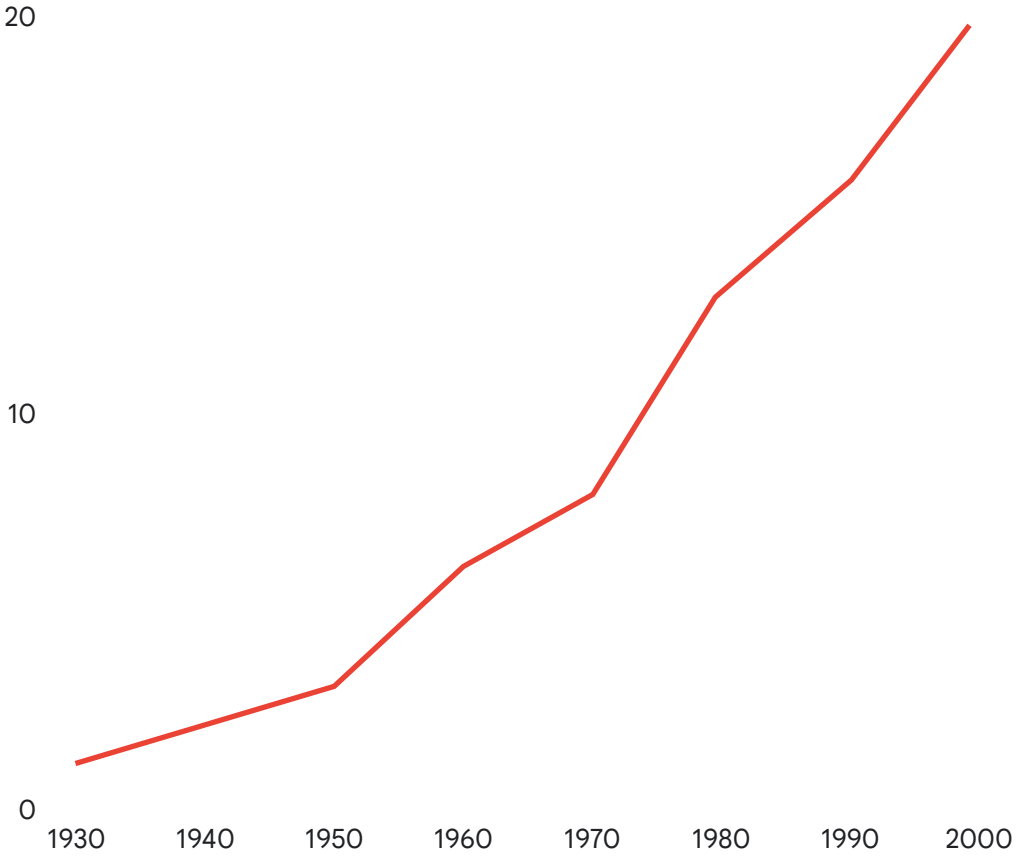
The biopharmaceutical industry provides an example, as drug discovery has become slower and more expensive over time—a phenomenon known as **Eroom's Law**.

While the number of researchers has been rising since 1930, Stanford researchers found that each novel innovation has been harder and more costly to find than in the past. In other words, R&D productivity has declined. OECD studies and Eurostat data confirm this trend in Europe.

More broadly, this once-reliable engine of economic growth has been yielding lower returns.

More and more researchers...

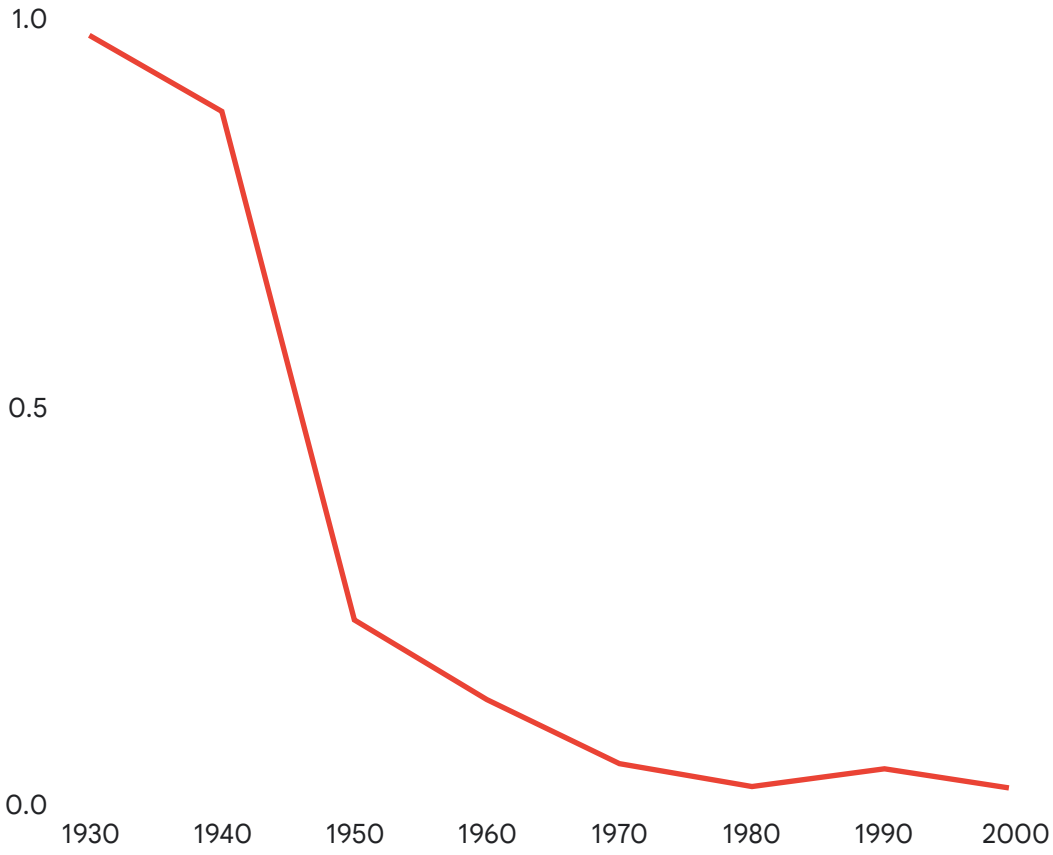
Effective number of researchers, US
Index (1930 = 1)



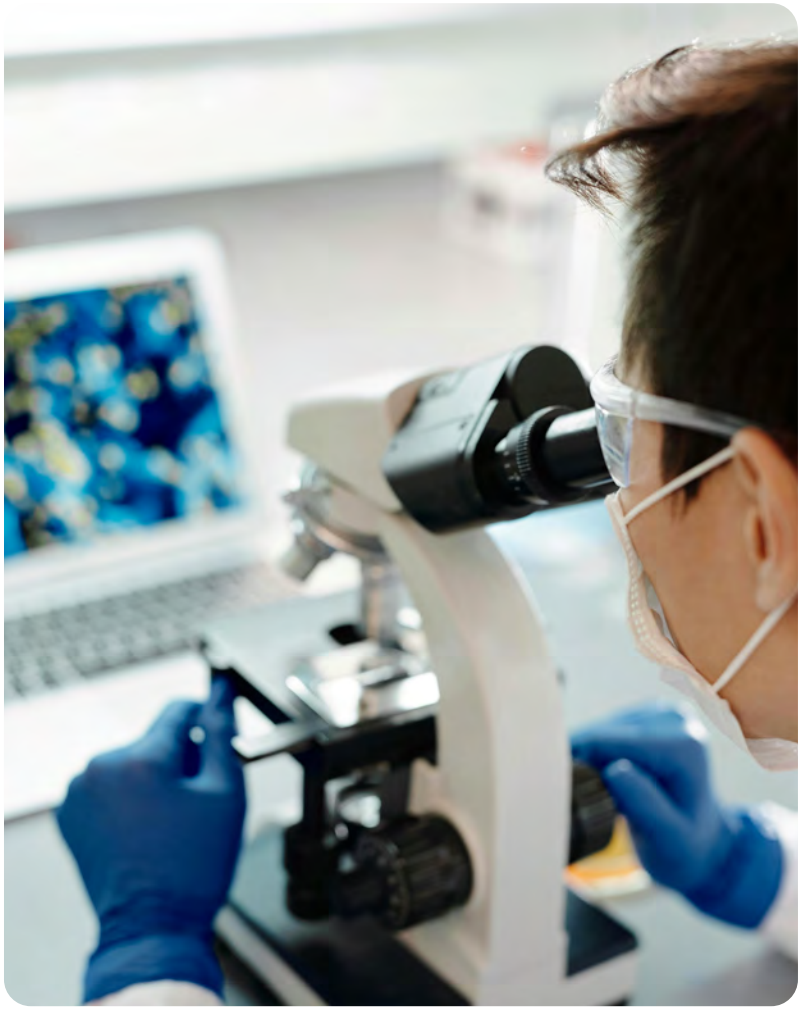
Note: Number of researchers has been normalised to 1 in 1930.
Source: Implement Economics based on the OECD (2023), the EU Industrial R&D Investment Scoreboard, Bloom et al. (2020), and European Federation of Pharmaceutical Industries and Associations (EFPIA).

...are producing less and less innovation per dollar spent

Research productivity, US
Index (1930 = 1)



Note: Research productivity is the ratio of idea output, measured as TFP growth, to the effective number of researchers. Research productivity has been normalised to 1 in 1930.
Source: Implement Economics based on Bloom et al. (2020).



Europe's R&D faces a dual challenge: a global slowdown and weaker returns at home

Besides a global slowdown in R&D productivity, the EU faces a particular struggle to translate its R&D investments into tangible productivity and innovation gains.

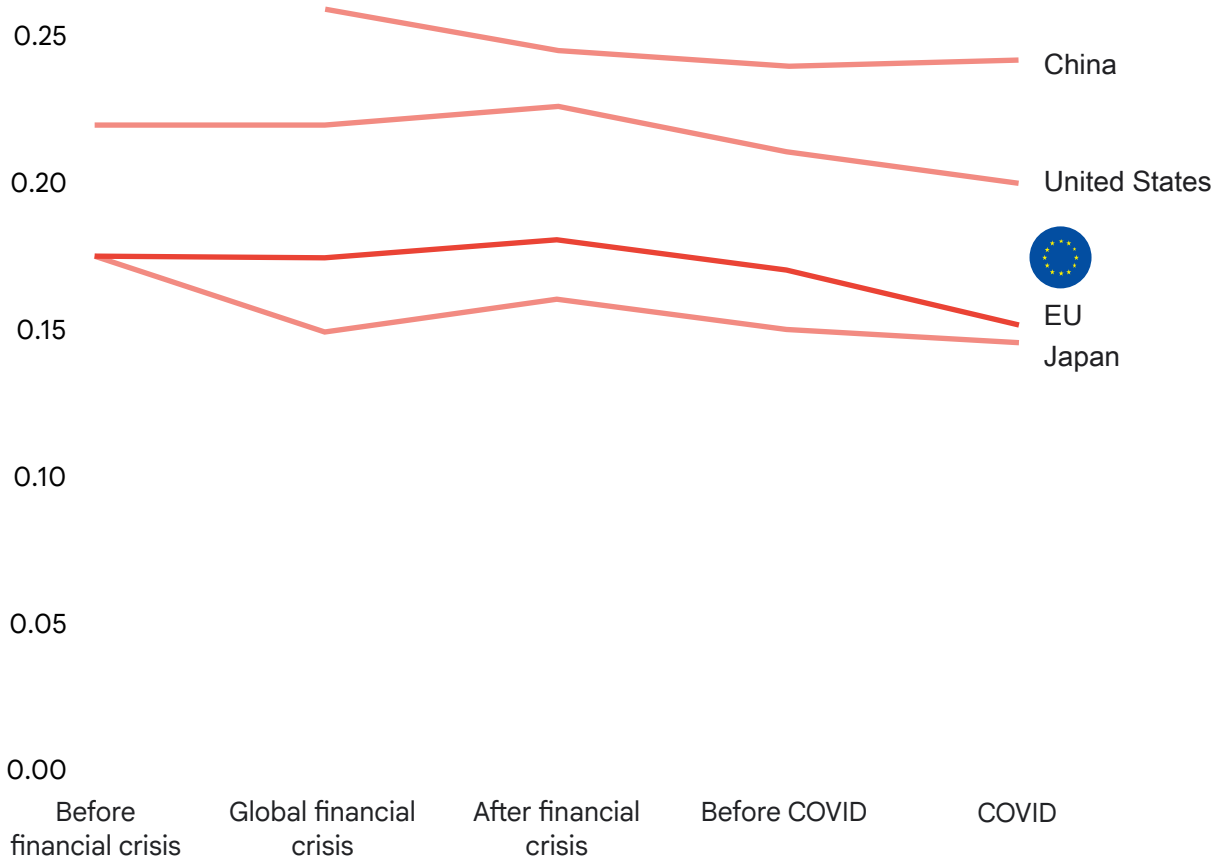
For decades, R&D in China and the US has been significantly more productive than in Europe — achieving higher returns in terms of patents, new products, and productivity improvements. These lower returns place Europe at a competitive disadvantage.

As a result, the EU faces a dual challenge:

1. **A global decline in R&D efficiency**, which means that each euro spent on research yields less innovation than before.

2. **A widening productivity gap compared to leading innovation nations such as China and the US**, putting Europe at risk of falling further behind in global competitiveness and technological leadership.

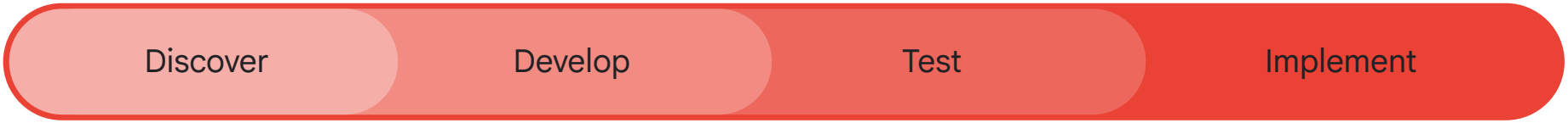
Estimated R&D-to-labour productivity elasticities across regions and time
R&D-to-labour productivity elasticities



Note: The graph can be interpreted as follows: If EU firms had doubled their investment before COVID, they would have got 16% more labour productivity.
Source: Implement Economics based on EU Industrial R&D Investment Scoreboard.

AI can reignite R&D productivity in Europe

Applying AI technologies to the innovation process can lead to scientific breakthroughs and increase innovation productivity. Every stage in the innovation cycle can benefit from AI's capabilities.



How AI can help...				
*More **efficient** R&D...*	Patent landscape analysis Analysing and summarising scientific literature	Predicting and optimising drug candidates	Simulating experiments Predictive quality control Automated anomaly control	Intelligent manufacturing Personalised service deployment Adaptive operational systems
*More **disruptive** R&D...*	Identifying novel biological or chemical pathways Suggesting new research hypotheses	Designing entirely new molecular structures Creating breakthrough drug modalities	Revealing unexpected interactions or effects Suggesting alternative experimental approaches	Developing self-optimising production systems Creating entirely new business and delivery models

Note: There are numerous frameworks for innovation cycles across all of R&D and science. The illustration above is inspired by the stage gate model developed by S. Edgett and R. Cooper and the innovation process at Oslo University and Stanford University.
Source: Implement Economics based on OECD AI Principles, OECD Frascati Manual (2015), Stage Gate, Oslo University, and Stanford University

→ Case

AlphaFold has revolutionised molecular research, accelerating breakthroughs in biology

Improving productivity in pharmaceutical R&D requires leveraging innovations like AlphaFold, which significantly reduces the time and cost of protein analysis

The challenge

Proteins underpin every biological process, in every living thing. Made from long chains of amino acids, each has a unique complex 3D structure. But figuring out just one of these can take several years, and hundreds of thousands of dollars.

The solution

AlphaFold solved this problem, with the ability to predict protein structures in minutes, to a remarkable degree of accuracy. That's helping researchers understand what individual proteins do and how they interact with other molecules.

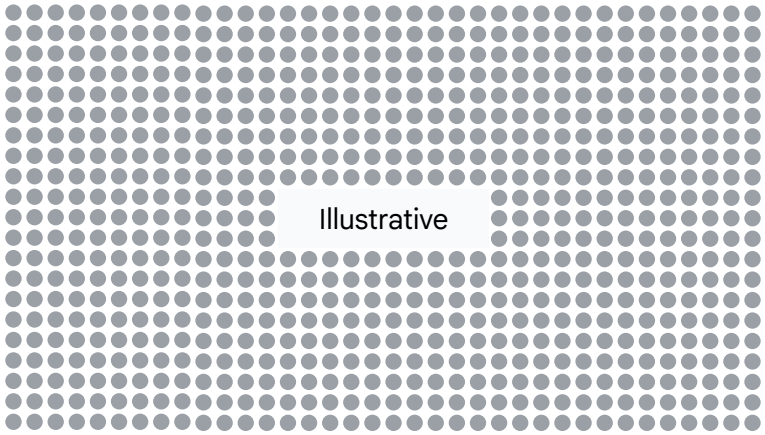
The impact

AlphaFold has predicted over 200 million protein structures – nearly all catalogued proteins known to science. The AlphaFold Protein Structure Database makes this data freely available. So far, it has over two million users in 190 countries. That means it has already potentially saved millions of dollars and hundreds of millions of years in research time. Launched in 2024, AlphaFold 3 further advances the model, now also allowing it to predict the structure of DNA, RNA, ligands, and chemical modifications, while also improving protein interaction predictions by at least 50%.

Protein mapping before and after AlphaFold
Number of days used to map one protein

Before

After

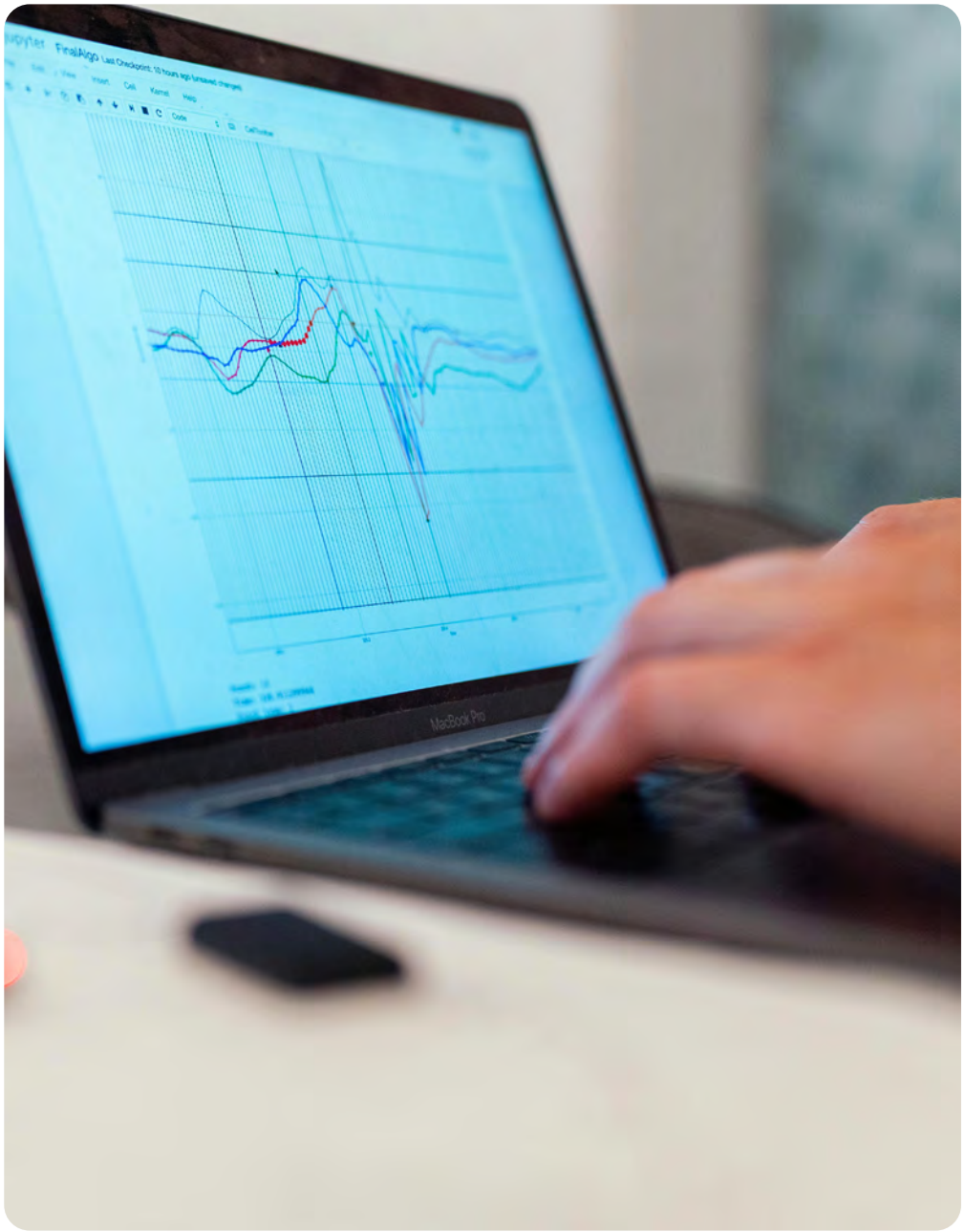


Researchers are using AlphaFold in nearly every field of biology...

Various case studies on the use of AlphaFold...

- Stopping malaria in its tracks
- Racing against drug-resistant bacteria
- Understanding the faulty proteins linked to cancer and autism
- Using AI to spot osteoporosis earlier
- Paving the way for potential Parkinson's treatments

Source: Implement Economics based on Google's AlphaFold.



The pharmaceutical industry is an R&D intensive industry and a major economic driver in Europe, employing over **600,000 people directly** and contributing **EUR 160 billion to GVA** — around 1.5% of total EU GDP. **With value added per employee ~260% higher than the EU average**, it is one of Europe's most productive sectors.

A recent study found that Chinese listed companies using AI for drug discovery have greatly increased the share of innovative drugs in their production.

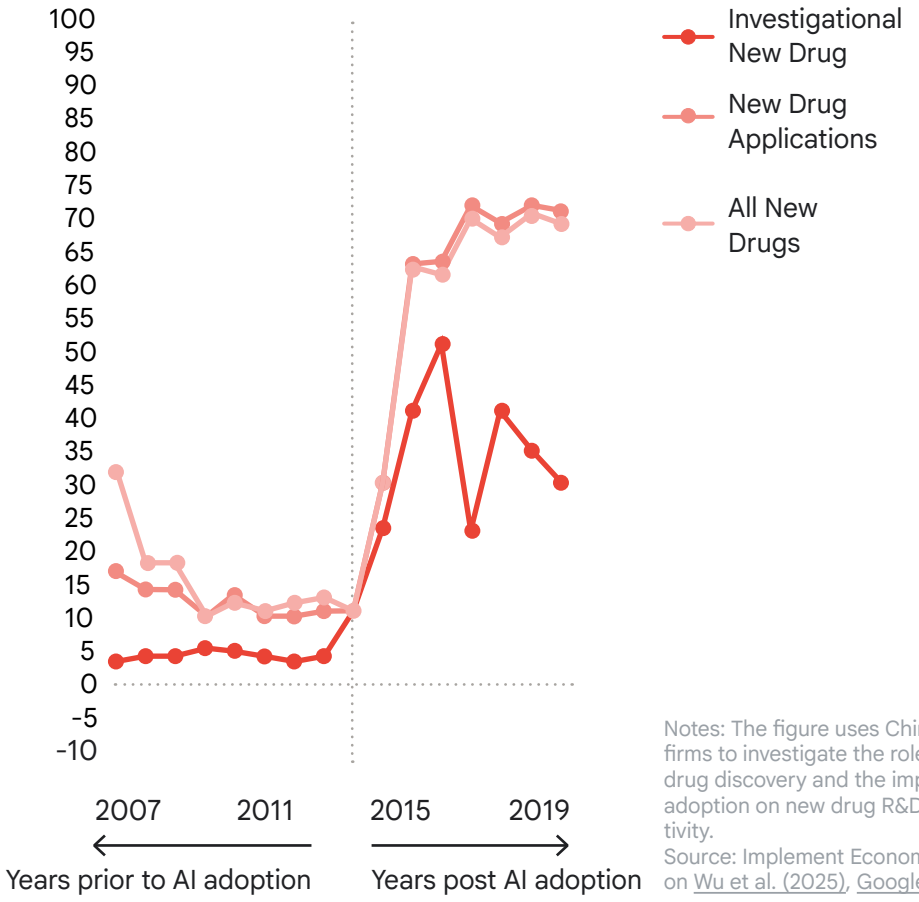
The number of AI-discovered molecules entering clinical trials is rapidly increasing among AI-focused biotech companies worldwide.

AI is accelerating drug discovery—raising the share of innovative drugs from about 10% to 70%

AI adoption increases the share of innovative drugs...

Share of innovative drugs by application type among Chinese firms

%

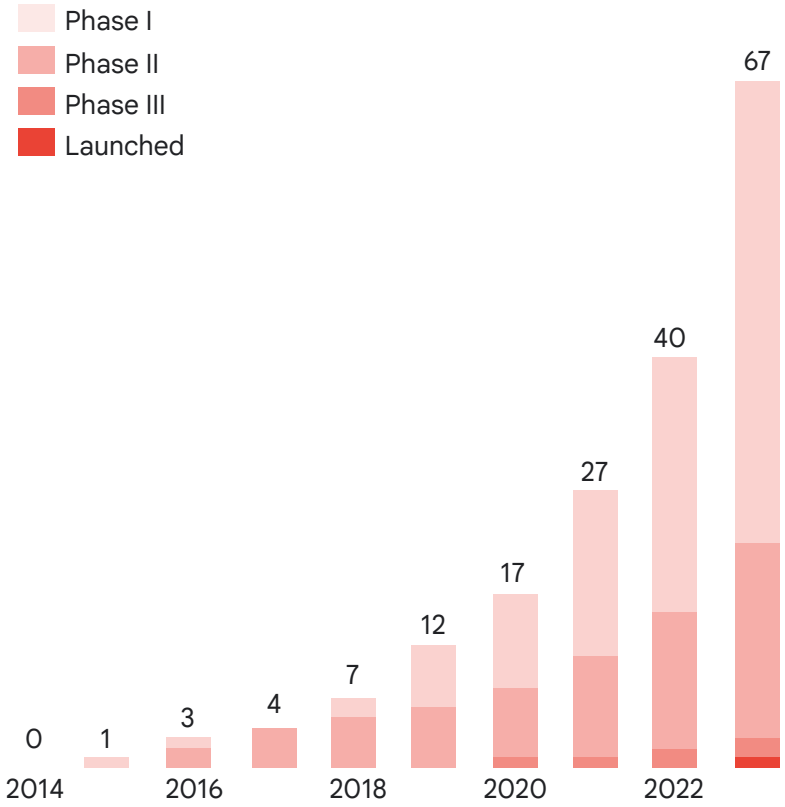


Notes: The figure uses Chinese listed firms to investigate the role of AI in drug discovery and the impact of AI adoption on new drug R&D productivity.
Source: Implement Economics based on Wu et al. (2025), Google, and PwC.

...and AI-discovered molecules are increasingly reaching clinical success

AI-discovered molecules by clinical phase in a sample of global biotech companies

No. of AI-discovered molecules in clinical trials

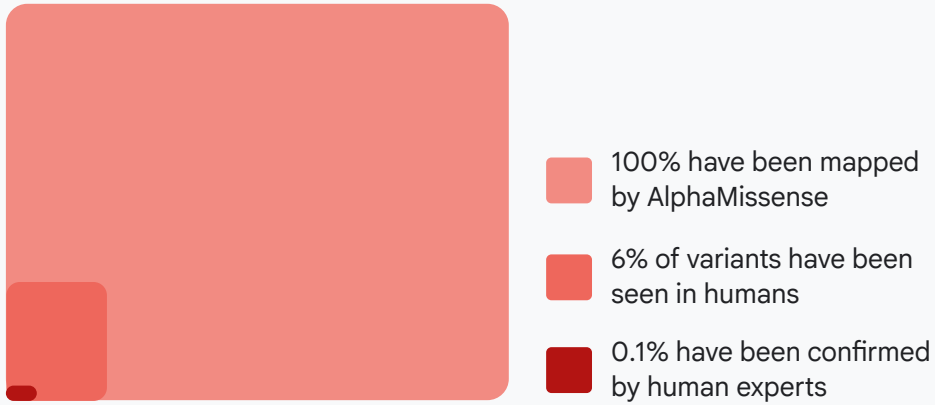


What took us months and years to do, AlphaFold was able to do in a weekend.

Professor John McGeehan,
Former Director for the Centre for Enzyme Innovation (CEI)

Notes: The figure uses publicly available data from a compendium of >100 AI-native Biotech companies. These companies are headquartered in the United States, Europe, China, Japan and Israel among others (see here for supplementary data).
Source: Implement Economics based on Jayatunga et al. (2024).

All possible 71 million human missense variants mapped by AlphaMissense
Share of mapped variants



→ Case

AI has accelerated disease and treatment understanding through classification of all 71 million possible human genetic mutations

The challenge

Uncovering the root causes of disease is one of the greatest challenges in human genetics.

The solution

AlphaMissense applies AI to this vast biological challenge — determining whether genetic mutations are harmful or benign. By modelling both structure and protein language, the system has classified all 71 million possible human missense variants. Of these, **only 6% have ever been observed in humans, and just 0.1% have been verified by experts.**

The impact

AlphaMissense outperforms other computational methods in predicting missense variant effects, enhancing the diagnosis of rare genetic disorders and helping discover new disease-causing genes.

Source: Implement Economics based on Google's Deepmind, and Besiroglu et al. (2023).

Generative AI can boost R&D efficiency by 10-20%, varying by domain and measure

AI has the potential to improve the R&D process by compressing research timelines, revealing previously undetectable patterns in complex European datasets, and empowering Europe's scientists to lead on global grand challenges.

Studies show significant productivity gains from scientific AI, translating into R&D efficiency gains corresponding to 10-15% of overall R&D costs.

Estimated productivity effects from AI in R&D

Study	Estimated effect	Interpretation
Babina et al. (2021)	+18-20%	Increase in sales due to AI adoption through product innovation
Wu et al. (2025)	+13-17%	Increase in innovation output per CNY 1 billion of R&D expenditure
Dell'Acqua (2025)	+13%	Shorter time-to-solution for innovation teams allowed to use AI
McKinsey (2023)	+10-15%	Productivity delivered as percentage of overall R&D costs

Source: Implement Economics based on Google, Babina et al. (2021), Wu et al. (2025), McKinsey (2023), and Dell'Acqua et al. (2025).

72%

of 21,000 people in a global Ipsos and Google survey, expect AI to have a positive impact on science

Besides increasing efficiency, AI can double the quality of innovation

AI can significantly **boost the quality and disruptive potential** of innovations.

A recent study shows that teams using AI were **three times more likely to develop top-decile solutions** compared to those without AI (15% vs. 5.8%). This suggests that AI not only improves efficiency but also increases the likelihood of breakthrough, high-impact outcomes.

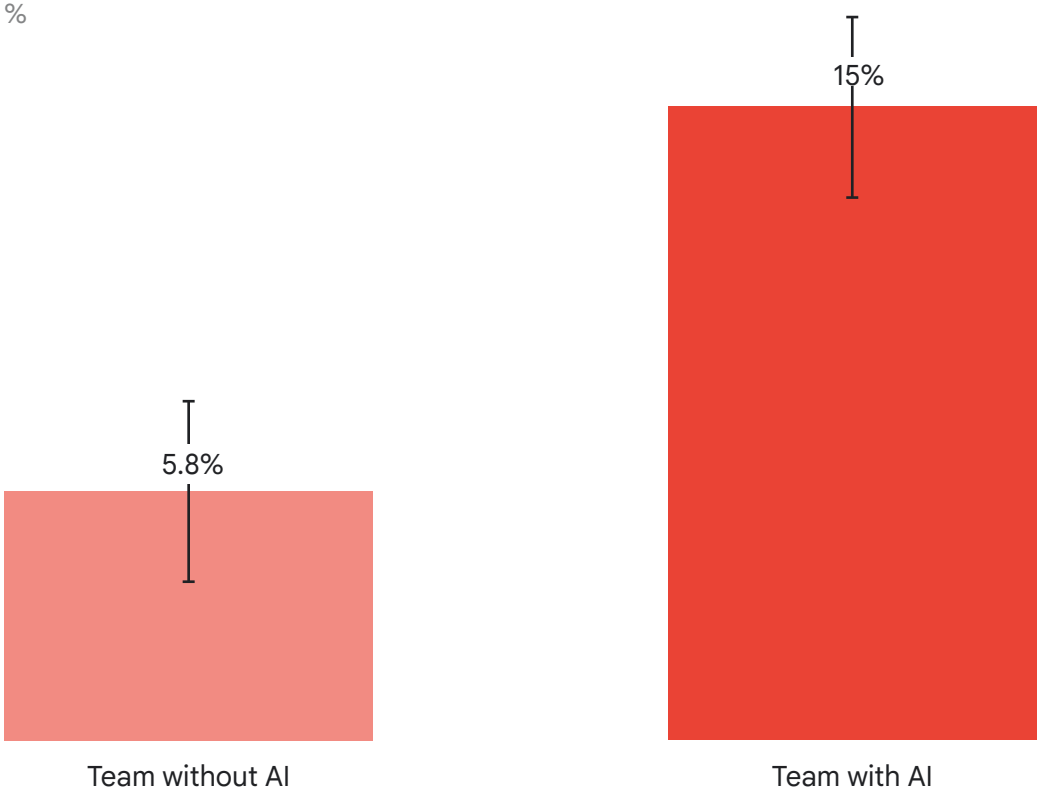
Another recent study on patent quality shows similar results, finding that patents citing AI publications are about twice as likely to be influential (cited ~2x more) and novel.

The following page assesses the potential economic impact of AI on R&D using published studies — though this likely understates AI's role as a catalyst for a new era of invention.

> *AI breaks down functional silos. Professionals using AI produced balanced solutions, regardless of their professional background.*
>
> **Dell'Acqua et al. (2025)**

Probability of being rated top 10% quality

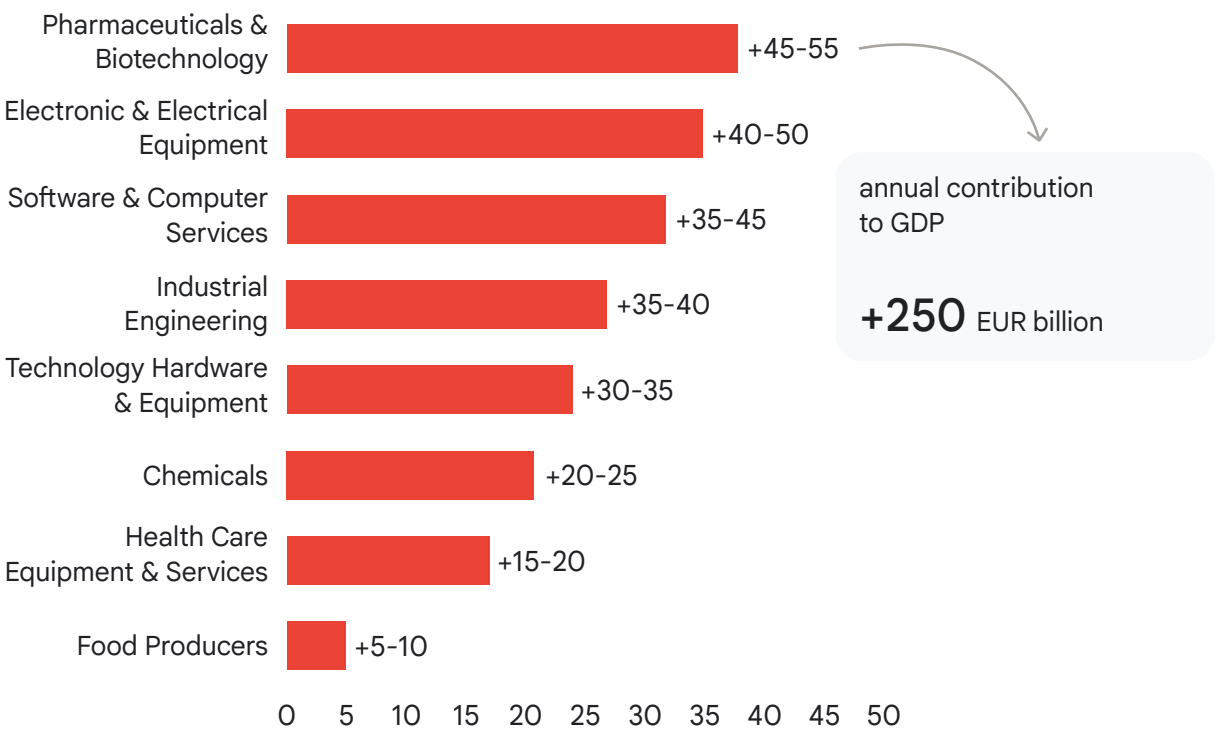
%



Note: Treatment group estimates are relative to a single person working without AI (control group). Estimates on time reduction are significant at the 5% level. Individuals with AI were 16% faster than the control group. Research was conducted in an experiment where innovation teams were allocated assistance by AI technologies using randomisation. The set-up allows for causal interpretations of estimated effects.
Source: Implement Economics based on Dell'Acqua et al. (2025), and Bergeaud (2025, not yet published).

AI can significantly increase the efficiency of R&D processes potentially adding EUR 250 billion to EU GDP

Annual contribution to EU GDP by 2034 from AI's boost to R&D proces
EUR billion



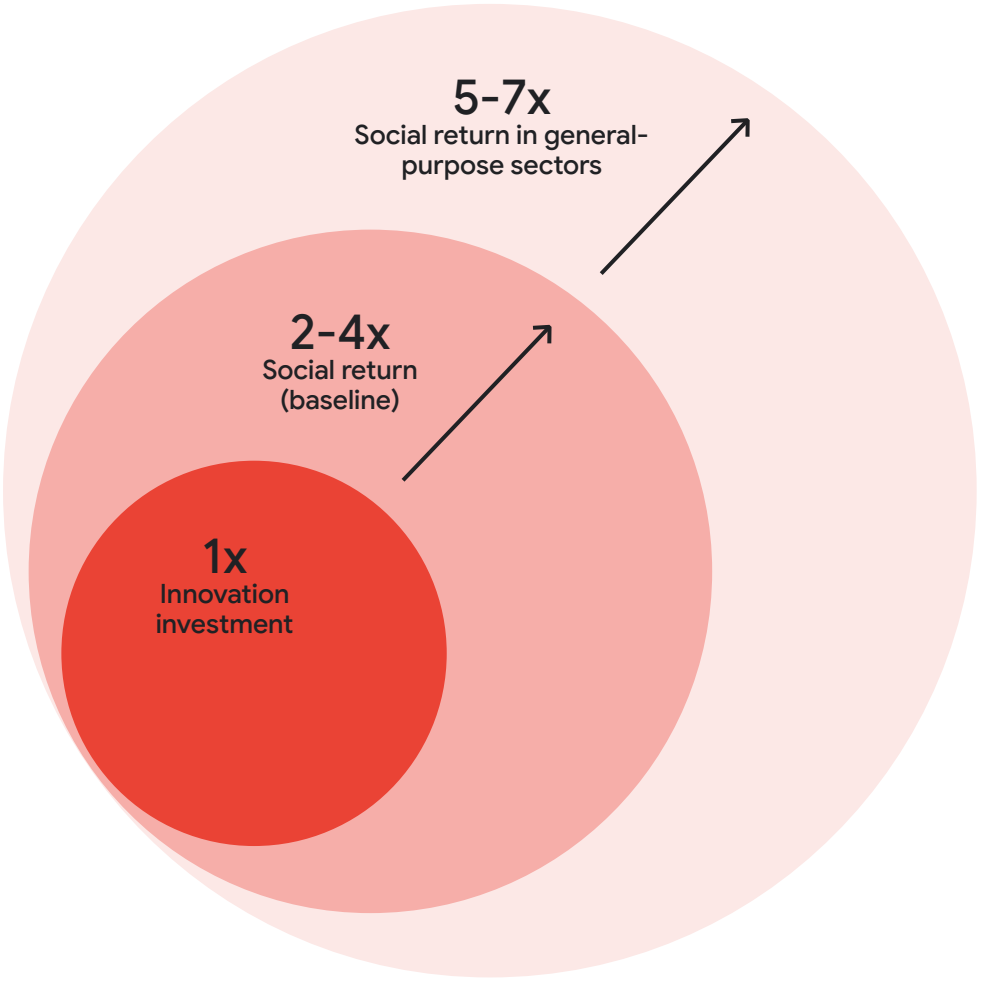
If AI can improve the efficiency of knowledge-based R&D investments by 10–15% — as several studies suggest, particularly in sectors with intensive research processes such as pharmaceuticals, chemicals, and advanced manufacturing — the EU could achieve substantial economic gains. We estimate that widespread AI adoption in R&D across these sectors could boost GDP by up to EUR 250 billion annually by 2034.

Importantly, this estimate only captures private gains at the firm-level and does not account for the substantial positive spillover effects on the broader economy, which are exceptionally large for early-stage technologies due to imitation and recombination benefits.

> *[...] since product development involves lengthy experimentation with uncertain benefits, the ability of AI algorithms to quickly learn from large datasets can [...] make the process of learning about promising projects more efficient.*
>
> **Babina et al. (2024)**

Note: Firm-level productivity gains are estimated based on the top 800 companies in Europe (in terms of R&D expenditure) using company profits and labour remuneration from the sectoral averages through Eurostat. Productivity gains are then applied to relevant sector aggregates to reflect the entire EU economy. Firm-level effects do not take into account the large spillover effects from R&D investments. Thus, the aggregate effects from AI in R&D are likely significantly larger. Relevant sectors are drawn from McKinsey (2023) and Babina et al. (2021). R&D efficiency gains are based on annual R&D spending and firm-level GVA, with value added effects calculated using R&D-to-productivity elasticities that vary by each sector's tech intensity. Economic effects are calculated on a Gross Value Added (GVA) basis and then converted to Gross Domestic Product (GDP) using the EU27 GVA-to-GDP ratio from 2024. GDP equals GVA when adding net product taxes.
Source: Implement Economics based on McKinsey, Eurostat, Kumbhakar et al. (2011), the EU industrial R&D investment scoreboard, and the EU innovation scoreboard.

Estimated social return on innovation investment



Note: Empirical studies estimate social returns on R&D investments to range from around x2 at the lower bound to up to x32 at the upper bound, depending on the social discount rate applied. Discount rates vary across countries, from 3.5% in the U.K. to 7% in the U.S., with the latter implying a return of 13.3 per unit of R&D investment. Returns are especially high for general-purpose technologies, which generate cross-sector spillovers. Against this backdrop, a return of x7 can be considered a conservative estimate.
Source: Implement Economics based on Jones & Summers (2020), and other studies that find similar results, including Bloom, Schankerman & Van Reenen (2013), Hall, Mairesse & Mohnen (2010), Bresnahan et al. (1995), Brynjolfsson et al. (2019), and IMF (2021).

The wider social return from these R&D productivity enhancements is many multiples of the innovation investment

Private firms can only capture part of the financial returns from R&D investments, as innovation generates **large spillover effects** to other firms, sectors, and society at large.

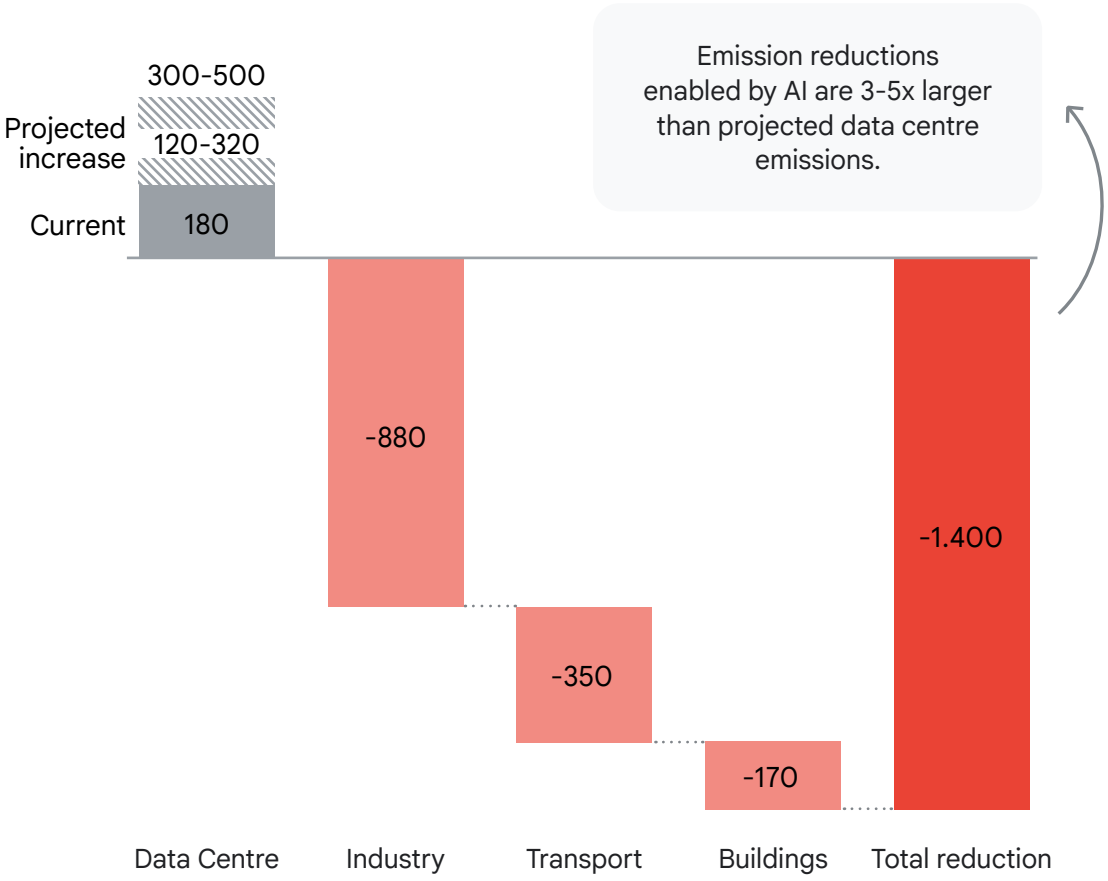
Empirical studies consistently estimate that the social return from R&D is at least double the private return, and may reach five to seven times in sectors characterised by general-purpose technologies like AI.

This suggests that the broader economic impact of **AI-induced R&D efficiency could be two to seven times larger than the direct firm-level gains identified in this report.**

> *Even under conservative assumptions, it is difficult to find an average return below $4 per $1 spent.*
>
> **Jones & Summers (2020)**

AI can speed up climate research and is expected to enable savings in other sectors 3-5x larger than its own emission by 2035

Global direct and indirect emission changes in a widespread AI adoption scenario, 2035
Million tons CO_2



Existing AI applications alone can unlock major efficiency and operational gains that could reduce global CO_2 emissions by 1,400Mt by 2035, according to IEA, which is 3-5x more than the projected total data centre emissions. Google is already contributing to this potential by enabling 26 million tons of emissions reductions in 2024 through five AI-powered tools, including Google Earth Pro, and fuel-efficient routing in Google Maps.

Using AI to mitigate and adapt to climate change could hold significant potential through:

- → **Information:** AI tools can analyse vast datasets, providing valuable insights that help inform decisions. For example, AI can help identify investment opportunities in clean energy and energy efficiency.
- → **Prediction:** AI tools can significantly improve climate forecasting models, enabling better preparation for extreme weather events and derisking investments.
- → **Optimisation:** AI tools can optimise to find incremental gains across complex systems like energy grids, logistics networks and industrial processes, leading to substantial cost savings and reductions in GHG emissions.

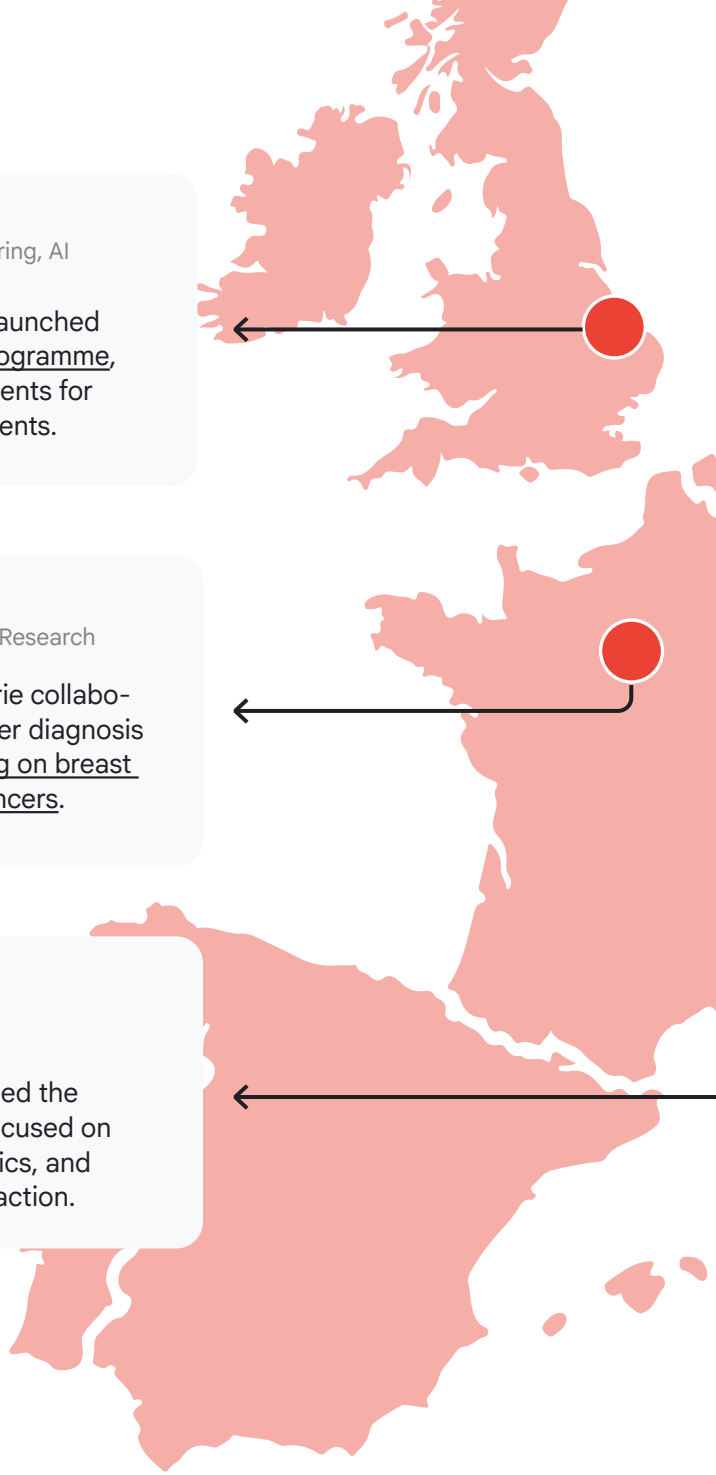
AI is a strategic enabler in climate R&D as it reduces the time and cost of innovation and unlocks new materials and models critical for decarbonisation.

Note: Respondents all have decision-making authority over climate or AI topics in their organisations.
Source: Implement Economics based on IEA, Google, and Verendel (2022).

Google is a leading contributor to AI research, having published over 2,700 research papers in the past three years. In 2023 and 2024 alone, Alphabet, Google's parent company, has invested around USD 95 billion in R&D worldwide. This research has driven many key advancements in the field, with over 30% of the top 100 most cited AI publications authored by the company's researchers. Additionally, Google has also contributed to up-skilling of the general public through Grow with Google, which has helped over 12 million people across Europe gain key digital skills since 2015.

→ Case

Google is a major contributor to AI research, and partnerships with universities help spread productivity-enhancing technologies to researchers



United Kingdom
Royal Academy of Engineering, AI Equity

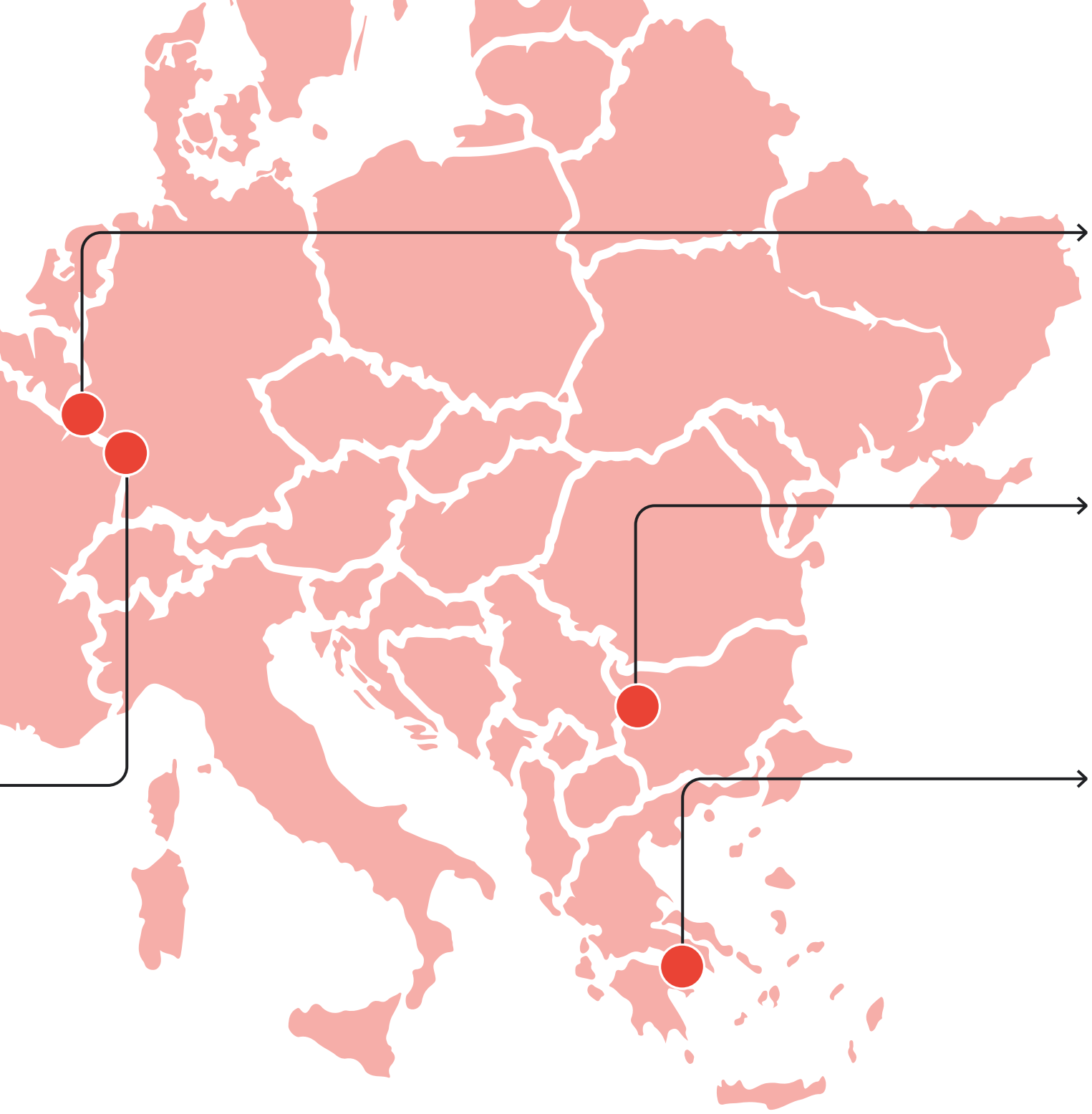
Google DeepMind co-launched the Research Ready programme, offering paid AI placements for underrepresented students.

France
Institut Curie, AI in Cancer Research

Google and Institut Curie collaborate to apply AI in cancer diagnosis and treatment, focusing on breast and gynaecological cancers.

Germany
MPI for Informatics, Visual Computing & AI

Google and MPI launched the VIA Research Centre focused on computer vision, graphics, and human-computer interaction.



Luxembourg
University of Luxembourg, AI and Cybersecurity

Google partners with the university's SnT centre to launch a Centre of Excellence in AI and cybersecurity.

Bulgaria
INSAIT, AI Institute Development

Google supports INSAIT in Sofia to become Eastern Europe's first world-class AI and computer science research centre, recently expanding its funding.

Greece
NKUA, AI Education

Google and NKUA signed a MoU to expand digital skills education in AI, ML, and cybersecurity for students and researchers.

Source: Implement Economics based on Google and press releases from the universities

Part 4

Commercialising AI

Europe needs to grow innovative digital businesses to drive the innovation and diffusion of AI

> *[...] productivity growth is the result of a combination of two forces: disruptive innovation brought about by new, dynamic startups challenging incumbents; and efficiency gains in mature traditional industries applying these innovations.*
>
> **The EU Commission** in A Competitiveness Compass for the EU

AI is becoming a core building block of modern startup business models

Startups are increasingly founded on AI technologies, reflecting both the growing entrepreneurial confidence in AI and its expanding role in driving innovation. Data from Y Combinator, a leading global startup accelerator, shows a rapid rise in AI-based startups in recent years.

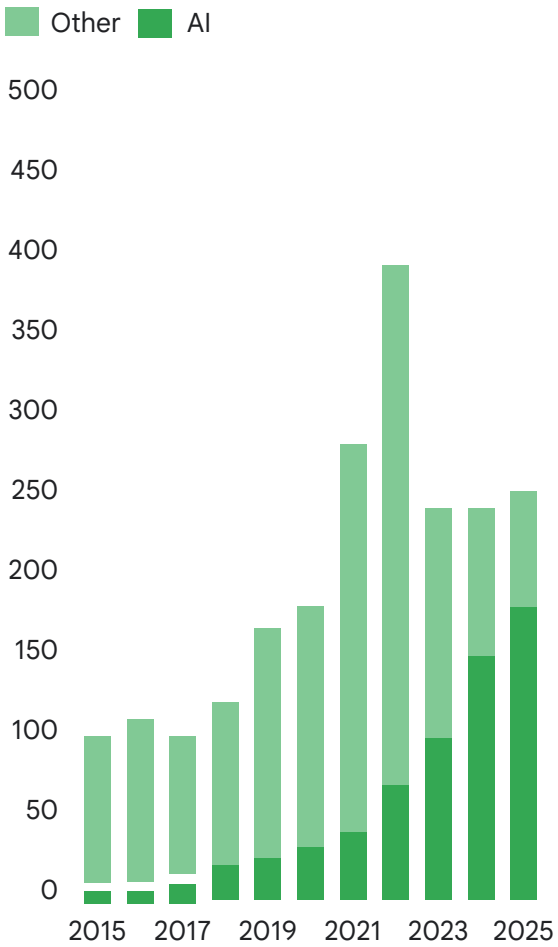
This global trend is visible in Europe, **where 79% of innovative digital businesses (IDBs) are already using generative AI, going beyond adoption to adapt and develop it for business needs.** IDBs are defined as young firms with scalable business models and high growth potential that are either digital at their core or heavily enabled by technology. Classified as startups (2–50 employees), scaleups (51–500), or grownups (500+), they act as early adopters, active experimenters, and key contributors to the AI ecosystem.

A recent AI report co-funded by the EU shows that AI startups can outperform competitors when they combine technical expertise with deep sector knowledge, for example in healthcare or manufacturing. This underlines the critical role of Europe's IDBs in advancing both the development and diffusion of AI.

Google contributes to accelerating European startups by providing capital, expertise, and networks. Since opening in 2014, Google Ventures has invested over USD 500 million in 40 European startups. Further, Google for Startups has helped startups worldwide raise more than USD 8 billion and create over 54,000 jobs, with two of its six dedicated campuses located in the EU, in Madrid and Warsaw.

Startups in Y Combinator by field globally

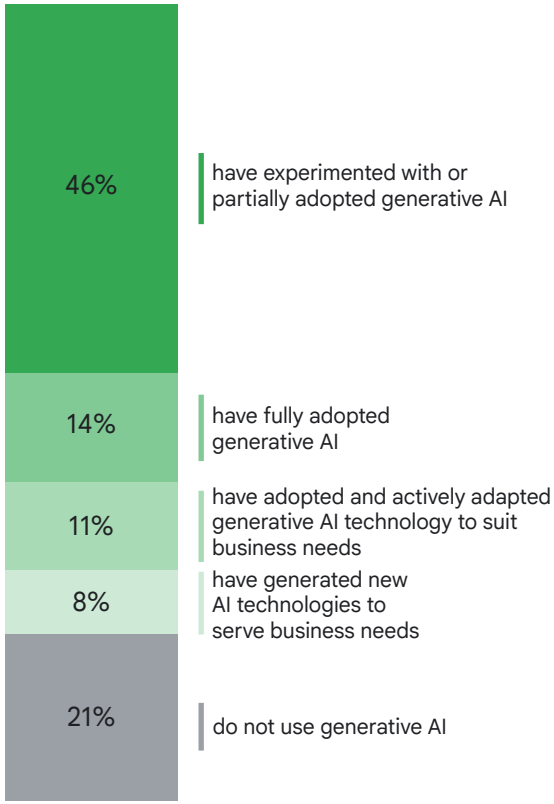
Number of startups



Use of generative AI in European IDBs

% of respondents

79% of European innovative digital businesses use generative AI



Note: Y Combinator is an accelerator programme providing a public list of all Y Combinator-backed companies. Y Combinator data includes all startups accepted into its accelerator programme, encompassing both US and international companies, with approximately 70% based in the US. The number of startups is reviewed as per winter in the year noted on the x-axis. Sample size of n=1095 in Europe for Notion Capital survey.
Source: Implement Economics based on the Notion Capital survey (2024), Y Combinator, JPMorgan, and Eloundou et al. (2024).

Innovative digital businesses play a central role in developing applications that tackle business challenges

To unlock the full potential of AI, the EU needs application layer solutions that meet real needs across both the public and private sectors.

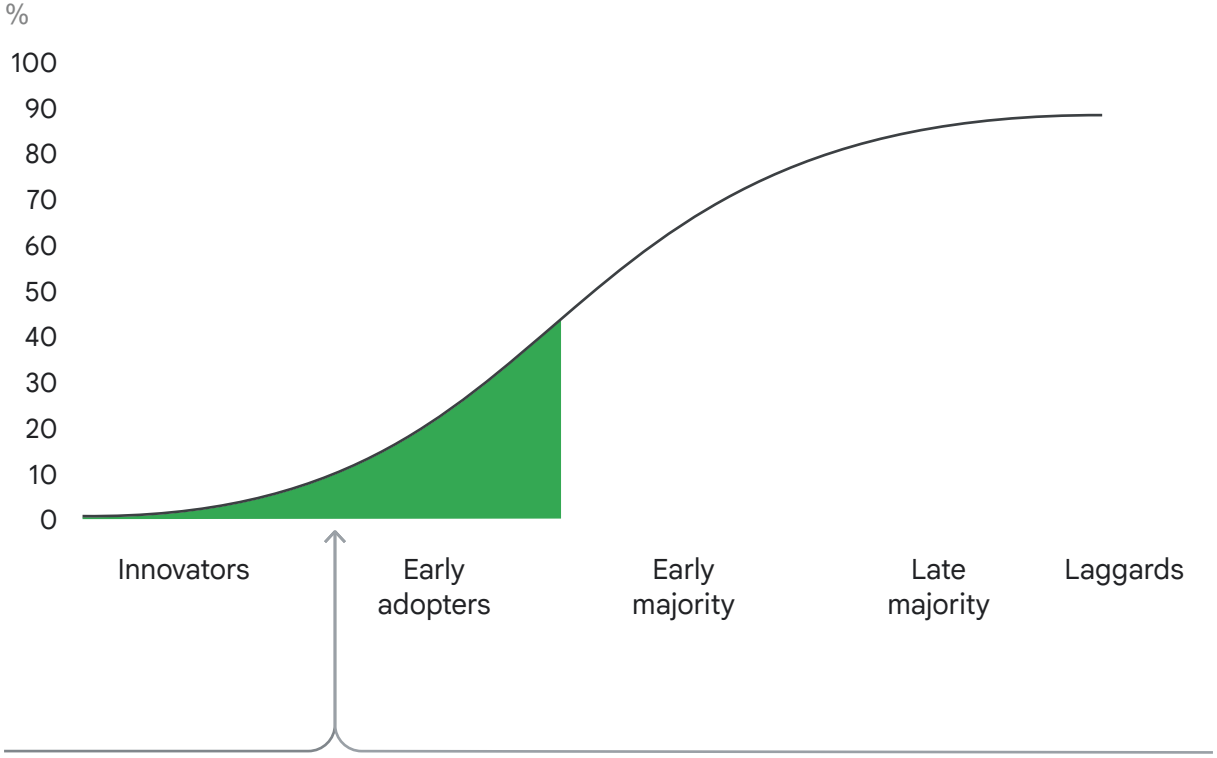
While companies of all sizes and types can tap into this rapidly growing opportunity, innovative digital businesses are particularly important because they can:

- → Develop new AI tools and applications
- → Enable businesses across all sectors to adapt and benefit from AI
- → Demonstrate AI's value by being early adopters and innovators
- → Inspire smart AI usage in other businesses
- → Create competitive pressure on slower adopters

These firms amplify the opportunity by sparking broader uptake of AI applications throughout the economy.

Companies such as Synthesia (AI video), ElevenLabs (voice AI), Lovable (AI coding), and n8n (workflow automation) are already demonstrating European startup success, leading in their respective verticals by building on top of existing AI infrastructure. For example, Lovable allows users without coding experience to create fully functional applications, and has become the fastest growing startup in the world to go from USD 1 million to USD 100 million in annual recurring revenue in just 8 months.

Diffusion of AI technologies in Europe



Mistral AI

...is a leading European AI startup developing open-weight LLMs and foundational AI systems.

H Company

...is a Paris-based startup building next-generation AI models for general purpose applications.

DataSnipper

...builds an intelligent audit platform integrated into Excel, automating repetitive audit and analysis using AI.

Note: The figure shows generative AI adoption expressed as a share of economy-wide firms exposed to AI automation.
Source: Implement Economics based on Bruegel (2021).

Commercialising AI is expected to drive 30-40% of the innovation potential

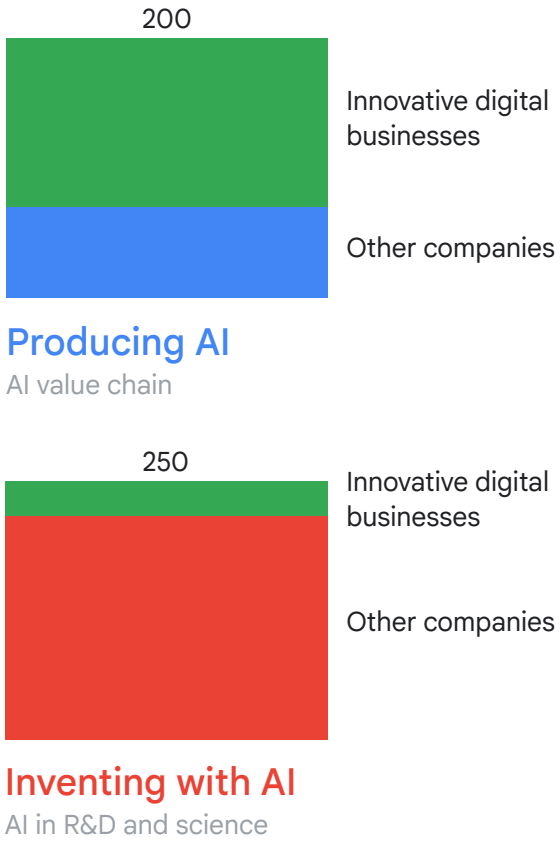
Innovative digital businesses (IDBs) are central to realising Europe's AI innovation potential, particularly within AI production. Their contribution varies across the two AI innovation potentials:

- **Producing AI:** Innovative digital businesses are expected to play a very important role in expanding the AI value chain in Europe, especially within AI applications and services, where Europe has strong innovation and attracts funding. We assess that 60–70% of the value chain expansion can be driven by innovative digital businesses.

- **Inventing with AI:** Innovative digital businesses will also contribute to the potential of inventing more with AI in Europe. In Europe, 80% of R&D spending occurs in large corporations. Yet, innovative digital businesses play a pivotal role in transforming research. They develop AI-native discovery methods and tools that boost R&D productivity across the economy, including in established sectors. We assess that 10–15% of AI invention potential will be captured by innovative digital businesses.

Combined, we estimate that innovative digital businesses will be key to the AI innovation potential in Europe, and their commercialisation of AI will drive **30–40%** of the AI innovation potential.

EU GDP potential in 2034
EUR billion



The AI value chain expansion consists of three segments

- **AI infrastructure:** IDBs play a relatively small role in this capital-intensive layer, which is led by established hyperscalers and semiconductor giants. IDBs contribute with novel hardware and optimisation software.
- **Foundation models:** IDBs such as Mistral AI and Aleph Alpha are key players, and European IDBs are expected to play a large role in this segment, e.g., with open-source and/or specialised AI models.
- **AI applications and services:** IDBs are expected to dominate in this segment. They are expected to create the vast majority of new AI-powered applications and industry-specific solutions for the European economy.

Note: The estimation of the distribution of innovative digital businesses across different parts of the potential is based on market share data, survey results, and industry studies. The future composition of innovative digital businesses in these domains is naturally subject to uncertainty.
Source: Implement Economics based on synergy, European Economic and Social Committee, State of European Tech Survey, Nasdaq (2023), Vellum (2025), European Commission, European Innovation Scoreboard 2023, Windsor (2024) using Dealroom data, and Orbis data.

Successful innovative digital businesses are not only key for accelerating AI diffusion, they are also 130% more productive than European firms on average

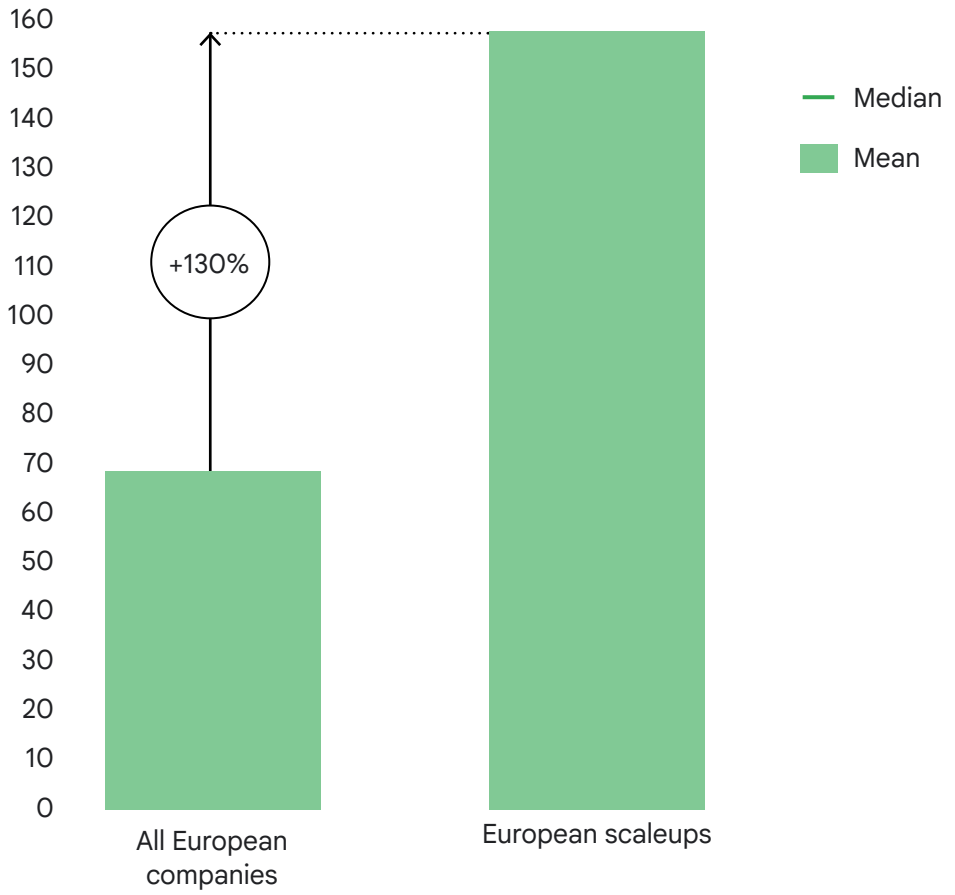
European innovative digital businesses are not only key to innovation and diffusion of AI in the broader economy; they also add significant direct economic value through higher productivity.

Innovative digital businesses that successfully scale have an outsized contribution to the economy by being significantly more productive than average European firms.

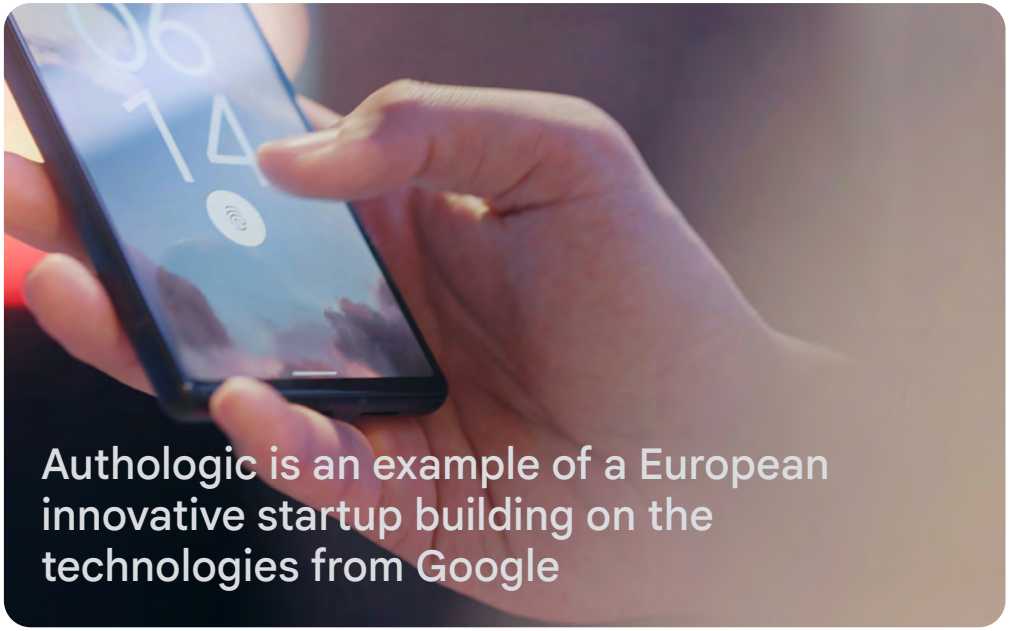
A recent study by the European Investment Bank (EIB) finds that scaleups are around 130% more productive than European companies on average. The EIB defines scaleups as high-growth firms that have reached valuation of between USD 500 million and USD 10 billion, and the study is based on a large sample and a long observation period, which makes the results robust.

> *European startups and scaleups are strategic drivers of the EU's competitiveness. [...] accelerating innovation, creativity and sustainable growth.*
>
> **The European Commission** in the EU Startup and Scaleup Strategy

Labour productivity in the EU: Scaleups vs. other companies
Value added per employee, EUR thousand



Note: The EIB study relies on deal-level data from PitchBook and follows cohorts of European companies that reached scale-up status between 2013 and 2023. The economic potential shown on page 90 of this report uses Dealroom data and defines scaling success based on company size by employment count. Both PitchBook and Dealroom data identify the same group of high-growth firms.
Source: Implement Economics based on EIB and The AI innovation opportunity in Sweden, Denmark, Finland, Norway, Lithuania, Belgium, the Netherlands, and Ireland.



Authologic is an example of a European innovative startup building on the technologies from Google

→ Case

Cybersecurity startup Authologic is building a global e-ID Hub using AI with support from Google for Startups

The challenge

Verifying digital identity globally remains complex and fragmented, making it difficult for users to access services securely and easily across borders.

The solution

Authologic is building a global e-ID Hub and making identity easy and safe to use everywhere in the age of AI. Leveraging Google Workspace and Google Cloud Platform for expansion and compliance, Authologic automates identity processes to improve security and user experience. The company has also started testing Gemini to support its marketing operations.

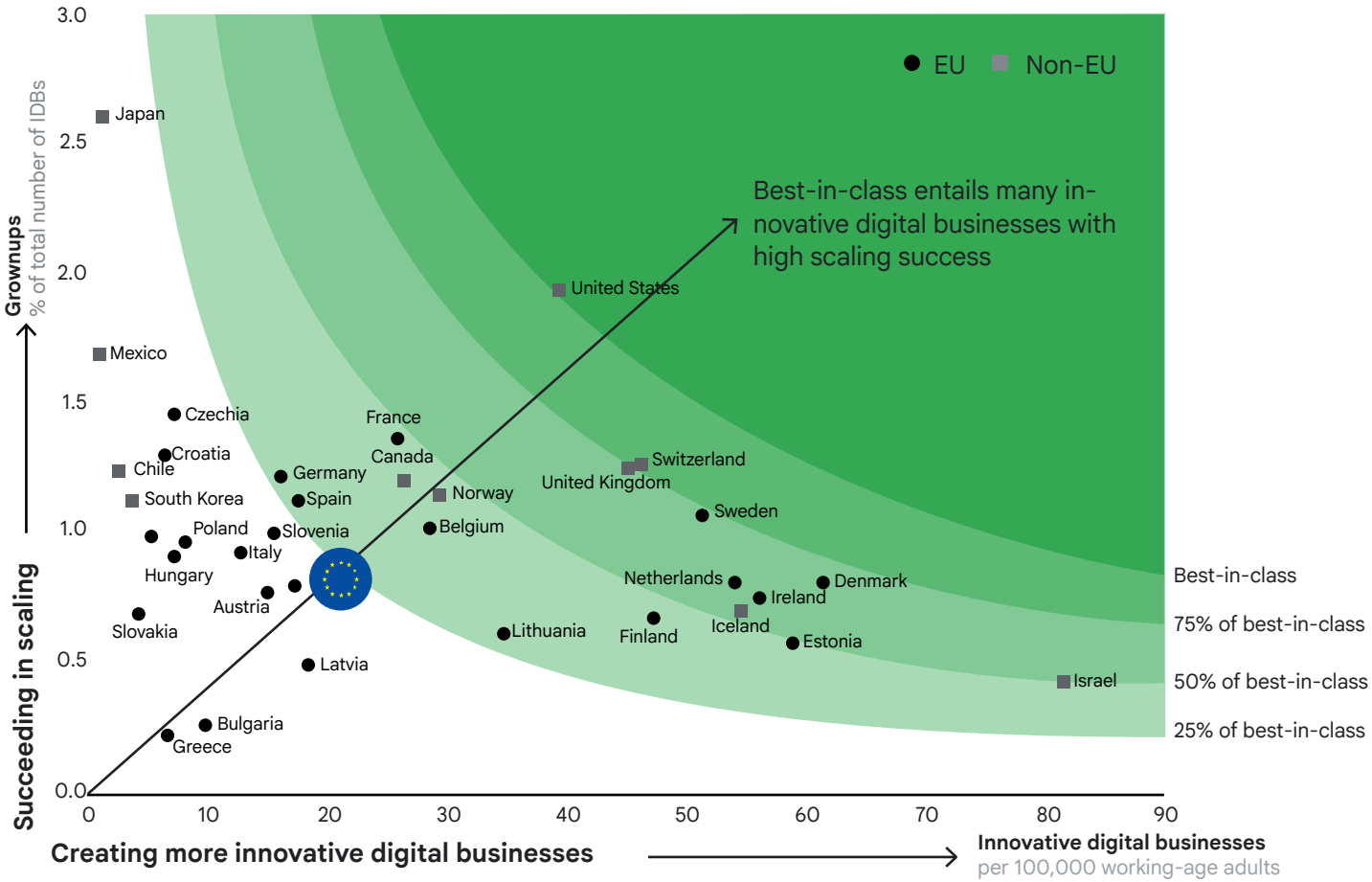
The impact

Authologic has built a global e-ID Hub accessible through one API, integrating government-issued digital IDs, identity wallets, and Bank IDs. Authologic aims to create a seamless and universally accepted platform for digital identity verification.

Source: Implement Economics based on Google.

Europe needs more and better innovative digital businesses to be on a par with the best

Europe is lagging behind OECD leaders in scaling success and the concentration of innovative digital firms



> *The core problem in Europe is that new companies with new technologies are not rising in our economy.*
>
> **Mario Draghi**
> in The future of European competitiveness

Innovative digital businesses are AI accelerators, turning AI models into real-world solutions.

The EU has fewer such businesses compared to leading OECD countries and even fewer manage to scale into grownups, risking slower deployment and a weaker collective AI potential. Eastern and Southern Europe generally lag a bit more behind, whereas many Northern European countries have demonstrated greater success in fostering innovative digital businesses.

Bridging this gap can unlock a large part of the growth potential in AI applications and services.

Note: Grownups are defined as established innovative digital businesses that have successfully scaled and employ more than 500 people.
Source: Implement Economics based on Dealroom, Eurostat, McKinsey, and EIB.

Scaling more innovative digital businesses is crucial for European competitiveness and could boost GDP by EUR 500 billion

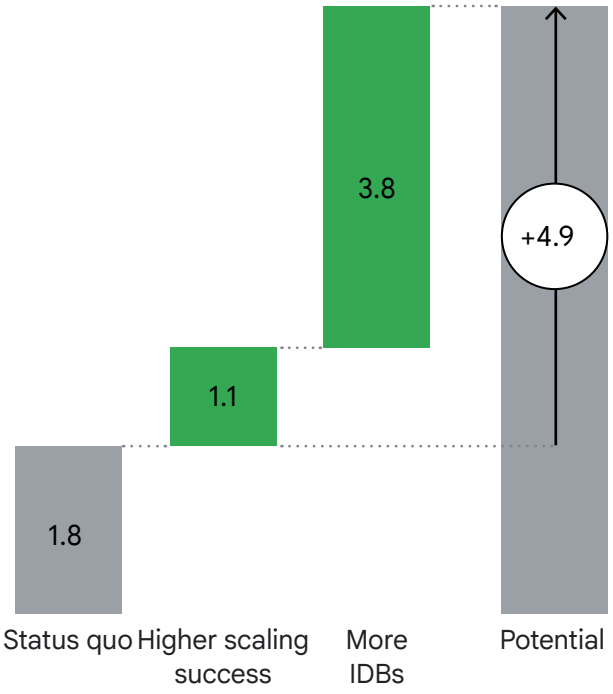
Scaling and growing innovative digital businesses (IDB) is crucial in Europe's competitiveness, and an important enabler for capturing the broader growth opportunity in AI applications and services. Their success plays a critical role in realising the AI innovation opportunity in Europe.

Improving Europe's stock and success of innovative digital businesses to be proportional to the average rate of the top three leading OECD countries could contribute around EUR 500 billion annually. The impacts stem from:

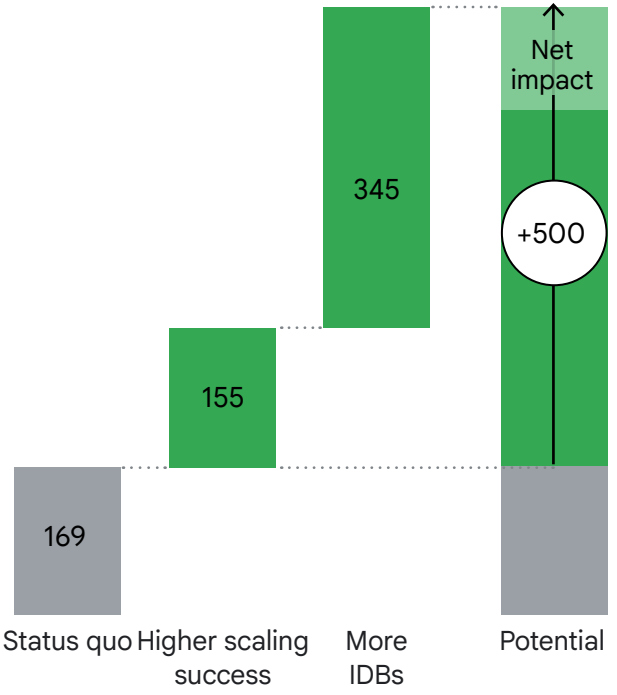
- **Higher scaling success of innovative digital businesses.** Matching the scaling success, i.e. the share of grownups, of the top three OECD countries could create 1.1 million high-value jobs and add EUR 155 billion annually.
- **More innovative digital businesses.** Reaching the rate of the top three OECD countries in terms of entrepreneurial activity could create 3.8 million high-value jobs and contribute EUR 345 billion per year.

Considering that workers in new jobs may have been employed in jobs with average EU productivity, the net impact on the EU economy is EUR 100-110 billion.

Jobs in innovative digital businesses in the EU
Million



Annual gross value added by innovative digital businesses in the EU
EUR billion



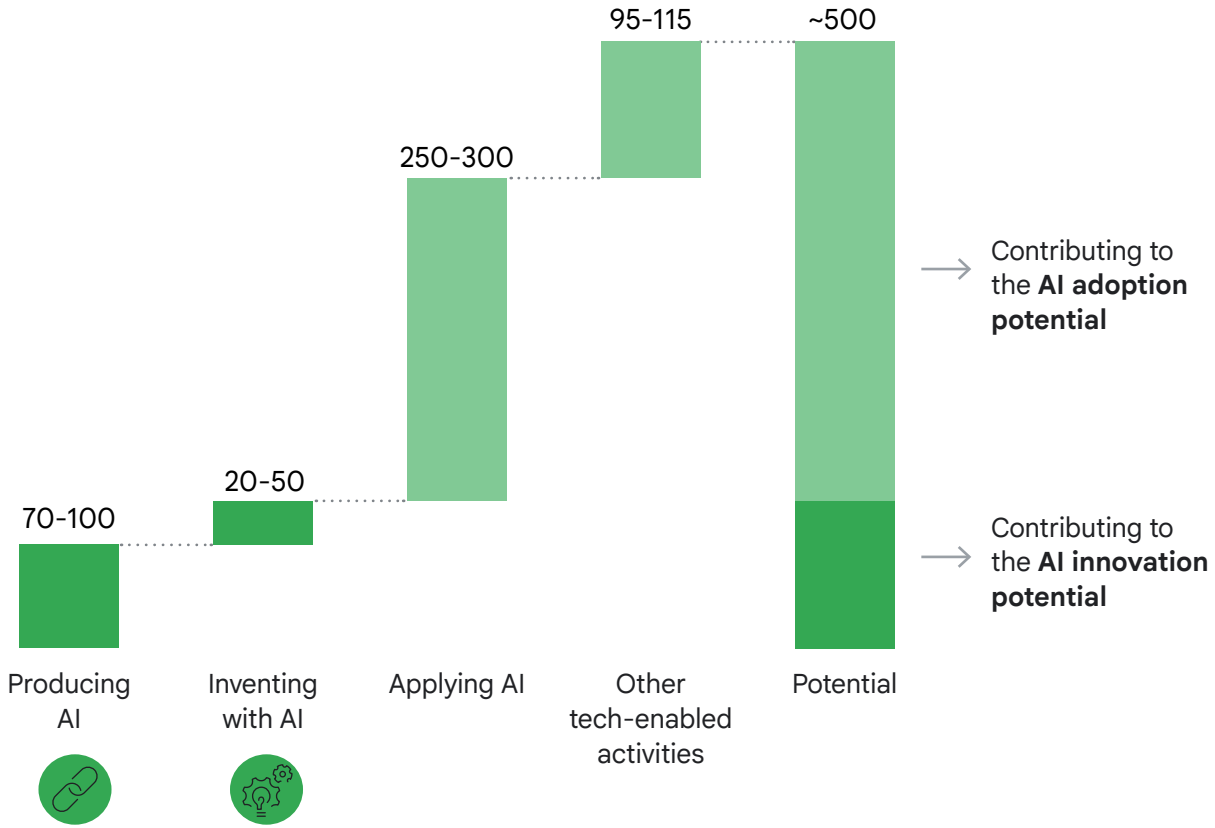
Note: *Higher scaling success* is defined as the EU performance corresponding to the average of the top three OECD countries (UK, Switzerland and the US). Likewise, the scenario of *More innovative digital businesses* is defined by the EU achieving the same number of innovative digital businesses per 100,000 people of working age as the average of the top three OECD countries (Ireland, Denmark and Estonia). This report's calculations do not presuppose a given timeline to achieve the potential.
Source: Implement Economics based on Windsor (2024) using Dealroom data, and Orbis data.

Commercialising AI is key to both the AI innovation potential and the AI adoption potential

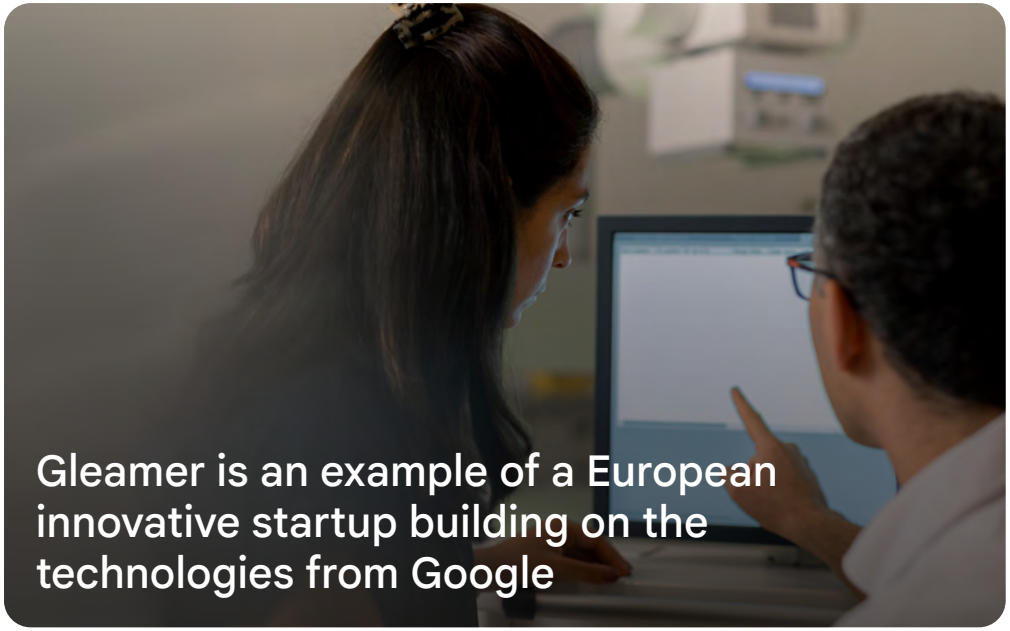
Innovative digital businesses are central to realising both Europe's AI innovation potential and the broader AI adoption potential.

- **Producing AI:** Innovative digital businesses are expected to play a very important role in expanding the AI value chain in Europe, especially within AI applications and services.
- **Inventing with AI:** Innovative digital businesses also contribute to the AI invention potential, and a small share of this potential is expected to be captured by innovative digital businesses.
- **Applying AI:** The most significant role of innovative digital businesses is in applying AI to grow their businesses. These businesses are also central to spreading AI across EU sectors and can demonstrate the value of AI as early adopters and innovators, thereby inspiring smart AI usage in other businesses.
- **Other tech-enabled activities:** While around 80% of Europe's IDBs are using AI to drive their business, there are also other types of tech-enabled businesses, which is part of the overall potential of EUR 500 billion from creating and scaling IDBs at the pace of leading OECD countries.

Annual gross contribution to EU GDP from growing and scaling more innovative digital businesses
EUR billion



Note: The estimation of the distribution of innovative digital businesses across different parts of the potential is based on market share data, survey results, and industry studies. The future composition of innovative digital businesses in these domains is naturally subject to uncertainty.
Source: Implement Economics based on synergy, European Economic and Social Committee, State of European Tech Survey, Nasdaq (2023), Vellum (2025), Windsor (2024) using Dealroom data, and Orbis data, European Commission, and European Innovation Scoreboard 2023.



Gleamer is an example of a European innovative startup building on the technologies from Google

→ Case

Gleamer's AI transforms over 40 million scans worldwide each year

The challenge

Radiologists face increasing workloads and growing demand for fast, precise diagnostics worldwide. Ensuring consistent image analysis at scale is a major challenge for healthcare systems.

The solution

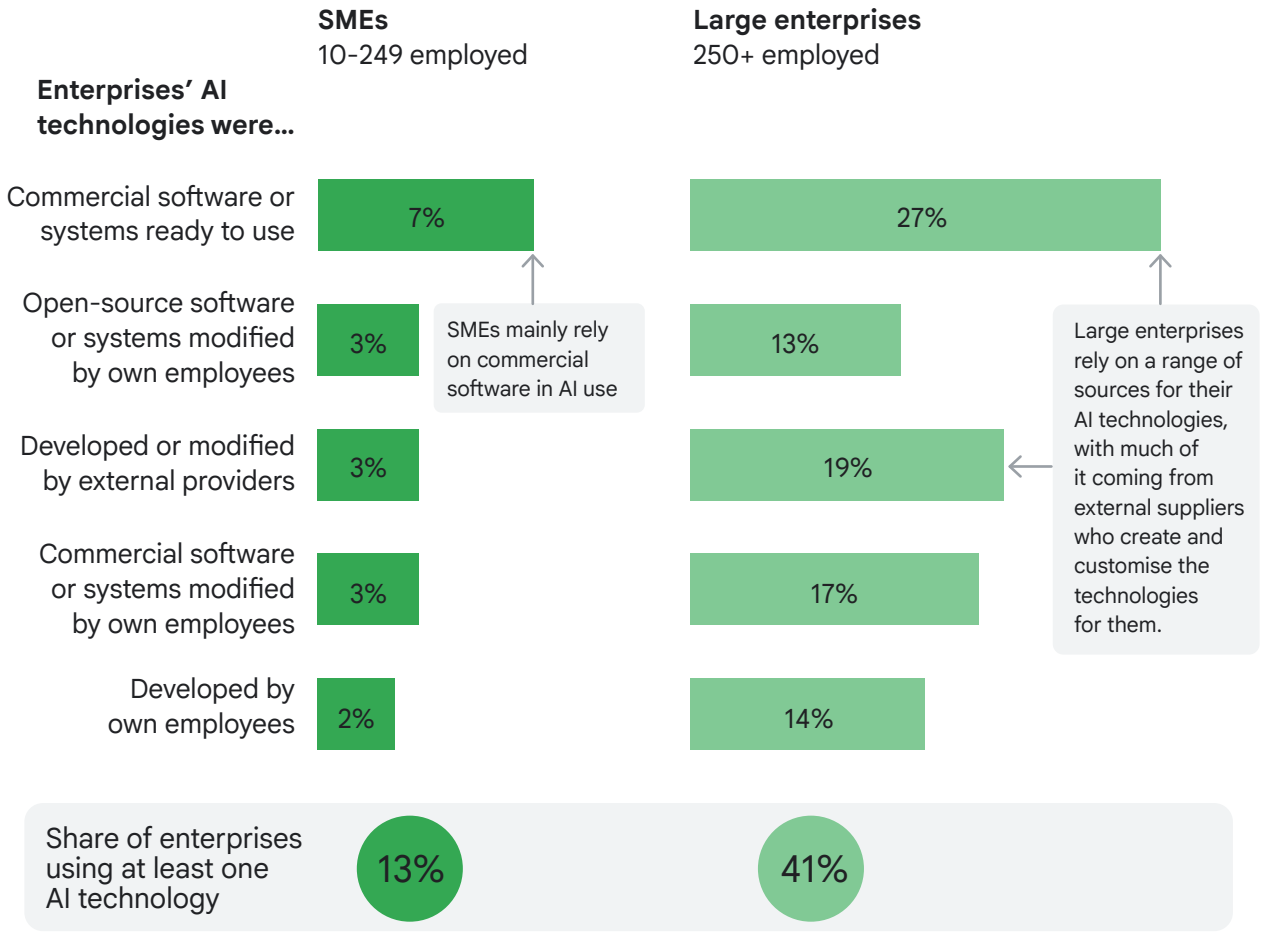
Gleamer, a leader in AI applied to radiological analysis, partnered with Google Cloud to strengthen its scalability and accelerate the development of innovative solutions for healthcare professionals. The collaboration supports advanced features like automated reporting using Vertex AI's AI models, including Med-PaLM and Gemini.

The impact

Gleamer's AI solutions are now deployed in over 2,500 institutions across 45 countries, processing more than 40 million examinations annually. Its excellence is recognised globally, with over 40 scientific publications and 100 clinical studies. Gleamer's advanced AI-powered trauma detection tool has cut average patient waiting time by approximately 70 minutes in the emergency department at the Rennes University Hospital in France.

Source: Implement Economics based on Google and Gleamer.

Accelerating AI adoption of SMEs requires ready-to-use commercial AI solutions



Note: The concept of AI use and AI adoption differ. The survey is based on the question "Enterprises use at least one of the AI technologies". Superficial use would therefor also show up in the survey results and the estimates should be interpreted with this in mind.
Source: Implement Economics based on Eurostat and DESI.

99% of European businesses are small and medium-sized enterprises (SMEs), providing jobs for over 100 million people.

While innovative digital businesses present a large economic opportunity and channel for diffuse AI, all SMEs stand to benefit from the adoption of AI. However, AI use among SMEs is at 13%, significantly lagging behind the 41% adoption rate of large enterprises.

This disparity indicates that SMEs have different needs when adopting AI services. SMEs depend more on ready-to-use technologies and open-source software.

Therefore, widespread AI adoption in Europe's many SMEs relies on an open, well-regulated market, where they can choose the AI service that best fits their needs.

Part 5

The way forward

Suggestions to enhance the European Commission's strong and timely initiatives to close the innovation gap

> *Starting and scaling up companies in Europe is currently hindered by market fragmentation, risk capital constraints and insufficient innovation support.*
>
> **The European Commission**
> in A Competitiveness Compass for Europe

To realise the AI innovation opportunity, Europe must address three key barriers hampering innovation

For over two decades, Europe's productivity growth has lagged due to difficulties in transforming innovation into marketable technologies and integrating them into industry. This stems from insufficient private R&D spending, lower returns, and less VC investment. To make Europe a more attractive investment destination, three key barriers must be addressed:

Complex and restrictive EU regulation

> *Startups and scaleups developing innovative technologies often encounter significant regulatory challenges that impede their growth and competitiveness.*

The European Commission
in the EU startup and scaleup strategy

Market fragmentation

> *The lack of integration in the financial, energy, and electronic communications sectors is a primary reason for Europe's declining competitiveness.*

Enrico Letta
in Much More Than a Market

Lacking R&D investment

> *The EU is losing ground in R&D and in the creation of innovative tech companies with global reach.*

Mario Draghi
in The Future of European Competitiveness

Note: The list of barriers to innovation presented here is not exhaustive.
Source: Implement Economics based on the European Commission, Letta (2024), and Draghi (2024).

The European Commission is addressing the three barriers with its Competitiveness Compass

The European Commission is working intensely to boost competitiveness and innovation. In January 2025, the Commission presented a new competitiveness model based on innovation-led productivity. This strategic focus on innovation is vital for Europe to strengthen its economic security and uphold its autonomy. The Compass aims to nurture Europe's strengths, harness its resources, and eliminate barriers to growth.

In the next two pages, we will explore how the Competitiveness Compass initiatives can help boost innovation and examine key elements of the AI Continent plan. While the Commission is on the right track, we suggest a few recommendations to enhance existing initiatives.

Compass flagship initiatives to close the innovation gap

2025

Q1	Q2	Q3	Q4	2026
AI Factories Initiative	Startup and Scaleup Strategy	Apply AI Strategy	Digital Networks Act	European Research Area Act
Omnibus Proposals	AI Continent Plan	Data Union Strategy	EU Cloud and AI Development Act	28th Regime
An International Digital Strategy for the European Union	Single Market Strategy	European Strategy for Research and Technology Infrastructures		European Innovation Act

Five horizontal enablers of the Competitiveness Compass

- Regulatory simplification
- Removing barriers to the Single Market
- Enabling more efficient financing
- Promoting skills and quality jobs
- Ensuring better coordination

Source: Implement based on the European Commission.

The Competitiveness Compass paves the way for enhancing European innovation

The Competitiveness Compass presents strong initiatives that aim to restore Europe's dynamism and boost economic growth with five horizontal enablers:

	Regulatory simplification	Removing barriers to the Single Market	Enabling more efficient financing	Promoting skills and quality jobs	Ensuring better coordination
Commission initiatives	The Startup and scaleup strategy proposes simpler rules, including a European 28th regime, to reduce administrative burdens and costs for new businesses. The Omnibus proposal aims to bundle and simplify EU rules on compliance in sustainable finance reporting, especially for SMEs. The coming European Innovation Act will promote regulatory sandboxes.	The Single market strategy identifies and tackles the most harmful barriers to intra-EU trade and investment, such as limited recognition of professional qualifications and fragmented rules on packaging.	The Savings and Investments Union Strategy aims to effectively channel savings into investments, offer citizens better access to capital markets and give businesses easier access to capital. The Startup and Scaleup Strategy aims for better funding, a larger EU venture capital market, and greater involvement from institutional investors, supported by initiatives like the Scaleup Europe Fund.	The Union of Skills aims to provide education and training by launching the "Skills Guarantee" pilot, strengthening EU Skills Academies, and attracting global talent with initiatives like "Choose Europe" and the EU Talent Pool. The "Blue Carpet" programme aims to attract and retain top talent by improving access to skilled individuals.	The competitiveness coordination tool aims to align EU and national implementation of shared policy objectives, supported by the European Competitiveness Fund, which consolidates multiple existing financial instruments.
Recommendations enhancing current efforts...	To enhance regulatory simplification (e.g. consistent reporting and content legislation), EU policy should **reorient precautionary tech regulation to actively promote innovation**, as current regulations on AI and data privacy may reduce the productivity gains of AI adoption by over 30%. **Evaluate the likely economic impact of proposed tech regulations**, ensuring that they foster rather than stifle innovation, taking into consideration the impact on a broad set of stakeholders in a holistic way.	European scaleups, being 130% more productive than average, make an outsized contribution to Europe's economy. The Commission should ensure a growth environment for startups, including access to the best AI solutions, as well as continuing to support large businesses once they reach scale. Thus, the Commission should **avoid regulatory asymmetry, ensure consistent regulation** for all business sizes, and encourage initiatives like the 28th regime to support the growth of new innovative businesses.	The Commission's current initiatives to **cut red tape** will help attract capital to AI applications and services, the biggest growth opportunity in the AI value chain for Europe, potentially boosting EU GDP by EUR 130-165 billion. Europe's significant savings surplus is not being fully leveraged, with around EUR 300 billion of it flowing abroad, mainly to America. The Commission should **encourage Europeans to invest in the technologies and companies shaping Europe's future,** as recognised by the Saving and Investment Union Strategy**.**	Incentivise researchers to engage in technology transfer and venture creation by incorporating entrepreneurial achievements into academic progression and leveraging support from programmes like Horizon Europe and the EIC accelerator.	Launch **joint public procurement** to scale up demand, leveraging the public sector's 20-25% share in the generative AI adoption potential. Public R&D funds in Europe are fragmented, lacking incentives for risk-taking and commercialisation. Instead of broad R&D tax credits, **funds should target "moonshot" or mission-oriented** projects to advance in critical technologies like AI, biotechnology, and clean energy as outlined in the European Economic Security Strategy.

Source: Implement Economics based on the European Commission.

The AI Continent Action Plan aims to capitalise on Europe's strengths to establish it as a global leader in AI

The European Commission's AI Continent Action Plan highlights that harnessing the AI opportunity requires development, adoption, and sustainable infrastructure, focusing on five key domains:

	Computing Infrastructure	High-quality data	Strategic AI innovation and adoption	Strong AI talent base	Facilitating compliance with the AI Act
Commission initiatives	Scale up the EU's AI computing infrastructure with AI Factories and Gigafactories to provide massive power for model training and foster collaboration. This includes mobilising EUR 20 billion via the InvestAI Facility and at least tripling EU data centre capacity with the Cloud and AI Development Act.	Enhance access to high-quality data for AI innovators through a new Data Union Strategy, improving interoperability and availability across sectors. Data Labs, integrated with AI Factories, will pool and share data, linking to Common European Data Spaces and simplifying compliance.	Stimulate AI algorithm development and accelerate adoption across EU strategic sectors and public services via the upcoming Apply AI Strategy. European Digital Innovation Hubs will become "Experience Centres for AI" to support adoption, complemented by an AI in Science Strategy and GenAI4EU investments in advanced AI models.	Strengthen Europe's AI talent base by reinforcing skills, improving AI literacy, and addressing shortages through excellence in education, training, and research. This will enlarge the AI specialist pool, incentivise talent retention, and attract global talent via the AI Skills Academy, which will offer education, apprenticeships, and fellowship schemes.	Foster a positive regulatory environment by facilitating AI Act compliance, particularly for smaller innovators. This includes launching the AI Act Service Desk and establishing regulatory sandboxes to streamline procedures and ensure a predictable single market for AI.
Recommendations enhancing current efforts…	The globally integrated AI infrastructure value chain means no region can be self-sufficient. Europe needs 2-3 times more cloud capacity for future AI demand. To expand efficiently, Europe should, in line with the International digital strategy, **partner with cost-effective, innovative, and trusted private providers, including non-European ones, under clear and fair rules.** **Invest in grids to ensure they are resilient, interconnected, decentralised,** digital and flexible, in line with the European Grid Package.	Unlocking Europe's AI potential in development, adoption, and innovation requires access to vast and high-quality data. This entails **preserving the EU's copyright system and avoid adding new obligations or caveats that will block or hinder AI development.** **Interpret EU's privacy laws in a way that supports AI innovation,** incentivises best privacy practices, and focuses on limiting real privacy harms to citizens.	**Access to powerful AI models and infrastructure is paramount**; lacking these could shrink Europe's AI adoption potential from 8% to 2% of GDP, risking around EUR 800 billion. The Apply AI initiative should **broaden its current focus on 'industrial use cases'** to encompass five key sectors: business services, IT and finance, wholesale and retail trade, and the public sector, in addition to manufacturing. These sectors collectively represent 75% of the potential for AI adoption.	Successful AI startups excel by integrating technical AI expertise with in-depth sector knowledge, underscoring the value of **interdisciplinary collaboration**—also a focus of the Union of Skills strategy. Leverage **public-private partnerships** to develop AI skills and meet real-world scientific needs, such as the Google DeepMind and EMBL-EBI collaboration offering a course on using AlphaFold2 for structural biologists.	Implementation of new regulation such as the AI Act **must avoid creating excessive uncertainties** or burdens that could deter investment, such as the GDPR has been shown to do. **Ensure that the AI Act enforcement is based on a model's real-world capabilities** and actual potential for harm, rather than simply the computing power used to create it, which makes for a poor proxy for risk. These measures need to be proportionate, workable and agreed upon well ahead of the compliance deadlines to avoid delays in the launch of the latest AI innovations in Europe. Additional regulation on AI should be subject to a **clear cost-benefit analysis**.

Source: Implement Economics based on the European Commission.

Harnessing Europe's AI strengths requires open competition, leveraging high-quality data, cutting red tape, and strategic public funding

Harnessing Europe's strengths is vital to realising the AI innovation opportunity. Open competition among all providers, including non-European ones, enhances innovation and meets customer needs. As the Commission notes in its International digital strategy, "no country or region can tackle the digital and AI revolution alone," making collaboration with partners and tech allies crucial for European competitiveness and economic security.

As highlighted in Google's EU AI opportunity agenda, investing in AI infrastructure, supporting research, and creating legal frameworks for responsible AI growth are essential to unlocking AI opportunities. In the Policy Framework for Building the Future of Science with AI, Google underscores three focus areas – the *three I's* - to advance AI-driven scientific progress.

Infrastructure

The expansion of data centres is essential for the EU's digital progress. Europe must modernise electricity grids to ensure a reliable and clean energy supply and scale advanced clean energy technologies.

Prioritise streamlining and harmonising permitting processes for data centres, digitising applications, and clarifying regulatory requirements to overcome current delays.

A rich, interoperable European data ecosystem is vital for the responsible development of AI. Safeguarding the EU's enabling copyright system is essential for fostering innovation and maintaining competitiveness. Initiatives like the Data Union Strategy can unlock immense value.

Investment

Encourage startups in scientific research through grants and joint public procurement. By leveraging the public sector's 20-25% share of the AI adoption potential, governments can help create a substantial market for startups and innovative businesses to tap into.

Consolidate fragmented public R&D funds to incentivise risk-taking and target 'moonshot' projects in Europe's strategic sectors like AI, biotechnology, and clean energy.

Stimulate private investment by cutting red tape and strengthening the single market. Better leverage Europe's savings surplus to invest in technologies and companies shaping the continent's future, crucial for capitalising on growth opportunities in AI applications and fostering widespread AI adoption.

Innovation

Implement Pro-Science and innovation legal frameworks by creating harmonised, interoperable regulations, particularly concerning privacy and cross-border data flows.

Cultivate Europe's AI talent through interdisciplinary collaboration across Member States. Public-private partnerships, like Google's, can bolster skills development and ensure that AI tools address real-world scientific needs.

Specialised tools are essential for European science, especially robust AI models aligned with research priorities. Google supports their development through contributions, such as AlphaFold, MedGemini, and our AI co-scientist concept.

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