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Progress builds on existing knowledge

The text and data mining exception is key to AI-driven progress for Europe

July 2026

COMMUNICATIONS CHAMBERS

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1. Executive summary

During the second half of the 20th century Europe was catching up with the US economically but is now falling behind. The Draghi report published in September 2024 articulated the challenge, and identified AI as an opportunity for Europe:

"With the world now on the cusp of another digital revolution, triggered by the spread of artificial intelligence (AI), a window has opened for Europe to redress its failings in innovation and productivity and to restore its manufacturing potential."

The world is now very clearly amid an AI-led transformation. AI models are useful and are improving rapidly, adoption of AI tools is widespread and the pivot to reliance on AI for coding in early 2026 is an early proof point for their wider application.

Investment in compute has skyrocketed and available compute is fully utilised. Enterprises are willing to pay for AI services, with AI company Anthropic reporting in May 2026 that its annualised revenue run-rate had surpassed $47 billion. User benefits can be expected to significantly exceed AI company revenues.

Not only is AI economically significant, but it is also contributing to science, technology and the arts. AI has the characteristics of a 'renaissance technology'.

The contribution of AI to science and technology will also underpin future economic growth. AI is not only a general-purpose technology, but the invention of a method of invention that can sustain the growth of knowledge and progress.

Demonstrating the potential of AI for science is the protein structure prediction algorithm AlphaFold. The AlphaFold breakthrough won Demis Hassabis and John Jumper of Google DeepMind a Nobel prize in Chemistry in 2024. Understanding protein structure is a building block for developing new medicines and biomaterials. AI is contributing to health as well as wealth.

AI is also contributing to media, art and culture. Just as recorded music, photography, cinematography and the internet contributed to culture and art, AI is facilitating new forms of expression and discovery. AI is also a powerful tool for cultural exploration. The cultural sector in Europe, except for a dip during COVID-19, has been growing.

AI will contribute in other ways including, via growth, reducing the appeal of zero-sum economic and political thinking. AI also has the potential to help address grand challenges including an ageing population, national security and the energy transition.

Europe is positioned to benefit from AI use; indeed, the use of AI is necessary for the transformation of industry and commerce to remain competitive. However, regulatory roadblocks need to be addressed.

The EU's emphasis on technological sovereignty is a reason to strengthen Europe's capacity to develop, deploy, adopt and adapt AI, not a reason to restrict access to global models, cloud services or knowledge. Sovereignty without capability is brittle and capability depends on access to knowledge, including a stable text and data mining (TDM) framework.

Given the scale of compute required, not all of it will be local, in particular given near-term energy constraints in Europe. Nor are vertical and domain-specific models an alternative to broad training: they tend to perform best when built on strong base models trained on a broad corpus of knowledge. The European Commission's technological sovereignty

package also places emphasis on open-source models, which can support European capability and diffusion, but open models still depend on access to broad training data and compute; they are not a substitute for a stable TDM framework or access to global AI services.

These considerations mean there is a trade-off involved with calls for stricter controls on the use of existing knowledge for model training - either models trained elsewhere would be relied upon or the supply of AI would be restricted - harming competitiveness and the whole economy. Stricter controls would also create a barrier to entry for AI startups, harming European prospects.

Europe should maintain the TDM framework introduced in 2019 in anticipation of growing use of automated techniques. It offers clarity for model development in the European Union.

Reopening TDM would - at the very least - result in a harmful period of uncertainty at a critical time in terms of the development and use of AI. Uncertainty over the EU TDM framework may also increase the likelihood of national policy initiatives that unravel a single EU market approach.

Implementation questions do not require reopening the TDM exception. The immediate task is to make the framework workable, predictable and proportionate.

A clear distinction should be maintained between model training inputs and model outputs, with the focus in terms of intellectual property rights protection on outputs.

Questions over whether models should be able to build on openly available information, whether and in what form transparency requirements might apply for policy purposes, and whether models remember training data - which they may do partially and probabilistically - should not determine infringement analysis. Questions of whether generated material infringes protected expression are best addressed in relation to outputs.

Focusing infringement on outputs rather than regulation in relation to model inputs also maximises freedom in relation to evolving technical interfaces and business models that are adding value for content creators and model developers.

There are nevertheless separate and legitimate questions as to whether the scale at which AI allows personas or content with a likeness to existing content to be generated requires new protections. These questions, which relate to model outputs, should be the focus; not counterproductive efforts to reopen TDM, as suggested by the European Parliament.

To reap the rewards from AI, AI models need to be able to learn from existing public knowledge, but to protect creators we should focus on how model outputs are governed.

2. The need to restore European progress

In 2003 Nicholas Crafts observed that European catch-up with the US reversed around the mid-1990s:[1]

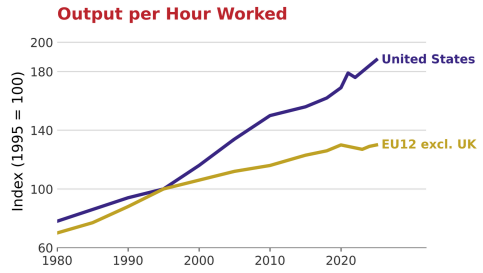
"Productivity growth in virtually all west European countries exceeded that of the United States throughout the period 1950 to 1995. Since then American productivity performance has strengthened and that of the EU has weakened. The most important reason is contrasting experiences with Information and Communications Technology (ICT)."

Two decades on, the scale of the ongoing divergence was made clear in the Draghi report:[2]

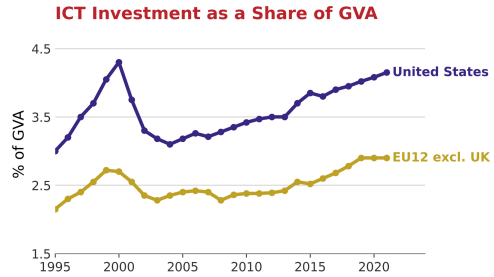
"The EU-US gap in the level of GDP at 2015 prices has gradually widened from slightly more than 15% in 2002 to 30% in 2023... Around 70% of the gap in per capita GDP with US at PPP is explained by lower productivity in the EU."

Figure 1 highlights the productivity and investment gap between the EU-12 (excluding the UK) and the US.[3]

Figure 1: Gap between EU-12 and US



Source: Bick et al. (2026), based on BLS and Penn World Table. Values digitised/interpolated from published figure.



Source: Bick et al. (2026), based on EUKLEMS & INTANProd. Values digitised/interpolated from published figure.

The Draghi report also set the challenge in a wider context than economic, while singling out becoming more productive as the only way to meet the broader challenge:

"Europe's fundamental values are prosperity, equity, freedom, peace and democracy in a sustainable environment. The EU exists to ensure that Europeans can always benefit from these fundamental rights. If Europe can no longer provide them to its people – or has to trade off one against the other – it will have lost its reason for being."

"The only way to meet this challenge is to grow and become more productive, preserving our values of equity and social inclusion. And the

[1] Crafts, November 2003, Fifty years of economic growth in western Europe: no longer catching up but falling behind? https://siepr.stanford.edu/publications/working-paper/fifty-years-economic-growth-western-europe-no-longer-catching-falling

[2] The Draghi report on EU competitiveness, September 2024. https://commission.europa.eu/topics/competitiveness/draghi-report_en#paragraph_47059

[3] Bick *et al*, March 2026, Mind the Gap: AI Adoption in Europe and the US. https://www.brookings.edu/wp-content/uploads/2026/03/6_Bick-et-al_unembargoed.pdf

only way to become more productive is for Europe to radically change."

Draghi identified AI as a window of opportunity for Europe to redress its productivity failings.

"With the world now on the cusp of another digital revolution, triggered by the spread of artificial intelligence (AI), a window has opened for Europe to redress its failings in innovation and productivity and to restore its manufacturing potential."

The challenges Europe faces include an ageing population, achieving decarbonisation and improving defence capabilities. With low growth, which constrains state capacity, these challenges are harder to meet.

Finally, low growth contributes to zero-sum thinking, the belief that for someone to gain someone else must lose; and its twin, zero sum politics – as the FT argue:[4]

"A stalled economic conveyor belt is behind the rise of anti-system, anti-growth parties on both the right and left"

Restoring European competitiveness and productivity growth is a priority for a broad set of reasons.

Not only will AI help deliver productivity growth via integration into business and government; it will also help by accelerating scientific and technical progress, which will contribute to further growth and help address societal challenges directly. AI can help restore broader progress, not simply competitiveness.

How much AI helps in Europe depends on the extent to which AI model building, model use and economic transformation are enabled, and while that hinges on many things, a key ingredient is the opportunity for AI to learn from existing knowledge.

[4] FT, December 2025. Welcome to the age of zero-sum politics. *https://www.ft.com/content/30a49ab7-285b-4641-89f8-7375fc560ab9*

3. AI is ushering in a 'new Renaissance'

AI is a general-purpose technology (GPT) and the invention of a method of invention (IMI) in science and technology and tool for creative expression and discovery. AI has the characteristics of a 'renaissance technology'.

Steam power and electricity were general-purpose technologies with widespread application; while the printing press and the internet also contributed to science and artistic expression and discovery.

It is important to remind ourselves that the second-round impacts of technology revolutions can have significant, but unpredictable, consequences.

While we might not wish to wind-back the clock on printing, it did help unleash Luther's writings, contributing to over a century of conflict in Europe during the Reformation. Not all benefits and harms will be anticipated, and it is almost futile to attempt to do so, but some broad lessons from the past can be sketched out. Crucially, with hindsight, we see an arc of progress driven by technology.

Connected computing ('the internet') contributed to invention and discovery, including scientific and artistic.

AI builds on the foundations of the internet, and it is reasonable to expect the contribution to be both greater and more sustained for two reasons.

First, the building blocks for distributing and utilising AI services are in place in terms of network connectivity, devices, software applications and cloud computing (though much more compute is required).

Second, AI offers 'intelligence' on tap. AI can interact and process audio, natural language and visual information. AI can reason and generate economically, scientifically and culturally useful outputs. AI can also write code and contribute to its own improvement.

The anticipated economic contribution of AI comes after a period of low productivity growth and economic dynamism. There is nothing else on the horizon that could restore the old normal in terms of progress.

AI also comes at a time when we face collective challenges including government indebtedness, an ageing population, increased defence needs and the challenge of decarbonisation. It is timely.

A return to growth might also reduce zero-sum thinking, and the domestic and geopolitical tensions associated with such thinking. More than 'the economy' is at stake.

Scientific progress looks set to be revitalised. AI can help scientists be more productive and compress the timescales for breakthroughs in areas ranging from medicine to materials science, energy and decarbonisation. AI can help address some of our most pressing challenges.

An illustration of the power of AI for science is the protein structure prediction algorithm AlphaFold. The AlphaFold breakthrough won Demis Hassabis and John Jumper of Google DeepMind a Nobel prize in Chemistry in 2024. Understanding protein structure is a building block for developing new medicines and biomaterials.

AI is also contributing to media, art and culture. Just as recorded music, photography, cinematography and the internet contributed to culture and art, AI is facilitating new forms of expression and discovery. Some art forms may decline, just as portraiture declined with photography, but other forms will grow; just as photography encouraged the exploration of new movements such as expressionism in art.

AI is contributing to media and art in two ways. First, by streamlining existing forms of expression, allowing individuals or small teams to do what would not have been possible previously. Second, by allowing new forms of expression, for example artist Refik Anadol used artificial intelligence to interpret and transform more than 200 years of art in his large-scale dynamic installation *Unsupervised* at MoMA in 2022-2023.

A key ingredient of economic, scientific, cultural and artistic progress is freedom to learn, reinvent and create. As Joel Mokyr, a 2025 'Nobel' winner argued, the effective use of knowledge depends on its circulation:

"Knowledge is shared and distributed, and its transmission through learning is essential for such a society [a technological society] to make effective use of it."

As we enter the AI era, we should maintain an open stance to learning - by humans and machines - while recognising that technological change has repeatedly required legal adaptation.

This paper develops these themes, with a focus on restoring European progress in an age of AI.

4. Compute at scale is required

"The biggest lesson that can be read from 70 years of AI research is that general methods that leverage computation are ultimately the most effective, and by a large margin." Richard Sutton, 'The Bitter Lesson'[5]

Consistent with the 'bitter lesson', large language models (LLMs) took-off once sufficient compute and training data were thrown at the challenge, and capabilities have scaled subsequently with training data and compute.

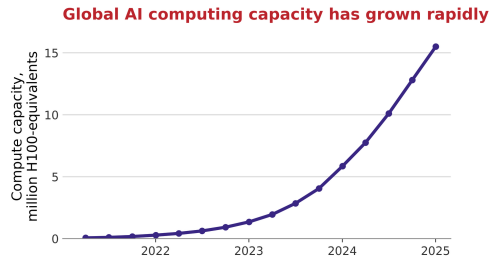
Not only has scaling produced better models, but scaling the inference compute used increases the quality of model outputs. The improved capabilities of models are driving adoption and intensity of use, with the recent improvement in model capability for coding being illustrative of quality driving demand.

Together these developments are driving demand for vast amounts of compute. SemiAnalysis point to a compute shortage:[6]

"Token demand is skyrocketing and the need for AI compute continues to accelerate. The improvement in model capabilities combined with the rapid emergence of agentic workflows has driven a surge in user adoption and aggregate token demand... Despite a huge AI infrastructure buildout over the past few years, available compute is scarce."

Globally AI computing capacity is doubling every 7 months[7] (Figure 2), with cumulative chip power reaching 13 GW by Q4 2025 (data centres also need additional power for cooling etc).

Figure 2: Global AI compute capacity

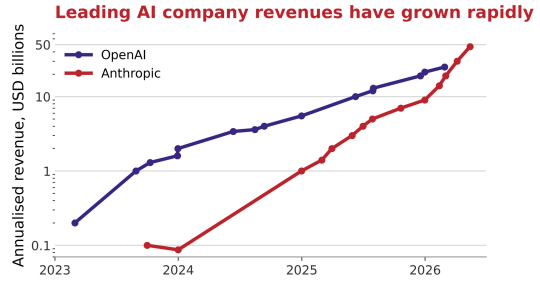


Source: Epoch AI, AI Chip Sales. Aggregate values approximate/reconstructed from the published dataset figure.

Unlike the dot.com era, characterised by investment in unused 'dark fibre', available compute is fully utilised in the AI era.

Commercial users value AI and are willing to pay for it, as evidenced by rapidly growing AI company revenues (Figure 3).[8] Anthropic reported in May 2026 that its annualised revenue run-rate had surpassed $47 billion,[9] having surpassed $30bn in April 2026.[10]

Figure 3: AI company revenue growth



Source: Epoch AI, AI Companies database, revenue reports.

In the US a Gigawatt (GW) scale compute cluster was completed by Anthropic-Amazon

[5] Richard Sutton, March 2019, The bitter Lesson. https://www.cs.utexas.edu/~eunsol/courses/data/bitter_lesson.pdf
[6] SemiAnalysis, April 2026, The Great AI Silicon Shortage. https://newsletter.semianalysis.com/p/the-great-ai-silicon-shortage
[7] EPOCH AI, January 2026, Global AI computing capacity is doubling every 7 months. https://epoch.ai/data-insights/ai-chip-production/
[8] EPOCH AI, April 2026, AI Companies. https://epoch.ai/data/ai-companies/
[9] Anthropic, May 2026, Anthropic raises $65B in Series H funding at $965B post-money valuation. https://www.anthropic.com/news/series-h
[10] Anthropic, April 2026, Anthropic expands partnership with Google and Broadcom for multiple gigawatts of next-generation compute. https://www.anthropic.com/news/google-broadcom-partnership-compute

in March 2026 and construction of further GW scale clusters is underway by Anthropic-Amazon, OpenAI and xAI.[11] The US is expected to add 90GW of capacity between 2026 and 2028.[12]

The EU plans up to five 'gigafactories' with over 100,000 advanced AI processors each (around 1 GW in total). Investment in commercial compute clusters, substantially greater in scale, is also underway in Europe.

Reuters reported that EU data-centre capacity is expected to rise from 12 GW in 2025 to 28 GW by 2030[13].

Taken together, Europe's public and commercial AI compute plans appear sufficient for frontier-model training but are dwarfed by the aggregate buildout underway in the US. Model training in the EU is also dependent on the existing TDM exception.

Demand for compute is also shifting from model training to inference as adoption grows and usage intensifies. Agentic AI, where models work on extended autonomous tasks, is also driving demand for inference.

Either Europe will be AI poor, or it will to a significant extent utilise models developed outside of Europe and compute provided by a range of non-European providers located both within and outside of Europe.

This is far from a counsel of despair, since much of the benefit of AI will come about from its use rather than its production. But it raises a dilemma at the heart of questions over text and data mining (TDM).

The *status quo* in the EU, which permits TDM under an opt-out regime, and which does not impose extraterritorial restrictions on model use, is compatible with production and use of AI at scale.

However, if more stringent requirements were adopted, benefits for rightsholders would come at the cost of less intensive use of AI by all sectors, including the creative sectors.

There is no free lunch to be had, but there is a risk that the benefits of AI – discussed in subsequent sections – would be substantially diminished if the TDM exception were weakened.

[11] EPOCH AI, April 2026, Frontier Data Centers. *https://epoch.ai/data/data-centers/*
[12] SemiAnalysis, April 2026. *https://x.com/SemiAnalysis_/status/2041999673586483589?s=20*
[13] Reuters, June 2026, EU plans energy standards for data centres amid concerns over soaring power use. *https://www.reuters.com/business/energy/eu-plans-energy-standards-data-centres-amid-concerns-over-soaring-power-use-2026-06-03/*

5. AI will drive prosperity

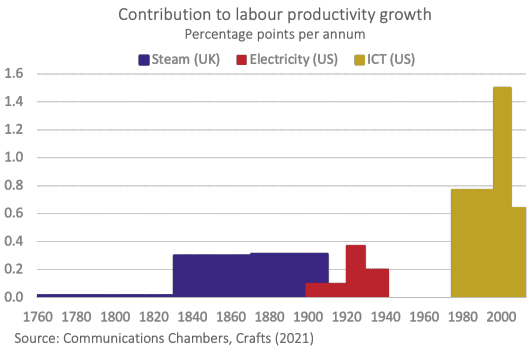
There have been periodic waves of scepticism about AI including claims it is a 'stochastic parrot', has 'hit a wall' or that 'model collapse' will follow training on model-generated content. Yet progress has continued, sped up during 2024[14] and is ongoing.

It is now generally accepted that AI will impact positively on growth and economic dynamism, but by how much; and might it be 'too much too fast'? History, expectations and modelling can inform our judgement.

History of general-purpose technologies

Past general-purpose technologies (GPTs) - steam, electricity and the internet have generated waves of productivity and income growth. [15]

Figure 4 Productivity growth from past general-purpose technologies



Source: Communications Chambers, Crafts (2021)

Over the period 1870 to the end of the 20th century these waves contributed to an 18-fold increase in productivity, with benefits split between increased leisure and 9-fold real income growth for a group of Western European countries. Employment per capita stayed almost constant at around 45%.

AI also represents the invention of a method of invention (IMI), something it has in common with the internet. The internet delivered a sustained wave of growth of around 1 percentage point per annum, at least in the US, though the growth contribution fell away in the early 2000s.[16]

AI versus past general-purpose technologies

While previous GPTs took time to make significant contributions, AI has all the characteristics of a GPT and IMI, and there are reasonable grounds for thinking it will deliver early and sustained benefits:

- AI is already useful in a wide range of applications, and its capabilities are improving rapidly. During 2025 reasoning models went mainstream, and in February 2026 there was a leap in the capability of coding agents.[17] Adoption is rapid.
- The cost of inference for an LLM at a fixed level of performance has fallen around 40-fold per year - faster than Moore's law.[18]
- AI is finding wide application across science and technology.

AI has a head start because it can build on the foundations of the internet, and because the share of software and intangible knowledge in

[14] EPOCH AI, December 2025. AI capabilities progress has sped up. https://epoch.ai/data-insights/ai-capabilities-progress-has-sped-up
[15] Crafts, September 2011, Artificial intelligence as a general-purpose technology: an historical perspective, Oxford Review of Economic Policy, Volume 37, Number 3. https://academic.oup.com/oxrep/article/37/3/521/6374675
[16] Dan Sichel and David Byrne, August 2017. The productivity slowdown is even more puzzling than you think. https://cepr.org/voxeu/columns/productivity-slowdown-even-more-puzzling-you-think
[17] Tyler Cowen, February 2026, An AI Breakthrough that Will Go Down in History. The Free Press. https://www.thefp.com/p/a-day-that-will-go-down-in-history
[18] EPOCH, AI trends. https://epoch.ai/trends

the economy is already high. Software alone is around 4 percent of GDP in some economies, and intangible knowledge (R&D, design, marketing and other business processes) brings the share to around 10 to 15 percent.[19]

AI can leverage a large existing economic base, and rapid progress in coding agents is driving productivity gains in software generation, including 'self-improvement' in AI models.

Expectations for the economic impact of AI

A heuristic for thinking about an acceleration of progress due to AI is to express it as time compression:[20]

"I would love to compress what happened in 200 years of the Industrial Revolution into a 20-year period, if we're lucky." Satya Nadella, CEO Microsoft

The industrial revolution involved sustained but modest growth of around 1% per annum[21], doubling GDP over 70 years. Growth accelerated during the 20th century.

Compressing the 14-fold growth over the past 200 years into 20 years would require growth of 14% per annum - higher than any multi-decade growth episode for any country ever.

A related vision focusses on compression of science timelines:[22]

"It usually takes an average of five to 10 years [to discover] one drug. And maybe we could accelerate that 10 times, which would be an incredible revolution in human health" Demis Hassabis, Google DeepMind

Faster scientific progress would not only support economic growth but also offer benefits in areas including health.

Turning to modelled growth estimates, they vary by over two orders-of-magnitude, from less than 0.07% per annum (Acemoglu[23]) to over 20% per annum (Epoch AI[24]). There are reasonable grounds for narrowing the range, but significant uncertainty remains.

Low growth estimates

At the low end, Acemoglu focused on automation reducing the costs in certain specific tasks but did not dwell on deepening of automation, nor did he consider changes to the process of science.

Considering what AI is capable of in early 2026, and given its trajectory of improvement, these exclusions appear unreasonable.

Aghion and Bunel[25] applying the same method as Acemoglu - but with revised empirical assumptions - obtain a growth estimate an order of magnitude greater.

Aghion and Bunel also consider parallels with past technological revolutions and estimate that AI could increase aggregate productivity

[19] Bontadini and Haskel, October 2025, AI as an Innovation in the Method of Innovation: Implications for Productivity Growth in the US and Europe. https://spiral.imperial.ac.uk/server/api/core/bitstreams/aa4caa79-9ed3-4da2-b8f8-8281b022e249/content

[20] Dwarkesh Podcast, November 2025, Satya Nadella — How Microsoft is preparing for AGI. https://www.dwarkesh.com/p/satya-nadella-2

[21] Gregory Clark, 2007, The Industrial Revolution. https://faculty.econ.ucdavis.edu/faculty/gclark/papers/HEG%20-%20final%20draft.pdf

[22] FT, January 2025, AI-developed drug will be in trials by year-end, says Google's Hassabis. https://www.ft.com/content/41b51d07-0754-4ffd-a8f9-737e1b1f0c2e

[23] Daron Acemoglu, April 2024, The Simple Macroeconomics of AI. https://economics.mit.edu/sites/default/files/2024-04/The%20Simple%20Macroeconomics%20of%20AI.pdf

[24] https://epoch.ai/gradient-updates/ai-and-explosive-growth-redux

[25] Philippe Aghion and Daren Bunel, June 2024, AI and Growth: Where Do We Stand? https://www.frbsf.org/wp-content/uploads/AI-and-Growth-Aghion-Bunel.pdf

growth by between 0.8 and 1.3 percentage points per year over the next decade.

It seems reasonable to reject the lower end of the range estimated by Acemoglu.

High growth estimates

At the high end lies the Epoch estimate, which exceeds the multi-decade growth experience of any country.

Things that are hard to automate can however bind and constrain growth (several papers have explored the impact of constraints: O-Ring automation,[26] weak links[27] and learning spillovers[28]).

Many tasks can also only be performed by qualified and certified humans. Some of these restrictions may be modified to permit AI, for example autonomous driving; while others may persist or may be clarified by the courts in ways that preclude AI e.g. legal privilege.

It seems reasonable to reject the upper end of the range as estimated by Epoch AI.

A goldilocks zone for growth?

If we reject very low and very high estimates for the growth contribution of AI, we are left with a contribution that is likely to be material but remains uncertain.

An estimate that considers the impact of AI as an IMI, by Bontadini and Haskel (2025)[29] forecasts a boost to labour productivity growth of as much as 1% per annum for the United States and around 0.3% per annum for Europe.

Another set of estimates for the euro area economy, reported in a speech by a member of the Executive Board of the European Central Bank, linked the impact to the speed of diffusion: [30]

"Faster adoption could yield substantially larger potential TFP gains over the coming decade – in the order of 0.3-0.4 percentage points per year, depending on the assumption of the scale of GDP exposure to AI. Slow adoption, as observed in past general-purpose technologies, would instead lead to TFP increases of around 0.2 percentage points per year."

A survey-based approach conducted between October 2025 and February 2026 found for the US economy that: [31]

"...comparing the beliefs of five groups: academic economists, employees at AI companies, policy researchers focused on AI, highly accurate forecasters, and the general public. The median respondent in each group expects substantial advances in AI capabilities by 2030, small declines in labor force participation consistent with demographic shifts, and an annual GDP growth rate of 2.5%, which exceeds both the typical medium-run (2.0%) and long-run (1.7%) baseline forecasts from government agencies and private-sector forecasters."

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[26] Gans, 2026, O-Ring Automation. https://www.nber.org/system/files/working_papers/w34639/w34639.pdf
[27] Jones and Tonetti, January 2026, Past Automation and Future A.I.: How Weak Links Tame the Growth Explosion. https://web.stanford.edu/~chadj/JonesTonetti_Automation.pdf
[28] Philip Trammell, February 2026, Workflows and Automation. https://philiptrammell.com/static/Workflows_and_Automation.pd
[29] Bontadini and Haskel, October 2025, AI as an Innovation in the Method of Innovation: Implications for Productivity Growth in the US and Europe. https://spiral.imperial.ac.uk/server/api/core/bitstreams/aa4caa79-9ed3-4da2-b8f8-8281b022e249/content
[30] European Central Bank, March 2026, AI and the euro area economy. https://www.ecb.europa.eu/press/key/date/2026/html/ecb.sp260323_1~1e06784a89.en.html
[31] Karger *et al*, March 2026, Forecasting the Economic Effects of AI. https://static1.squarespace.com/static/635693acf15a3e2a14a56a4a/t/69cbb9d509ada447b6d9013f/1774959061185/forecasting-the-economic-effects-of-ai.pdf

Further the survey found that:

"Conditional on a "rapid" AI progress scenario, in which AI systems surpass human performance on many cognitive and physical tasks, experts forecast substantial, though not historically unprecedented, economic shifts: annualized GDP growth rising to around 4%... by 2050."

However, an important qualification is that existing forecasts and surveys largely pre-date rapid progress in the use of agentic AI for coding in early 2026. This progress has raised expectations of what AI may be capable of more generally.

Recent agentic coding progress may therefore suggest some estimates may understate the upside; while diffusion, regulation, organisational change and bottlenecks may still constrain realised gains.

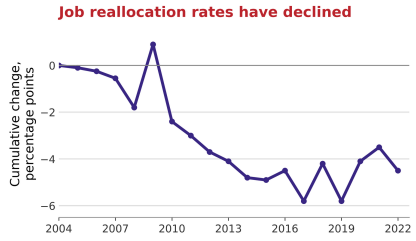
A growth contribution in the low single-digit range is plausible. Another way of framing this is that AI offers the prospect of restoring 20th century rates of progress.

One might think of this as the goldilocks zone for growth, neither too hot (disruptive) nor too cold (inviting zero-sum thinking etc). And even a small but sustained uplift in growth would have a large impact.

Lifting per capita GDP growth in Europe from the average 1% rate over the past two decades to 2% per annum would halve the time required to double incomes (or increase leisure) from 70 years to 35 years.

Further, while it is widely believed that we live in an era of rapid change, the past two decades have been characterised by slow productivity growth and declining job reallocation rates (Figure 5 shows the decline in job reallocation rates in the OECD).[32]

Figure 5: Job reallocation rates have declined



Source: OECD DynEmp v3_3 database, October 2025; OECD (2026). Approximate values digitised from published figure.

An acceleration in growth and job reallocation would therefore come off a low base.

Achieving an acceleration is nevertheless conditional on a favourable environment for AI production and use, including maintaining the TDM exception.

[32] OECD, May 2026, Corporate income taxation and business dynamism, OECD Taxation Working Papers, No. 77. Figure 1, based on OECD DynEmp v3_3 database, October 2025. *https://www.oecd.org/en/publications/corporate-income-taxation-and-business-dynamism_59a40a50-en/full-report.html*

6. AI will underpin science, technology & industry

AI is helping create new knowledge but depends on access to existing knowledge for training. Whereas previously there was evidence of a slowdown in scientific productivity,[33] AI offers the prospect of an acceleration.

AI may therefore not only contribute directly to the economy, but also indirectly via the accumulation of knowledge which can be self-sustaining over an extended period.

AI can also contribute to societal welfare by helping solve challenges including health and age-related diseases as well as assisting with the energy transition. These contributions will not necessarily be reflected in GDP statistics but will nevertheless contribute to human welfare and the environment.

As a hypothetical, if we assume AI led to discoveries that allowed all cancers to be cured, with cancer accounting for around 25-30% of deaths, and considering that cancer is age related, the extension of life expectancy would be around 3 years[34].

Utilising a mid-point value for a quality adjusted life year in Ireland of €30,000[35], and assuming a quality-of-life score of 0.8, an additional 3 years of life would be equivalent to €32 trillion of welfare gains scaled to the EU (a gain corresponding to a significant and sustained growth uplift).

The gains from AI via science may also be less subject to lags than the history of general-purpose technologies would suggest.

A limited number of scientists complementing AI may be sufficient to accelerate science,[36] and the time required for business process innovation may be less of a constraint with, for example, new drugs able to be delivered via existing health care institutions.

A further reason why the application of AI to science looks promising is that there is a clear signal to train on, we can check that a problem is solved or determine experimentally if the result or conjecture is correct.

Gaining regulatory approval for greater numbers of new medicines and materials may however prove a constraint, if regulatory capacity and capability is not scaled to match accelerated discovery.

AlphaFold – an early demonstration of AI accelerating science

AI is not only making incremental contributions to science and technology but also solving what Demis Hassabis refers to as "root-node problems" i.e., core scientific challenges where solving them unlocks downstream progress.

An example is protein structure prediction algorithm AlphaFold. The AlphaFold breakthrough won Demis Hassabis and John

[33] Cowen and Southwood, August 2019, Is the rate of scientific progress slowing down? https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3822691
[34] CDC, May 2013, United States Life Tables Eliminating Certain Causes of Death, 1999–2001. https://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_09.pdf
[35] HIQA, March 2025, National Guidelines for the Economic Evaluation of Health Technologies in Ireland. https://www.hiqa.ie/sites/default/files/2025-03/Economic-Evaluation-Guidelines.pdf
[36] Williamson, January 2026, AI benefits may follow a different power law relationship with adoption than the internet era. https://substack.com/home/post/p-184031788

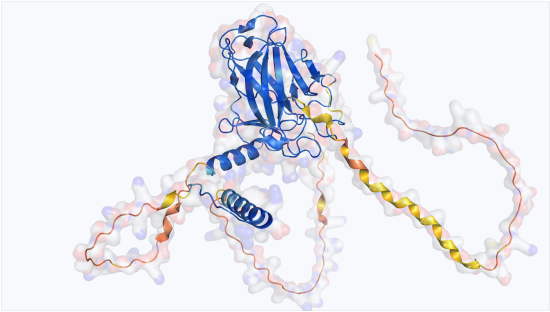
Jumper of Google DeepMind a Nobel prize in Chemistry in 2024.

The reason AlphaFold is an unlock to downstream progress is that DNA determines protein sequences, sequences determine structure and structure is key to biological activity and discoveries in medicine and bioscience.

AlphaFold has increased known protein structures from around 100,000 previously[37] to over 200 million[38].

Figure 6 shows p53 - a cellular tumour antigen related to diseases such as cancer and one of the most popular proteins in the AlphaFold database.[39]

Figure 6: Protein structure related to tumours



Isomorphic Labs, which was spun out of Google DeepMind, is developing and commercialising AI-based prediction of protein interactions, key to designing new medicines.

The wider promise of AI for science

AI is contributing in a range of areas including mathematics, science and medicine, materials science, weather prediction and AI-controlled robotic laboratories.

Large combinatorial problems

AI is particularly suited to large combinatorial problems including protein structure, understanding the genome[40] and developing new medicines and materials.

GNoME found 2.2 million new crystals, including 380,000 stable materials that could power future technologies potentially including improved batteries.[41]

Reasoning

Reasoning models, building on large language models, are trained on problem sets and spend varying amounts of time during inference, depending on the challenge.

While the intelligence of reasoning models remains jagged, they have started to contribute to breakthroughs.

Cell-to-Sentence 27 B, built on the Google Gemma family of open models, generated a novel hypothesis about cancer cellular behaviour, which scientists experimentally validated in living cells.[42] With more preclinical and clinical tests, this discovery may reveal a promising new pathway for developing therapies to fight cancer.

An internal OpenAI version of model GPT-5.2 derived a new formula (Equation 39) in

[37] John Jumper *et al*, July 2021, Highly accurate protein structure prediction with AlphaFold, *Nature* 596.
[38] https://deepmind.google/technologies/alphafold/
[39] Google DeepMind, November 2025, AlphaFold: Five years of impact. https://deepmind.google/blog/alphafold-five-years-of-impact/
[40] Google DeepMind, June 2025, AlphaGenome: AI for better understanding the genome. https://deepmind.google/blog/alphagenome-ai-for-better-understanding-the-genome/
[41] Google DeepMind, November 2023, Millions of new materials discovered with deep learning. https://deepmind.google/blog/millions-of-new-materials-discovered-with-deep-learning/
[42] October 2025, How a Gemma model helped discover a new potential cancer therapy pathway. https://blog.google/innovation-and-ai/products/google-gemma-ai-cancer-therapy-discovery/

theoretical physics related to the strong nuclear force.[43]

AI has also progressed beyond a tool useful in the application of known mathematics to producing proofs in relation to open problems.[44]

Robotics

While AI can help solve combinatorial and reasoning problems, progress in science also depends on testing and experimental validation.

An 'autonomous laboratory' system made up of an LLM 'scientist', lab robotics and human overseers created by scientists at OpenAI and Ginkgo Bioworks achieved a 40% reduction in the cost for protein synthesis.[45]

It is expected that the use of AI and robotics will become widespread for laboratory work, lowering costs and increasing the scale and speed of experiments and testing possible.

Organisation and regulation

A barrier to the acceleration of science and technology is regulation. Where it can be simplified or removed, it should be, but some safety regulation is necessary and will remain.

As AI accelerates innovation, regulatory capacity, to process the increase in new drugs, materials and other innovations requiring approval, should be expanded. It may also be possible to streamline testing by utilising simulation.

AI can also reduce the burden and lags involved with regulatory compliance, and this can have a dividend far greater than administrative savings alone since it can speed up approval, facilitate iterative learning and reduce time to market and therefore the risk associated with high up-front cost innovation.

Novo Nordisk, known for its diabetes and weight-loss drug Ozempic, built a system around Claude that has taken the time required to compile clinical trial reports down from 12 to 15 weeks to just 10 to 15 minutes.[46]

Boom Supersonic utilised AI to help with regulatory filings, and doing so permitted smaller more innovation focused team structures and iterative product development:[47]

"One thing LLMs are very good at is filling out regulatory paperwork...What it allows us to do is go from large armies of turn-the-crank kind of talent to small teams of incredibly creative talent that are no longer change-averse because change is inexpensive." Boom CEO Blake Scholl

AI, science and industry

AI and science are integral to the industries of the future, and to re-inventing existing industry, as noted by the Draghi report:

"With the world on the cusp of an AI revolution, Europe cannot afford to remain stuck in the "middle technologies and industries" of the previous century. We must

[43] OpenAI, February 2026, GPT-5.2 derives a new result in theoretical physics. https://openai.com/index/new-result-theoretical-physics/

[44] OpenAI, May 2026, An OpenAI model has disproved a central conjecture in discrete geometry. https://openai.com/index/model-disproves-discrete-geometry-conjecture/

[45] Smith *et al*, February 2026, Using a GPT-5-driven autonomous lab to optimize the cost and titer of cell-free protein synthesis. https://www.biorxiv.org/content/10.64898/2026.02.05.703998v1

[46] Fortune, December 2025, Anthropic is all in on 'AI safety'—and that's helping the $183 billion startup win over big business. https://fortune.com/article/anthropic-ceo-dario-amodei-openai-chatgpt-artificial-intelligence-safety-donald-trump/

[47] Conversations with Tyler, October 2025, Blake Scholl on Supersonic Flight and Fixing Broken Infrastructure - Live at the Progress Conference (Ep. 261). https://conversationswithtyler.com/episodes/blake-scholl/

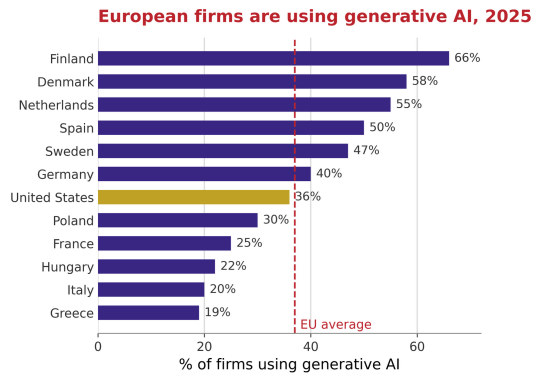
unlock our innovative potential. This will be key not only to lead in new technologies, but also to integrate AI into our existing industries so that they can stay at the front."

AI and tech companies have science programmes including DeepMind Science, OpenAI Science, Anthropic AI for Science, Microsoft Research AI for Science and Mistral initiatives in mathematics and science. The Chan Zuckerberg Initiative is also supporting Biohub to utilise frontier AI to cure or prevent disease.[48]

Industry is adopting AI, and European industry is far from a laggard (Figure 7):[49]

"Across the world, most businesses are still merely dipping their toes in artificial intelligence. Not so Schneider Electric, claims Peter Weckesser, who oversees the digital efforts of the French maker of industrial equipment. It has around 100 applications of the technology already in operation."

Figure 7: AI adoption



Source: EIB Investment Survey 2025; selected countries as in Economist chart.

Siemens, the largest engineering company in Europe, is building on LLMs but training them on domain-specific and machine-specific data.[50] Siemens is using models from Mistral, OpenAI and Nvidia for industrial AI.

Mistral AI and semiconductor equipment manufacturer ASML have partnered to apply AI to accelerate time to market for higher performance lithography systems.[51] ASML invested €1.3 billion in Mistral AI, as part of the strategic partnership.

Mistral AI and Ericsson have partnered to apply AI to telecoms to speed up software delivery and strengthen network performance.[52] Mistral AI and Ericsson will jointly research and co-develop AI agents tailored to Ericsson's data and engineering environments, bringing data closer to AI and enabling faster decision-making in product development and deployment.

The European Commission has expressed concern that the automotive industry in Europe risks falling behind on key technologies including autonomous driving.[53]

Wayve, a London-based self-driving software startup, has received funding from automakers Mercedes-Benz, Stellantis and

[48] Biohub, November 2025, Biohub launches first large-scale scientific initiative combining frontier AI with frontier biology to cure or prevent disease. https://biohub.org/news/ai-biology-cure-disease/
[49] The Economist, January 2026, Europe can still win the other AI race. https://www.economist.com/business/2026/01/22/europe-can-still-win-the-other-ai-race
[50] Decoder Podcast, February 2026, Siemens CEO Roland Busch's mission to automate everything. https://www.theverge.com/podcast/875233/siemens-ceo-roland-busch-ai-automation-digital-twins-nato-tariffs
[51] ASML, September 2025, ASML, Mistral AI enter strategic partnership. https://www.asml.com/en/news/press-releases/2025/asml-mistral-ai-enter-strategic-partnership
[52] February 2026, Mistral AI and Ericsson partner to drive AI innovation in telecom. https://www.ericsson.com/en/news/2026/2/mistral-ai-and-ericsson-partner-to-drive-ai-innovation-in-telecom
[53] European Commission, March 2025, Industrial Action Plan for the European automotive sector. https://transport.ec.europa.eu/document/download/89b3143e-09b6-4ae6-a826-932b90ed0816_en

Nissan.[54] Unlike the vertically integrated Tesla and Waymo self-driving systems, Wayve's AI software system is available to third party car manufacturers.

Signs of success at adopting and incorporating AI are significant, particularly the fact that the expected benefits of AI may be greater from use than production. Bontadini and Haskel (2025)[55] estimate that the split in terms of benefits between production and use will be roughly 40/60 per cent.

The successful development and application of AI across science and industry depends on two things related to training data:

- First, many applications, including those utilising domain specific knowledge for training, are built on the foundations of LLM's trained on a large and diverse corpus of public knowledge.
- Second, the boundary between commercial and non-commercial access to training data should not be unduly distinct, otherwise a barrier to collaboration across academia, AI companies and European industry will be created.

Reinforcing the first point above is evidence that the better the base model quality the better the domain model tends to be,[56] and evidence that a stronger text only backbone benefits multi-modal models[57], relevant to applications including robotics.

Maintaining the TDM exception is essential for the competitiveness and reinvention of European science and industry.

[54] FT, February 2026, UK AI start-up Wayve raises $1.2bn from carmakers and Big Tech. *https://www.ft.com/content/181aee87-4815-4a0e-805f-c1d04f0c2f36*

[55] Bontadini and Haskel, October 2025, AI as an Innovation in the Method of Innovation: Implications for Productivity Growth in the US and Europe. *https://spiral.imperial.ac.uk/server/api/core/bitstreams/aa4caa79-9ed3-4da2-b8f8-8281b022e249/content*

[56] Xu *et al*, March 2025, Pre-trained Models Succeed in Medical Imaging with Representation Similarity Degradation. *https://arxiv.org/html/2503.07958v1*

[57] Le *et al*, March 2024, LLaVA-NeXT: What Else Influences Visual Instruction Tuning Beyond Data? *https://llava-vl.github.io/blog/2024-05-25-llava-next-ablations/#section-1-1-language-models*

7. AI is a tool for media, art and culture

Technology, art and culture are linked and evolve together

AI is a tool that can aid creation, expression and consumption of media, art and culture.

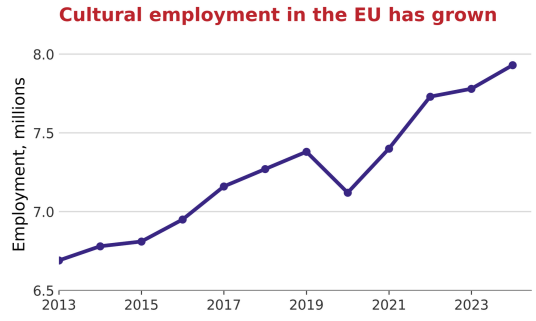
There's no such thing as a perfect analogy, but AI is like getting the Gutenberg press, public libraries and audiovisual technologies all at once.

The printing press eliminated the work of scribes, but opened a vast expansion in printed works, authorship, news media and affordability and literacy.

Photography led to a reduction in portraiture focused on likeness, created the conditions for impressionism and subsequent abstract movements and was used as an artistic tool and aid to painting.

Employment in cultural occupations and cultural sectors in Europe has grown over the past decade, aside from a dip due to COVID-19 (Figure 8).[58]

Figure 8: Cultural employment in the EU



Source: Eurostat, cult_emp_sex. EU cultural employment, 2013–2024.

AI will be disruptive, but not destructive of media, art and culture. Some creative activities will grow, while others may decline, as AI is embraced.

The UK Government commented as follows on the impact of AI:[59]

"Creative industries are among the earliest adopters of AI, both as producers and users of AI tools, and stand to benefit significantly from these gains. As of September 2024, nearly 40% of creative industries businesses had already adopted AI technologies. Createch businesses - those combining creative innovation with advanced technology - are expected to generate £18 billion in GVA and support 160,000 jobs over the next decade. These businesses are present across every creative sub-sector, with an estimated 13,800 creative firms leveraging technologies such as AI, which is already reshaping industries including video games and the performing arts. AI will therefore underpin growth and development across the creative sectors, reinforcing their role as a driver of innovation, productivity, and economic expansion."

AI is opening new forms of creativity

Art and technology have always evolved together, from the use of ochre for cave paintings to music synthesisers.

Glenn Lowry, who ran the Museum of Modern Art (MoMA) for three decades, said scepticism around AI mirrors the reaction to the advent of photography 200 years ago:[60]

[58] Eurostat, "Cultural employment by sex", dataset cult_emp_sex, Eurostat Data Browser. https://ec.europa.eu/eurostat/databrowser/view/cult_emp_sex/default/table?lang=en

[59] HM Government-Department for Science, Innovation and Technology, the Department for Culture Media and Sport, and the Intellectual Property Office, January 2026, Written evidence (AIC0013). House of Lords Communications and Digital Select Committee inquiry: AI and copyright. https://committees.parliament.uk/writtenevidence/161073/html/

[60] CBS News, February 2026, AI artist Refik Anadol uses massive datasets and AI to create immersive works shown around the world. https://www.cbsnews.com/news/artificial-intelligence-creating-art-refik-anadol-60-minutes/

"When suddenly the human hand is removed from the making of an image, what does that mean? And I think artificial intelligence is analogous to that. But I don't think you can stop technology."

Google DeepMind – building on video generation tool Veo – have worked with Primordial Soup, a venture dedicated to storytelling innovation founded by director Darren Aronofsky.[61] Primordial Soup is using Veo to explore new filmmaking techniques – including how to integrate live-action footage with Veo-generated video.

Artist Refik Anadol trained an AI system on publicly available metadata from the MoMA's collection. The finished work – 'Unsupervised' - reimagined 200 years of art in a dynamic video installation.

Unsupervised' was an extraordinary hit and viewers were transfixed. But Art critic Jerry Saltz didn't think lingering crowds were a sign of the artistic merit of 'Unsupervised', and commenting generally on the use of AI to generate art said:

"Most of it is "crap," Saltz said. But he cautioned against overreaction, noting that most art made during the Renaissance was also "crap." AI, he says, is still in its infancy. "AI is one day old. And we're already having conversations, 'I hate it, you love it. It's good, it's bad.' It's new, it's young."

AI opens new creative markets

ElevenLabs, founded by two Polish entrepreneurs, offers AI voice services and a voice marketplace where people can be paid for use of their voices. ElevenLabs also deploys safeguards, including blocking the cloning of political and celebrity voices, requiring verification for voice cloning, and offering an AI audio classifier to help people determine whether an audio clip was generated by ElevenLabs.[62]

AI is helping individuals and smaller teams express themselves

Filmmakers are using AI to compress team size and timescales, but also changing their focus:[63]

"...filmmakers work as creative architects, operating at a higher level of abstraction with and through AI tools."

Illustrative of tools which enhance creative filmmaking is start-up – InterPositive - which according to its founder Ben Affleck:[64]

"...builds an AI model based on an existing production's dailies, then lets a filmmaker introduce that model into the postproduction process to provide the ability to do things like mix and color, relight shots, and add visual effects."

AI is supporting existing media

AI is also helping established media companies focus on the core functions of human creativity and user engagement. Paul Bascobert, president of Reuters: [65]

"...AIs can allow us to get more of our people in the field, more of our people doing the

[61] Google DeepMind, Our partnership with Darren Aronofsky's Primordial Soup. https://deepmind.google/models/veo/
[62] ElevenLabs, February 2026, ElevenLabs partners with the UK Government on voice AI safety research. https://elevenlabs.io/blog/elevenlabs-partners-with-uk-aisi
[63] Social Market Foundation, February 2026, There is an AI in Team: Understanding human-AI collaboration, from tools to teammates. https://www.smf.co.uk/commentary_podcasts/there-is-an-ai-in-team-understanding-human-ai-collaboration-from-tools-to-teammates/
[64] Variety March 2026, Netflix Could Pay as Much as $600 Million for Ben Affleck's AI Film Start-Up: Report. https://variety.com/2026/digital/news/netflix-600-million-ben-affleck-ai-film-startup-interpositive-1236685038/
[65] Nilay Patel (Decoder), 8 May 2025, Reuters is ready to stand up for the press — and embrace AI. https://podcasts.apple.com/gb/podcast/decoder-with-nilay-patel/id1011668648?i=1000706782317&r=3519

distinctive work, the new work, less of our people moving content through the system, and that's really powerful to our mission to cover the world."

Another example is the CANAL+ partnerships with OpenAI and Google to incorporate AI into their app and to accelerate video indexing of their content library.[66]

The music industry is also, as the FT put it, cautiously embracing AI:[67]

"Universal's Nash says the products emerging from its AI deals would contribute to its medium-term forecast of 8 to 10 per cent annual subscription streaming revenue growth, in part by enabling "super premium" tiers."

"Nash says there is "this misunderstanding that AI is going to equally disrupt all media and what's going to happen is the technologies will capture all the value". Instead, he argues, momentum is building around licensing and new music services that would bring "deeper engagement and real participation in music culture", rather than "push a button, [generate] output like AI music slop"."

However, artists are concerned about the impact AI could have on them, and many musicians signed an open letter in 2025 calling for protection of their voice, sound and likeness. Additional protections for individuals, including of likeness, may be justified.

AI may promote the arts including old 'authentic' forms of art

Old forms may also be revived as authentic or elite or glitchy/low-fi. Witness the revival of vinyl recordings and other 'analogue' art.[68]

AI may accentuate this trend by driving a search for 'authenticity' and human connection. AI will also, by creating wealth, promote the arts.

AI is a tool for cultural exploration

AI is also a powerful tool for discovery and exploration of art and culture. You can point your phone at a painting and ask for context; explore any aspect of art, culture and history that takes your fancy; or use AI as a tutor to better understand a genre or improve one's creative skill.

But to be a good guide and tutor, to be accurate and representative, AI needs to learn from diverse training data and cultures.

[66] World Screen, April 2026, CANAL+ Inks AI Deals With OpenAI & Google Cloud. https://worldscreen.com/canal-inks-ai-deals-with-openai-google-cloud/

[67] FT, January 2026, The music industry's cautious embrace of AI. https://www.ft.com/content/a6b657ef-1034-4748-92fd-e24b37fb726e

[68] The Economist, July 2025, The rise of AI art is spurring a revival of analogue media. https://www.economist.com/culture/2025/07/17/the-rise-of-ai-art-is-spurring-a-revival-of-analogue-media

8. AI can contribute to state capacity

State capacity and sovereignty are linked since states with weak economic and technological capacity risk coercion by others.

State capacity is a pressing concern given public indebtedness (around 80% of GDP for the EU), expenditure pressure driven by an ageing population and defence needs, the decline of trust in institutions and slow progress on reform (Draghi etc).

Sovereignty has also risen as a concern given the Russian invasion of Ukraine and conflict in the Middle East disrupting fossil fuel markets, weaponisation of trade and tensions with the US over Greenland and tech[69] and dependence on geographically concentrated advanced chip fabrication. The European Commission announced a tech sovereignty package in June 2026.[70]

The key to navigating these challenges is to recognise the trade-offs involved and to ensure the preconditions are in place to allow AI to improve European competitiveness and grow the economy while also improving the capacity of the state.

Further, AI will change what is possible and radically change the relative cost/price of some things, which will involve out of equilibrium transitional effects. Before reacting, one therefore needs to 'solve for the equilibrium' to avoid adverse unintended consequences.

Confronting trade-offs

Sovereignty cannot be sustained alongside autarky, it is too costly and nations that do not engage in the trade of goods, services and ideas fall behind and become beholden to others.

Sovereignty is best understood as capability plus resilience, not autarky; and whilst concern regarding over-dependence on others can be legitimate, there are trade-offs:[71]

"The existence of a national security externality does not mean every other economic cost ceases to exist. In fact, the story is the opposite - precisely our fragile moment means that the stakes of growth and prosperity are much higher."

Leaving the economy to one side, and focusing on security, trade-offs remain: [72]

"It's not realistic or helpful," said one European military official of the "tech sovereignty" discussions. "Most of our European platforms are relying on American back-end… so it's very difficult to see anything happening in the short term. It's just not possible."

The relevant question is how to reduce risk while minimising the cost in terms of foregone global connectedness and access to frontier technology and services.

Low-hanging fruit for Europe include improving competitiveness by removing

[69] FT, February 2026, EU-US tensions over Greenland and tech are far from over, says Emmanuel Macron. https://www.ft.com/content/b5b248a4-c83b-45d9-b676-2dd2ee12597c

[70] European Commission, June 2026, Strengthening Europe's tech sovereignty. https://commission.europa.eu/news-and-media/news/strengthening-europes-tech-sovereignty-2026-06-03_en

[71] Luis Garicano, March 2025, Trading with bullies. https://www.siliconcontinent.com/p/trading-with-bullies

[72] FT, February 2026, Europe's 'tech sovereignty' ambitions carry security risks, military warns. https://www.ft.com/content/0f7f7aa7-af4e-4ea6-82da-5f8c719982fe

unnecessary constraints to the use and production of technology, which have accumulated over time in a web of complex regulation; and reducing barriers to pan-European business development.

It is also crucial to be realistic and focused on key vulnerabilities rather than attempting to replicate everything. The Draghi report recognised this in relation to cloud computing:

"...the EU must find a middle way between promoting its domestic cloud industry and ensuring access to the technologies it needs. It is too late for the EU to try and develop systematic challengers to the major US cloud providers: the investment needs involved are too large and would divert resources away from sectors and companies where the EU's innovative prospects are better."

Recognising that there are mutual dependencies does not imply foregoing control,[73] [74] and where infrastructure is local that provides a degree of assurance of service continuity irrespective of ownership.

Europe can also facilitate cloud infrastructure, for example, by not precluding nuclear energy where decarbonisation is the underlying goal. A commitment to maintaining TDM would also facilitate European investment in compute and AI.

Reinforcing the importance of energy and TDM to AI and compute investment is the decision in April 2026 by OpenAI to halt its Stargate UK data centre project. OpenAI said high energy costs and the government's decision to delay changes that would have made it easier for AI companies to include copyrighted content in their training data, contributed.[75] Unlike the EU, the UK lacks a TDM exception.

Solving for the equilibrium

AI has already, and will continue to, radically reduce the cost/price of information processing, 'intelligence' and autonomous systems.

This will require market and institutional adaptation as it will lower the cost of producing both good and harmful things. Illustrative is the development of free - at the point of consumption - communications. This has generated enormous benefits but has necessitated ongoing efforts to minimise spam, including the use of AI defences.

Consistent with price stability, price decreases for some things imply that the cost and price of other things - less amenable to the productivity gains from AI - will rise. Relative prices should be allowed to adjust.

AI also opens new possibilities, from drug discovery to enhanced cyber defence and offence.

These effects will result in disequilibria while markets and institutions adapt. It is crucial therefore to be cautious and not necessarily react to first round effects, without thinking through the equilibrium that may emerge.

Take drug discovery. Assuming it accelerates with AI, successful states will be the ones that increase the capacity for clinical trials, streamline them where feasible and, for smaller states, rely more on mutual recognition for drug approvals.

Areas where AI can help both adversarial actors and defence, including cyber security

[73] ECIPE. May 2024, https://ecipe.org/publications/eu-gap-ict-and-cloud-computing/
[74] ECIPE, February 2026, Rethinking European Technological Sovereignty: From Regulatory Control to Capability Building.https://ecipe.org/insights/rethinking-european-technological-sovereignty/
[75] FT, April, OpenAI halts Stargate UK data centre project. https://www.ft.com/content/124189b9-8b2b-4d62-a94b-8a91673ea378

and the information space, may be particularly prone to policy errors if one does not first attempt to solve for the equilibrium.

Expanding on cyber resilience in a world of AI, expert Anne Neuberger said:[76]

"AI does make attack far easier, much more continuous... And as such, defenders who aren't using AI in defense are in a much worse position because a human against a machine in this game just doesn't win. Humans and machines fundamentally can. But there are certain parts of cybersecurity that speed now matters much more, and they have to be automated."

Regulation intended to ensure AI is safe, but which delays development and defensive use of frontier models, might therefore undermine safety; while insisting that a human is in the loop could result in responses to threats that are too slow.

Anthropic's warning regarding the capabilities of Claude Mythos Preview[77] have focused minds on the question of cyber security. However, capabilities are symmetric, they are being used to find and repair potential exploits via 'Project Glasswing'.[78] The equilibrium may be stronger rather than weaker cybersecurity, provided we do not regulate or react in ways that undermines this possibility.

Given the national security sensitivity 'Project Glasswing' brings together only leading software providers. It is not open to all. Efforts to create a sovereign technology stack might therefore backfire if leading AI models were not used for defence, or if sovereign software was relied upon which was not pre-hardened prior to general release of a leading model.

Competitiveness and AI

AI, like electricity, will become a key input to almost everything. And while benefits will arise from production and use of AI, the larger benefit is likely to come from effective use (as they did with electricity and ICT).

The ability to develop and tailor AI models to specific use cases will also matter, Europe needs an environment conducive to both the production and use of AI.

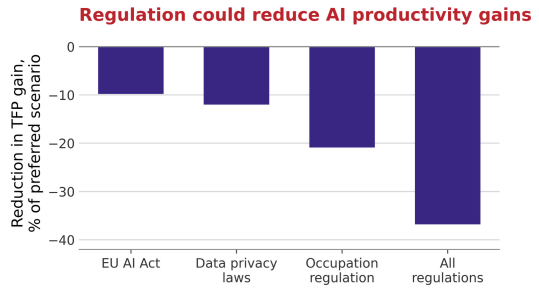
Yet evidence points to the likelihood, without simplification, reform and revised rules to permit the effective use of AI, that Europe will fall behind. The IMF concluded that:[79]

"...we show that national and EU regulations around occupation-level requirements, AI safety, and data privacy combined could reduce Europe's productivity gains by over 30 percent if AI exposure were 50 percent lower in tasks, occupations and sectors affected by regulation."

The IMF broke out the impact of EU regulation as follows (Figure 9).

[76] A16z AI Policy Brief, March 2026, Cyber Resilience in an AI World. https://a16zpolicy.substack.com/p/cyber-resilience-in-an-ai-world
[77] Anthropic, April 2026, Assessing Claude Mythos Preview's cybersecurity capabilities. https://red.anthropic.com/2026/mythos-preview/
[78] Anthropic, April 2026, Project Glasswing. https://www.anthropic.com/glasswing
[79] IMF, April 2025, AI and Productivity in Europe. https://www.imf.org/en/publications/wp/issues/2025/04/04/ai-and-productivity-in-europe-565924

Figure 9: Impact of regulation



Source: Misch et al. (2025), IMF WP/25/67. Approximate values digitised from Figure 8.

Further Bontadini and Haskel (2025)[80] estimate that AI will boost annual labour productivity growth by as much as 1 percentage point in the United States yet only about 0.3 percentage points in Europe. They commented on the gap:

"This is mainly driven by the historic evidence suggesting that Europe has a smaller and less productive upstream software/intangibles sector and lower software/intangible capital deepening.

...our results mirror the influential Draghi report documenting Europe's lag in both the implementation and production of (what he called) "hi-tech" goods..."

This is a gap that Europe can, and should, aim to address. The problem is not simply over-regulation, but also a need to adapt rules in specific domains to permit AI use.

Illustrative is the need to recast safety rules - ranging from those applying to driving to prescribing[81] - so that they permit autonomous systems and AI use subject to outcomes-based safety regulation (rather than current standards framed in terms of human credentials). Other challenges include permitting, as AI is not simply code but requires infrastructure; and flexibility for firms to grow, without excess costs if they fail[82].

State capacity and AI

Escaping the debt trap

AI-driven growth would increase tax revenues, holding the overall taxation share of GDP constant. This would increase the capacity of the state to pursue priorities and manage existing debt.

Higher global growth driven by AI may also drive-up real interest rates (given increased investment demand and higher consumption today - given an expectation of greater wealth tomorrow).[83]

Europe risks higher debt servicing costs without the growth dividend if it doesn't match the growth contribution of AI in other economies.

Escaping zero-sum thinking

Low growth has contributed to zero-sum thinking, the belief that for someone to gain someone else must lose; and its twin, zero sum politics.

The restoration of historical rates of growth therefore offers the prospect of a healthier political environment focused on progress and institution building.

Grand challenges and innovation

AI will, through innovations in biomedicine and materials science, help manage the

[80] Bontadini and Haskel, October 2025, AI as an Innovation in the Method of Innovation: Implications for Productivity Growth in the US and Europe. https://spiral.imperial.ac.uk/server/api/core/bitstreams/aa4caa79-9ed3-4da2-b8f8-8281b022e249/content

[81] British Medical Journal, January 2026, AI: Algorithm that performs prescription renewals "better than doctors" approved in world first. https://www.bmj.com/content/392/bmj.s44

[82] Pieter Garicano, February 2026, Why Europe doesn't have a Tesla. https://worksinprogress.co/issue/why-europe-doesnt-have-a-tesla/

[83] Luis Garicano, August 2025, R without G - Good news on AI could be bad news for Europe's debt problems. https://www.siliconcontinent.com/p/r-without-g

challenges of an ageing population and decarbonisation.

AI can help improve the quality of information, for example, by identifying inconsistencies and errors in exiting literature and by creating 'living evidence' bases that can speed the time from research to clinical practice[84]. AI may also nudge people towards more centrist views.[85]

Another way in which AI may help with the energy transition, beyond advances in materials science with application in areas such as battery technology, is - somewhat paradoxically - by increasing both energy demand and the resources available to fund and bring forward technologies including renewables, nuclear fission and potentially commercial fusion[86]. As the International Energy Agency (IEA) noted:[87]

"...AI has the potential to transform the energy sector in the coming decade. It is set to drive a surge in electricity demand from data centres around the world while also unlocking significant opportunities to cut costs, enhance competitiveness and reduce emissions."

AI empowering the state

AI will also empower the state directly, arguably so much so that we should consider ways to strengthen democracy and limit, or better channel, the power of the state for good.

Used wisely AI can contribute to better quality of government decisions and improve the legislative process[88]. AI allows more options to be considered, can compare approaches and outcomes across nations and regions, and can be used to automate *ex post* review of legislation and regulation, identifying any shortcomings and potentially suggesting changes.

AI can also be used to improve the quality and timeliness of government services, and by doing so may contribute to rebuilding trust in institutions, which has been in decline. Cross country evidence also points to a positive association between average growth over the last ten years and trust in government.[89]

A core function of government is the provision of justice, and while we may not choose to apply AI to criminal justice, it has been applied to dispute resolution with voluntary participation and human oversight.

The American Arbitration Association has utilised AI to assist in settling commercial disputes. The process is transparent, timely and has been well received. By speeding up justice, and relieving pressure on the courts, AI may also contribute to greater trust in the effectiveness of state institutions.[90] [91]

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[84] Alida *et al*, April 2024, A practical guide to living evidence: reducing the knowledge-to-practice gap, *European Journal of Cardiovascular Nursing*, Volume 24, Issue 1. https://pubmed.ncbi.nlm.nih.gov/38584322/

[85] FT, March 2026, Social media is populist and polarising; AI may be the opposite. https://www.ft.com/content/3880176e-d3ac-4311-9052-fdfeaed56a0e?syn-25a6b1a6=1

[86] June 2025, Google and Commonwealth Fusion Systems Sign Strategic Partnership. https://cfs.energy/news-and-media/google-and-commonwealth-fusion-systems-sign-strategic-partnership

[87] IEA, April 2025, Artificial Intelligence: A transformative technology with important implications for energy. https://www.iea.org/topics/artificial-intelligence *AI*

[88] Institute of Government, February 2026, Policy making in the era of artificial intelligence. https://www.instituteforgovernment.org.uk/publication/policy-making-era-artificial-intelligence

[89] Besley, Dann and Dray, April 2025, The global growth slowdown is bad news for trust in government. https://cepr.org/voxeu/columns/global-growth-slowdown-bad-news-trust-government

[90] Decoder, February 2026, The surprising case for AI judges. https://www.theverge.com/podcast/877299/ai-arbitrator-bridget-mccormack-aaa-arbitration-interview

[91] The Dispute Revolution: How AI is Rewriting the Rules of ADR. https://go.adr.org/rs/294-SFS-516/images/2025_Future_Dispute_Resolution_Conference_Report.pdf

AI may reduce problems of information asymmetry in markets, with consumers using AI to make complex comparisons between alternative goods and services, and to help get redress when things go wrong. AI may therefore help resolve some of the problems governments have sought to address, but on a more tailored and dynamic basis than regulation.

AI is also helping with security, notably with cybersecurity. Initially it was feared that AI would offer attackers an advantage, and it does. But it also offers a powerful defence that can identify software vulnerabilities before attackers do.

If regulation, including potential changes to the TDM exception, limits or delays the quality of AI available for defence, it may hand the advantage to offence.

; and attackers are unlikely to be constrained by European regulation.

9. Progress depends on freedom to learn

Progress depends on freedom to learn, create and disseminate new knowledge; and this freedom was fundamentally a European 'invention'.

The foundations began during the Renaissance-era with critical engagement with authority and wider circulation of texts, but it was the Enlightenment that institutionalised open knowledge.

As Joel Mokyr, 2025 'Nobel' winner in economics expressed it:[92]

"The central fact of modern economic growth is the ultimate irreversibility of the accumulation of useful knowledge paired with ever-falling access costs... The decline in access costs meant that knowledge was spread over many more minds and storage devices, so that any reversals in technological progress after the Industrial Revolution were ruled out. If the continued growth of the West was ever in danger, it came from the imbalance between rapid progress in the accumulation of useful knowledge and the more halting and ambiguous changes in supporting institutions."

It is those supporting institutions, and TDM in particular, that are the focus of this section.

Intellectual property rights evolution

The printing press prompted the Statute of Anne (1710), titled "An Act for the Encouragement of Learning" which replaced publishers' indefinite monopoly with time-limited rights vested in authors. Copyright was originally an instrument for the dissemination of knowledge and encouragement of learning.

In the digital era, the EU has acknowledged the centrality of large-scale learning to innovation. Articles 3 and 4 of Directive (EU) 2019/790 on copyright and related rights in the Digital Single Market establish specific exceptions for text and data mining, in recognition of the fact that knowledge analysis at scale is underpinning technological progress.

The EU text and data mining exception is a European strength, not unprecedented globally, but amongst the more permissive frameworks for learning.

Japan offers a broader exception, as there is no opt-out in relation to commercial use. The 2018 amendment to the Japanese Copyright Act introduced an exception permitting the use of copyrighted works for purposes that do not involve the enjoyment of the expressive content of the work. Using a work for purposes such as machine learning is not considered copyright infringement. However, outputs are subject to protection.

Machines as well as humans should be free to learn; what matters in terms of protecting creators is whether outputs, not inputs, duplicate existing works.

Updating technology neutrality in an age of AI

Freedom to learn can also be viewed through the lens of a recurring principle in Europe, namely that law and regulation should avoid prescribing (or privileging) a specific technology.

Thinking of human agents as a 'technology' alongside artificial ones may seem novel, but

[92] Joel Mokyr, June 2005, The Intellectual Origins of Modern Economic Growth, *The Journal of Economic History*, Vol. 65, No. 2. https://people.bu.edu/chamley/HSFref/Mokyr05.pdf

we will be working with AI, and a smooth workflow will require neutrality.

This does not imply neutrality of governance, the ways in which we govern humans and machines will differ depending on the risks and available mechanisms for monitoring, but we should hold humans and AI to the same standard.

Rightsholder protections

Rightsholders can utilise paywalls, opt out, strike commercial agreements that offer value-added access and seek redress through the courts where they consider that their rights have been violated.

Licensing paywalled and archived content

Paywalls have become a feature of the media landscape, driven by the comparative advantage of alternative channels for advertising and the decline in traditional advertising revenues.

Content owners can license access to such content with AI companies and may offer value-added access arrangements. Examples include:

- OpenAI and Axel Springer have a paid partnership including access to content behind paywalls.[93]
- Amazon and the New York Times agreement allowing real-time access to NYT content for use in products (e.g. Alexa) and training.[94]

Value-added APIs

AI companies may value high volume access to content for AI training and output generation. Content owners, provided they offer value-added services, can monetise this demand including for content that is freely available online. Examples include:

- Reddit and Google have a partnership which includes access to Reddit's API. Google gets high-volume and real-time access; the deal is not about paywalled access.
- The Wikimedia Foundation has high-volume API access deals with many major AI developers. Wikipedia's content remains freely available under a Creative Commons license, but the Enterprise program charges for faster, higher-volume access to the data.[95]

Partnerships related to model outputs

Beyond value-added access to training data, there is a growing category of deals related to model outputs.

Getty Images has partnered with Nvidia to build on its model Edify to offer customers generated images and with Perplexity to display Getty Images across its search tools.[96]

Opt-out, terms of service and robots.txt

Under the EU text and data mining framework companies can opt out. Terms of service limits and 'robots.txt' – a voluntary set of instructions telling automated crawlers which paths they're allowed to fetch – can be utilised.[97]

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[93] OpenAI, December 2023, Partnership with Axel Springer to deepen beneficial use of AI in journalism. https://openai.com/index/axel-springer-partnership/

[94] Reuters, March 2025, New York Times partners with Amazon for first AI licensing deal. https://www.reuters.com/business/retail-consumer/new-york-times-amazon-sign-ai-licensing-deal-2025-05-29/

[95] Ars Technica, January 2026, Wikipedia signs major AI firms to new priority data access deals. https://arstechnica.com/ai/2026/01/wikipedia-will-share-content-with-ai-firms-in-new-licensing-deals/

[96] Getty Images, July 2024, Getty Images Introduces Updated AI Model with Increased Speed, Quality, and Accuracy. https://newsroom.gettyimages.com/en/getty-images/getty-images-introduces-updated-ai-model-with-increased-speed-quality-and-accuracy

[97] Google, Introduction to robots.txt. https://developers.google.com/search/docs/crawling-indexing/robots/intro

While major AI companies including Google, OpenAI and Anthropic publish guidance indicating that their crawlers respect robots.txt, it may not be universally respected. Many sites utilise other measures including rate limits and bot detection, while Cloudflare[98] has tools aimed at blocking AI crawlers.

Further, the implementation of the opt-out differs across member states, and the European Commission has consulted on how to make it more standardised.[99]

Legal redress

Content owners can seek redress where they consider that their rights have been violated. There are many cases globally, with some settled and others ongoing.

In Bartz v. Anthropic, Judge Alsup ruled in June 2025 that training on lawfully acquired books was fair use, while Anthropic's separate retention of pirated books in a central library was infringing. Judge Alsup wrote that:[100]

"Like any reader aspiring to be a writer, Anthropic's LLMs trained upon works, not to race ahead and replicate or supplant them — but to turn a hard corner and create something different."

A proposed class settlement over the pirated-books claims received preliminary approval in October 2025.[101]

This case must be considered in the context of US law, and the question of whether training LLMs with pirated data is defensible as fair use was not a decided issue. The decision rested on the fact that pirated books were stored.

The position in the European Union is clear with the Digital Single Market Copyright Directive (Directive (EU) 2019/790) applying to 'lawfully accessible' works which excludes pirated copies.[102]

The above illustrates that content owners may obtain legal redress and that, in at least one US district court decision, training on lawfully acquired books was held to be fair use, while the retention of pirated books was treated separately. In the EU the use of pirated copies is excluded from the TDM exception.

The EU has the basis for a more predictable framework, provided it resists reopening the core exception and instead clarifies implementation.

AI company measures to avoid rights violations

AI companies seek to ensure that model outputs do not violate the rights of content owners. For example, Anthropic model Claude includes, amongst other copyright-related system prompts, the following:[103]

"CRITICAL: Always respect copyright by NEVER reproducing large 20+ word chunks of

[98] The Verge, July 2025, Cloudflare will now block AI crawlers by default. *https://www.theverge.com/news/695501/cloudflare-block-ai-crawlers-default*

[99] European Commission, December 2025, Commission launches consultation on protocols for reserving rights from text and data mining under the AI Act and the GPAI Code of Practice. *https://digital-strategy.ec.europa.eu/en/consultations/commission-launches-consultation-protocols-reserving-rights-text-and-data-mining-under-ai-act-and*

[100] Bartz *et al* v. Anthropic PBC, Filing 231, ORDER ON 122 FAIR USE. Signed by Judge Alsup. (whalc2, COURT STAFF) (Filed on 6/23/2025). *https://docs.justia.com/cases/federal/district-courts/california/candce/3:2024cv05417/434709/231*

[101] Justia U.S. Law, October 2025, Bartz et al v. Anthropic PBC, No. 3:2024cv05417 - Document 437 (N.D. Cal. 2025). *https://law.justia.com/cases/federal/district-courts/california/candce/3:2024cv05417/434709/437/*

[102] DIRECTIVE (EU) 2019/790 on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC. *https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0790*

[103] Ásgeir Thor Johnson, 2025, System prompt leaks – Anthropic. *https://github.com/asgeirtj/system_prompts_leaks/blob/main/Anthropic/old/claude-3.7-full-system-message-with-all-tools.md*

content from web search results, to ensure legal compliance and avoid harming copyright holders."

Policy issues related to model output

From a commercial and policy perspective, focusing on model outputs rather than inputs is likely to be more productive.

In the US, the NO FAKES Act[104] remains proposed rather than enacted, but it advanced out of the Senate Judiciary Committee in June 2026.[105] It targets unauthorised digital replicas of voice and visual likeness rather than the general legality of learning from publicly available works.

The EU's developing transparency architecture reinforces the distinction between training inputs and generated outputs. In June 2026, the European Commission published the final Code of Practice on marking and labelling AI-generated content, supporting compliance with the transparency obligations that become applicable under Article 50 of the AI Act in August 2026.[106] This illustrates how downstream transparency and provenance concerns can be addressed without reopening the legal framework governing access to training material.

As the costs of generating content fall it is questions like these that should be considered, not questions such as whether models should be restricted from using public data for training.

Model outputs versus training inputs

The principle of freedom to learn, which applies to human use of protected works, should apply also to AI; and helps clarify debate over text and data mining.

A focus on outputs renders potentially contentious and complex questions around training data transparency and 'memorisation' largely irrelevant.

What matters is whether model outputs, whether generated by the model or fetched from the web, violate content owners' rights. This is the same standard that applies to humans and not only simplifies things but also ensures that machines and humans can collaborate based on a common set of rules.

In relation to transparency, the challenges and trade-offs include the complexity of how training data should be reported given that it is vast and includes the open web, the fact that the data used for training is constantly evolving, questions of privacy, proprietary information and data curation, and the challenge of determining whether specific training data is subject to copyright[107].

In relation to 'memorisation', models do not remember their training data – they are compressed representations of the relationships embodied in, and inferred from, the training data – but they may, with sufficient prompting, recall fragments of training data with some probability.[108]

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[104] US Congress, April 2025, All Information (Except Text) for S.1367 - NO FAKES Act of 2025. https://www.congress.gov/bill/119th-congress/senate-bill/1367/all-info

[105] Holland & Knight, June 2026, Senate Committee Advances Bill to Protect Name, Image, Likeness and Voice Against Unauthorized AI Use. https://www.hklaw.com/en/insights/publications/2026/06/senate-judiciary-committee-advances-legislation-to-protect-name

[106] European Commission, Code of Practice on Transparency of AI-Generated Content. https://digital-strategy.ec.europa.eu/en/policies/code-practice-ai-generated-content

[107] Coalition for Creativity, September 2023, C4C's Perspective on the EU AI Act: Copyright in Real Life is Messy and AI Discussions Are Not Helping. https://coalition4creativity.org/2023/09/28/c4cs-perspective-on-the-eu-ai-act-copyright-in-real-life-is-messy-and-ai-discussions-are-not-helping/

[108] Ahmed *et al*, January 2026, Extracting books from production language models. https://arxiv.org/html/2601.02671v1

Given that models use search as well as inference to generate responses, debate over 'memorisation' is moot in any case. The greater risk is that content subject to copyright is discovered via the search process, so safeguards need to relate to generation and model outputs.

A focus on model outputs rather than training inputs is the best way forward.

Preserving the TDM exception

The EU has a text and data mining exception, one of the more workable and predictable in the world. Should the EU change it?

A report for the European Parliament's Committee on Legal Affairs (JURI)[109] argued that a prior-authorisation default, rather than an opt-out, should be considered; and that a statutory output-linked remuneration mechanism for rightsholders should also be considered. Parliament has adopted a non-legislative resolution calling for remuneration and transparency.[110]

The JURI study includes the following arguments for reform:

- Statutory remuneration is required to bridge the value gap between creators and AI developers.
- The current TDM exception was not designed to accommodate generative AI training.
- Without reform, the EU risks legal uncertainty, market concentration, and cultural homogenisation.

None of these claims hold up to scrutiny.

The notion of a 'value gap' is not informative

Technological progress increases value overall but also changes relative prices, where value added arises and is distributed.

The claimed existence of a 'value gap' between incumbents and a new production technology is not useful as an argument in shaping policy.

Illustrative is printing which expanded the scope for authorship and availability of books, contributed to the enlightenment and industrial revolution, but reduced the value of scribes.

In the transition from manuscript to print, legal responses focused on licensing, trade privileges, and later copyright - not on a statutory levy to compensate scribes.

History also shows that only a minuscule fraction of the social returns from technological advances are captured by producers[111], most of the benefits pass to users, and the users of AI include the creative industries.

Where the small fraction of value created captured by producers will end up is hard to judge - it is what venture capitalists place their bets on. The outcome depends on how demand, competition and bottlenecks evolve.

[109] JURI, July 2025, Generative AI and Copyright.
https://www.europarl.europa.eu/RegData/etudes/STUD/2025/774095/IUST_STU(2025)774095_EN.pdf
[110] European Parliament, March 2026, Protecting copyrighted work and the EU's creative sector in the age of AI.
https://www.europarl.europa.eu/news/en/press-room/20260306IPR37511/protecting-copyrighted-work-and-the-eu-s-creative-sector-in-the-age-of-ai
[111] Nordhaus, April 2004, Schumpeterian Profits in the American Economy: Theory and Measurement.
https://www.nber.org/system/files/working_papers/w10433/w10433.pdf

Standalone AI companies OpenAI[112] and Anthropic[113] have a combined value of around $1.2 trillion (T) based on funding rounds, compared to Nvidia's value gain of around $4T during the generative AI era. One could ask hypothetically, should AI companies be supported by a levy on Nvidia to bridge the 'value gap'?

Or, given the selloff and decline in market value of software and professional services related stocks during January-February 2026, a loss of $2T for the Software and Services index since its October 2025 peak[114], should they be compensated for the 'value gap'?

The notion that statutory levies and remuneration based on value shifts in the economy are required or desirable is unfounded. But it is legitimate to ask whether the current intellectual property rights framework is fit for purpose.

The TDM Directive was designed for advances such as generative AI

The 2019 TDM exception was introduced in recognition of the growing use of automated techniques:[115]

"New technologies enable the automated computational analysis of information in digital form, such as text, sounds, images or data, generally known as text and data mining. Text and data mining makes the processing of large amounts of information with a view to gaining new knowledge and discovering new trends." Recital 8.

The TDM exception was also forward-looking in intent, recognising the possibility of new technologies:

"In addition to their significance in the context of scientific research, text and data mining techniques are widely used both by private and public entities to analyse large amounts of data in different areas of life and for various purposes, including for government services, complex business decisions and the development of new applications or technologies."

It is therefore unconvincing to argue that the TDM exception was not designed to accommodate new technologies including AI.

Reopening TDM would undermine legal certainty

In relation to legal certainty, reopening the DSM Directive risks extending uncertainty through a prolonged legislative process and a transitional period in which rightsholders cannot reliably predict compliance duties or enforcement approaches. Uncertainty would be reduced by reaffirming the existing TDM framework while strengthening its operational clarity.

Uncertainty at the EU level may also increase the likelihood of market fragmentation. In France, the Senate adopted a bill on 8 April 2026 that would introduce a rebuttable presumption that AI providers had used protected cultural content.[116] The bill subsequently passed scrutiny by the National Assembly's Cultural Affairs Committee in

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[112] FT, February 2026, Nvidia and OpenAI abandon unfinished $100bn deal in favour of $30bn investment. https://www.ft.com/content/dea24046-0a73-40b2-8246-5ac7b7a54323?syn-25a6b1a6=1

[113] Anthropic, February 2026, Anthropic raises $30 billion in Series G funding at $380 billion post-money valuation. https://www.anthropic.com/news/anthropic-raises-30-billion-series-g-funding-380-billion-post-money-valuation

[114] Reuters, February 2026, From software to real estate, U.S. sectors under the grip of AI scare trade. https://www.reuters.com/business/software-real-estate-us-sectors-under-grip-ai-scare-trade-2026-02-13/

[115] European Union, April 2019, Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC (Text with EEA relevance. https://eur-lex.europa.eu/eli/dir/2019/790/oj/eng

[116] UGGCAVOCATS, April 2026, Senate adopts bill to establish presumption of use of cultural content by artificial intelligence providers. https://www.uggc.com/en/senate-adopts-bill-to-establish-presumption-of-use-of-cultural-content-by-artificial-intelligence-providers/

June 2026 but, as of early July, had yet to complete its passage through the National Assembly.

Reopening TDM would undermine pluralism

In relation to market concentration and cultural homogenisation, at the model and application layers, competition is dynamic, including rivalry between closed and open-weight models.

A move toward a more restrictive, transaction-heavy access regime for training data (opt-in by default) would raise compliance and licensing costs, which may disproportionately discourage smaller and open-source model development (the EC technological sovereignty package places emphasis on open-source).

In relation to open source, in the US this has been linked to copyright restrictions and uncertainty:[117]

"China's running away with open source models. I think a lot of it has to do with regulations and legal action due to things like copyright."

A policy goal of promoting competition and access to a plurality of models including models developed in Europe favours improving the workability and harmonisation of the opt-out mechanism, rather than shifting to an opt-in regime.

Greater pluralism in the AI supply ecosystem coupled with freedom to learn would also mitigate cultural homogenisation and help ensure that models are inclusive and representative of European culture and languages.

The elimination of the opt-out might also serve to promote competition, and has been advocated on economic efficiency grounds by Bertin Martens of Bruegel: [118]

"The right to opt out amounts to economically inefficient overprotection of copyright."

The case for removing the opt-out may also become stronger as AI takes on a more central role in the knowledge ecosystem, given the centrality of the "*accumulation of useful knowledge paired with ever-falling access costs" to progress*.

Nevertheless, commercial arrangements have developed against the backdrop of the opt-out, and attempting to eliminate it could undermine legal certainty.

Europe should commit to the existing TDM exception and focus attention on whether protections in relation to model outputs are appropriate.

[117] a16z AI Policy Brief, January 2026, To Regulate AI Effectively, Focus on How It's Used. https://a16zpolicy.substack.com/p/to-regulate-ai-effectively-focus

[118] Bertin Martens, April 2024, Economic arguments in favour of reducing copyright protection for generative AI inputs and outputs, Working Paper Issue 09/2024. https://www.bruegel.org/sites/default/files/2024-04/WP%2009%20040424%20Copyright%20final_0.pdf