SITRA

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APPLYING AI IN KEY EUROPEAN INDUSTRIES

Strengthening competitiveness and innovation in Europe

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Europe's competitiveness and strategic autonomy can be strengthened by accelerating and prioritising creation of vertical AI models and solutions. This working paper examines how sector-specific AI can drive innovation, unlock new opportunities and overcome key barriers to AI adoption in Europe. By establishing leadership on vertical AI, Europe can secure a stronger position in the global market.

Sitra working paper

Applying AI in key European industries – strengthening competitiveness and innovation in Europe

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Foreword

In the rapidly evolving global landscape of artificial intelligence (AI), Europe finds itself at a crossroads. The current five-year term of von der Leyen's second Commission will be a watershed moment for Europe's data economy and competitiveness. AI is the most transformative technology of our times.

This study explores how Europe can enhance its competitiveness and strategic autonomy through the effective use of AI. The biggest productivity gains come from effective application of AI in all industry verticals and areas of life. Applied AI refers to artificial intelligence tailored for specific domains, such as healthcare, logistics and manufacturing, where data and operational contexts play a critical role. As foundational AI models become increasingly commoditised, domain-specific data and expertise will define the next wave of innovation, providing a key advantage for those who can leverage them effectively. Europe has the potential to lead in this space, but seizing this opportunity requires deliberate effort and strategic investment.

The development of AI applications that integrate specialised datasets is still in its early stages. Similarly, AI agents – autonomous systems capable of performing complex tasks – are only beginning to show their true potential. To fully capitalise on these advancements, Europe must establish an AI-driven growth engine, or "AI flywheel" that fosters a self-sustaining cycle of innovation, investment, and ecosystem development. A robust AI flywheel can propel Europe's leadership in AI applications, ensuring a steady flow of breakthroughs that contribute to both sustainable economic prosperity and increased strategic autonomy.

This working paper by the Finnish Innovation Fund Sitra has two key objectives. Firstly, it provides an overview of applied AI and its transformative potential in various sectors. Secondly, it presents recommendations by the author Mika Ruokonen and Sitra, and seeks to initiate an early-stage dialogue among policymakers, industry leaders, and other stakeholders about the next steps for shaping a comprehensive applied AI strategy. By engaging in this discussion now, Europe can position itself at the forefront of AI-driven advancements and create a competitive edge in the evolving global AI landscape.

We extend our special thanks to Mika Ruokonen, the author of this paper, for his valuable collaboration. We invite you to explore the insights presented in this paper and join the conversation on how Europe can turn applied AI into a powerful force for innovation, economic growth, and strategic autonomy.

Kristo Lehtonen and Heikki Aura

Kristo Lehtonen is the Director of International Programmes at Sitra. Heikki Aura is the team lead for Data and AI at Sitra.

Summary

The international AI market is expanding rapidly. The aim of this report is to explore the potential of Europe in the field of applied AI. Applied AI refers to AI solutions tailored to different domains, such as healthcare, logistics and manufacturing, which exploit the knowledge of each specialisation and take into account the constraints of the domain's operational environment, such as regulation. The greatest productivity gains from AI can be achieved when it is applied efficiently and in a targeted manner across different industries. Generic AI solutions such as ChatGPT can improve productivity, but because they are widely available, their use is not able to provide companies with a sustainable competitive advantage.

Europe has the potential to become a leader, especially in applied AI, if it invests in vertical AI models that can be developed for different industries and provide unique added value, as well as AI applications and agents for automating different tasks and interacting with systems. Applied AI offers opportunities in both consumer and business markets. Europe should focus on creating innovative AI applications and services for the consumer sector, which respond to new and evolving needs. For businesses, the focus should be on developing specialised AI solutions that can solve complex, sector-specific problems.

This report shows that Europe is lagging behind the US and China in AI investment and that Europe's fragmented markets and dependence on foreign technology suppliers have slowed the adoption of AI. At the same time, with its skilled workforce and strong and diversified industries, Europe can seize significant opportunities in the field of applied AI solutions. However, AI investment and uptake needs to be accelerated in Europe, in both the private and public sectors. Europe needs to invest in a wide range of AI areas, including large-scale language models in all official EU languages, vertical AI models tailored to key industries and various types of AI agents. The scale of investment may vary, but a holistic approach is essential.

Europe should also pursue other measures to improve its position in the global AI cloud and develop AI and its application based on European values. The report sets out six recommendations that Europe can implement to strengthen its competitiveness, foster innovation and ensure strategic self-sufficiency in the rapidly evolving field of AI:

1. Europe needs to strengthen its strategic autonomy in AI and harness the power of its large single market.
2. Affordable and sustainable computing resources are fundamental in enabling the creation of AI applications.
3. Ensure availability of large language models in all EU languages.
4. Ensure access to high-quality industry-specific data.
5. Invest in the substantial evolution of AI-related workforce skills.
6. Securing adequate financing for applied AI is a strategic opportunity for the EU.

Tiivistelmä

Kansainväliset tekoälymarkkinat laajenevat nopeasti. Tämän selvityksen tavoitteena on tutkia Euroopan mahdollisuuksia soveltavan tekoälyn alalla. Soveltavalla tekoälyllä tarkoitetaan eri toimialoille, kuten terveydenhuoltoon, logistiikkaan ja valmistavaan teollisuuteen räätälöityjä tekoälyratkaisuja, jotka hyödyntävät kunkin erikoisalan tietoja ja ottavat huomioon alan operatiivisen ympäristön reunaehdot, kuten sääntelyn. Suurimmat tuottavuushyödyt tekoälystä voidaan saada, kun sitä sovelletaan tehokkaasti ja kohdistetusti eri toimialoilla. Yleiset tekoälyratkaisut, kuten ChatGPT, voivat parantaa tuottavuutta, mutta koska ne ovat laajasti eri tahojen saatavilla, niiden käyttö ei kykene tarjoamaan yrityksille pysyvää kilpailuetua.

Euroopan on mahdollista nousta johtoasemaan ennen kaikkea soveltavan tekoälyn alalla, mikäli se panostaa eri toimialojen tarpeisiin kehitettäviin ja ainutlaatuista lisäarvoa tuoviin niin sanottuihin vertikaalisiin tekoälymalleihin sekä eri tehtävien automatisointiin ja järjestelmien vuorovaikutukseen käytettäviin tekoälysovelluksiin ja -agentteihin. Soveltava tekoäly tarjoaa mahdollisuuksia niin kuluttaja- kuin yritysmarkkinoilla. Euroopan olisi keskityttävä luomaan kuluttajatoimialalle innovatiivisia tekoälyä hyödyntäviä sovelluksia ja palveluja, jotka vastaavat uusiin ja kehittyviin tarpeisiin. Yrityksille painopisteen tulisi olla sellaisten erikoistuneiden tekoälyratkaisujen kehittämisessä, joilla voidaan ratkoa monimutkaisia, alakohtaisia ongelmia.

Tämä selvitys osoittaa, että Eurooppa on jäänyt jälkeen Yhdysvaltojen ja Kiinan tekoälyinvestoinneista ja Euroopan pirstaleiset markkinat sekä riippuvuus ulkomaisista teknologiatoimittajista ovat hidastaneet tekoälyn käyttöönottoa. Samalla Euroopalla on osaavan työvoimansa ja vahvojen ja monipuolisten toimialojensa ansiosta huomattavia mahdollisuuksia, joihin tarttua soveltavien tekoälyratkaisujen saralla.

Tekoälyinvestointeja ja tekoälyn käyttöönottoa on kuitenkin nopeutettava Euroopassa niin yksityisellä kuin julkisella sektorilla. Euroopassa on investoitava useille eri tekoälyaloille, kuten laajoihin kielimalleihin kaikilla EU:n virallisilla kielillä, keskeisille toimialoille räätälöityihin vertikaalisiin tekoälymalleihin ja erilaisiin tekoälyagentteihin. Investointien laajuus voi vaihdella, mutta kokonaisvaltainen lähestymistapa on välttämätön.

Euroopan tulee jatkaa myös muita toimenpiteitä, joilla se voi parantaa asemaansa maailmanlaajuisessa tekoälykilvassa ja kehittää eurooppalaisiin arvoihin perustuvaa tekoälyä ja sen soveltamista. Selvityksessä esitetään kuusi suositusta, jotka toteuttamalla Eurooppa voi vahvistaa kilpailukykyään, edistää innovointia ja varmistaa strategisen omavaraisuuden nopeasti kehittyvällä tekoälyn alalla:

1. Euroopan tulee vahvistaa strategista autonomiaansa tekoälyn alalla sekä hyödyntää suuren yhteismarkkinansa voima.
2. Tekoälysovellusten luomiseksi Euroopassa on oltava riittävästi tarjolla kohtuuhintaista ja kestävästi tuotettua laskentakapasiteettia.
3. Suurten kielimallien saatavuus kaikilla EU-kielillä tulee varmistaa.
4. Pääsy laadukkaisiin toimialakohtaisiin datavarantoihin tulee varmistaa.
5. Tekoälyyn liittyvän osaamisen kehittämiseen on investoitava merkittävästi.
6. Tekoälysovellusten kehittäminen vaatii pitkäkestoisia investointeja, ja samalla tämä tarjoaa Euroopalle myös merkittäviä strategisia mahdollisuuksia.

Sammanfattning

Den internationella AI-marknaden expanderar snabbt. Syftet med den här rapporten är att utforska Europas potential inom tillämpad AI. Tillämpad AI avser AI-lösningar som är skräddarsydda för olika sektorer, t.ex. hälso- och sjukvård, logistik och tillverkning, och som utnyttjar kunskapen
inom varje specialsektor samt tar hänsyn till begränsningarna i sektorns operativa miljö, t.ex. reglering. De största produktivitetsvinsterna med AI kan uppnås när den tillämpas effektivt och målinriktat i olika branscher. Generiska AI-lösningar som ChatGPT kan förbättra produktiviteten, men eftersom de är allmänt tillgängliga kan användningen av dem inte ge företagen en hållbar konkurrensfördel.

Europa har potential att bli ledande, särskilt inom tillämpad AI. Förutsättningen är att Europa investerar i vertikala AI-modeller som kan utvecklas för olika branscher och ge ett unikt mervärde, samt i AI-applikationer och agenter för att automatisera olika uppgifter och interagera med system. Tillämpad AI erbjuder möjligheter på både konsument- och företagsmarknaden. Europa bör fokusera på att skapa innovativa AI-applikationer och AI-tjänster för konsumentsektorn som svarar på nya och föränderliga behov. Företagen bör fokusera på att utveckla specialiserade AI-lösningar som kan lösa komplexa, branschspecifika problem.

Den här rapporten visar att Europa ligger efter USA och Kina när det gäller AI-investeringar och att Europas fragmenterade marknader och beroende av utländska teknikleverantörer har bromsat införandet av AI. Samtidigt har Europa, med sin kvalificerade arbetskraft och sina starka och diversifierade industrier, betydande möjligheter att ta vara på när det gäller tillämpade AI-lösningar.

Investeringarna i och användningen av AI måste dock påskyndas i Europa, både inom den privata och offentliga sektorn. Europa behöver investera i ett brett spektrum av AI-områden, inklusive storskaliga språkmodeller på alla officiella EU-språk, vertikala AI-modeller som är skräddarsydda för nyckelbranscher och olika typer av AI-agenter. Omfattningen av investeringarna kan variera, men ett holistiskt synsätt är viktigt.

Europa bör också vidta andra åtgärder för att förbättra sin position i det globala AI-racet och utveckla AI och dess tillämpning utifrån europeiska värderingar. I rapporten lämnas sex rekommendationer som, om de genomförs, kommer att göra det möjligt för Europa att stärka sin konkurrenskraft, främja innovation och säkerställa strategisk självförsörjning inom det snabbt växande AI-området:

1. Europa måste stärka sin strategiska autonomi inom AI och utnyttja kraften i sin stora inre marknad.
2. Investeringar i överkomliga och hållbara dataresurser behövs för att säkra grunden för skapandet av AI-applikationer.
3. Tillgången till stora språkmodeller på alla EU-språk måste säkerställas.
4. Tillgång till högkvalitativa branschspecifika databaser måste säkerställas.
5. Betydande investeringar behövs i utvecklingen av AI-relaterade färdigheter.
6. Tillräcklig finansiering för utvecklingen av tillämpad AI måste säkerställas, eftersom det är en strategisk möjlighet för EU.

1. Introduction: Europe's competitive edge lies in applied AI

Artificial intelligence is reshaping industries, societies, and global competitiveness. The purpose of the study is to explore Europe's opportunities in applied AI, focusing on strategic autonomy, economic competitiveness, and the actions needed to position Europe as a global AI leader.

Artificial intelligence (AI) is widely recognised as one of the most transformative technologies of our time, with immense potential to drive productivity growth across Europe. Companies across industries are rapidly increasing their investments in AI and many of them are seeing measurable business results (Bean 2025). Most recently, generative AI and large language models (LLMs) have taken centre stage. A recent McKinsey (2024a) study highlights that adopting a holistic approach to fully capitalise on generative AI's potential could boost European labour productivity by up to 3% annually through 2030, particularly in consumer business, construction and real estate, professional services, transportation and advanced manufacturing sectors (McKinsey 2024c). And, generative AI represents only a fraction of all AI technologies available – such as machine learning, computer vision, and biometrics – suggesting that the overall impact of AI, in its various forms and applications, could be even greater. While AI presents a critical opportunity to address Europe's growth and productivity challenges, it also raises concerns about its potential to disrupt jobs and job markets.

Europe appears ready to rise to the AI challenge. In his recent report on European competitiveness, Mario Draghi (2024), former President of the European Central Bank and Prime Minister of Italy, emphasised the need to increase R&D investments in breakthrough technologies and commercial applications, establish coordinated large venture capital funds for scaling tech startups, and eliminate regulatory barriers by harmonising rules across EU member states to create an innovation-friendly single market. He stated:

> 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.

Draghi's call to boost R&D investments and lift productivity reflects two critical challenges Europe currently faces: demographic decline and an uncertain geopolitical environment.

Further, Ursula von der Leyen, President of the European Commission, in her political guidelines in July 2024 outlined concrete initiatives to drive AI adoption in collaboration with member states, industry, and civil society. She explained:

> We must now focus our efforts on becoming a global leader in AI innovation… we will ensure access to new, tailored supercomputing capacity for AI start-ups and industry through an AI Factories initiative. We will also develop with Member States, industry, and civil society an Apply AI Strategy to boost new industrial uses of AI and to improve the delivery of a variety of public services, such as healthcare.

The European Union has taken a decisive step in AI investment with the launch of the €200 billion InvestAI initiative, announced in February 2025. This funding program aims to supercharge Europe's AI capabilities by mobilising capital for AI gigafactories, large-scale research and development hubs designed to advance cutting-edge AI models. Structured as a CERN-like public-private partnership, InvestAI will provide scientists, startups, and companies of all sizes with the resources needed to develop the very large AI models essential for making Europe a global AI leader (European Commission 2025c).

Building on this, Henna Virkkunen, Executive Vice-President for Tech-Sovereignty, Security, and Democracy at the European Commission, is spearheading efforts to implement key AI initiatives. Further steps are being taken to operationalise the AI Factories programme, which has already received billions in public funding and is expected to unlock much more in private investment. These AI Factories provide startups and industry with access to supercomputing resources, enabling them to develop and scale cutting-edge AI solutions. Thirteen projects have already been selected, combining national and EU funding (European Commission 2024, 2025a and 2025c, EuroHPC 2024).

Additionally, she is advancing the "Apply AI Strategy" to accelerate industrial AI adoption and improve public services. She has also been tasked with establishing a "European AI Research Council" – also referred to as "CERN for AI" – to pool European resources like computing and researchers to support AI research in Europe (Kaltheuner & Saari 2024b). Lastly, progress is underway on the timeline and scope of the proposed EU Cloud and AI Development Act, expected to take shape in 2025 (Kaltheuner & Saari 2024b).

While AI as a general-purpose technology presents exciting opportunities in companies, such as identifying new products and markets and automating routine or hazardous tasks, it also poses difficulties for achieving long-term differentiation (Treves et al. 2024). Since these systems rely on similar algorithms and databases and learn from the new inputs of all users equally, the solutions they generate are often generic. Standard general-purpose systems like large language models offer similar capabilities to all users, levelling the competitive playing field (Frazier et al. 2024).

In addition, AI's effects are so profound and widespread that virtually all companies are compelled to adopt such technologies in their business. Relatively soon, nearly all companies have applied standard AI systems, and they will not be a source of competitive advantage, even if their impact is big in delivering productivity gains. The ones that will likely win with such standard systems will only be those who can apply them to amplify the competitive advantages they already have (Frazier et al. 2024, Barney & Reeves 2024). McKinsey (2024b) describes this as choosing "to use the same bricks to build a house that looks just like the one next door." As a result, while new value may be created with AI, it is not always sustainably captured.

This calls for a different perspective. While the global AI race has been dominated by the so-called bigger is better paradigm – pushing companies to develop ever-larger models – the EU should adopt a more balanced approach. The €200 billion InvestAI initiative provides the resources to support both large-scale AI development and more specialised, tailored models that align with Europe's strengths (Kaltheuner & Saari 2024a). Instead of competing purely on scale, Europe can carve out a competitive advantage by focusing on smaller, domain-specific AI models and specialised use cases, where it has unique expertise and market needs.

To fully harness AI for growth and productivity, Europeans should make targeted investments and apply it in industry-specific verticals where its impact is most tangible (Bessemer Venture Partners 2024, Kim 2023). **Vertical AI models** are specialised solutions that (1) integrate industry-specific data and

expertise, (2) address precise operational challenges, and (3) deliver measurable value by optimising workflows and enhancing decision-making within targeted sectors. Moreover, AI's advantages are largely realised through applications, with **AI agents** emerging as particularly promising innovations right now (Gate.io 2024, Marshall 2024, Thornhill 2024). AI agents are autonomous software programs that (1) execute tasks with minimal human intervention, (2) adapt and learn from interactions, and (3) enhance efficiency and decision-making across various industries by dynamically responding to their environment. Europe must strategically select its AI priorities – in our view, these two areas of applied AI offer the best opportunities for European companies to lead globally while driving both economic growth and security.

CASE STUDY

Aleph Alpha: advancing sovereign AI solutions for Europe

Aleph Alpha, a German AI startup founded in 2019, aims to develop a sovereign generative AI technology stack that operates independently of US companies and complies with European data protection regulations. Originally focused on large language model development, Aleph Alpha has recently pivoted towards providing AI consulting services and creating an AI operating system. This strategic shift reflects the company's response to intense competition in the AI sector and its focus on delivering tailored solutions for enterprises and governments.

In September 2024, Aleph Alpha introduced PhariaAI, an enterprise-grade operating system for generative AI. Designed to meet European data protection standards, PhariaAI features a sovereign architecture, LLM explainability, and regulatory compliance. This launch highlights Aleph Alpha's commitment to enable secure and future-proof AI solutions tailored to the specific needs of European organisations. (Aleph Alpha 2025)

To support decision-making and policy development in the EU, this study provides neutral, actionable insights into vertical AI models and AI agents in the context of European competitiveness and strategic autonomy. The analysis explores what these applied technologies are, what they enable, where Europe's opportunities lie, and how the continent can leverage them. The findings and recommendations are tailored for stakeholders within the EU context, helping them understand the potential and implications of these applied AI solutions. With the global AI race accelerating and the stakes higher than ever, Europe must overcome its current gaps in AI adoption, investment, and sovereignty, and act decisively to secure its position and claim its fair share of the value AI is creating worldwide.

The study is organised as follows, Chapter 2 discusses Europe's current situation and barriers with AI adoption, including spending, investments, innovation activities, and trade dynamics. Chapter 3 defines vertical AI models and AI agents, highlighting their similarities,

differences, and the drivers for companies to develop them. Chapter 4 explores how vertical AI models are transforming key European industry segments. Chapter 5 focuses on the emerging status of AI agents and their business potential. Chapter 6 examines the size and growth of AI markets and the investment needs for vertical AI models and AI agents in Europe. Chapter 7 identifies two key opportunity areas for Europe in applied AI: one in B2C and one in B2B. Finally, Chapter 8 concludes the study by summarising key findings and presenting six recommendations for Europe to succeed in the global AI race.

Out of scope: this study is not about the following

Other geographies: the study exclusively focuses on Europe, leaving out an in-depth analysis of AI developments, markets, and policies in other regions, such as the United States, China, or other global economies.

Non-AI technologies: technologies that are not directly related to AI – such as blockchain, quantum computing, consumer devices, and traditional IT systems – are not covered, unless they specifically intersect with AI applications.

Non-business topics: ethical considerations, sustainability issues, and societal impacts of AI – while important – are beyond the primary focus of this study which is centred on business competitiveness and strategic autonomy.

Basic AI research: fundamental research into AI – such as algorithm development or breakthroughs in neural network architecture – is not the focus. Instead, the study emphasises applied AI solutions, such as vertical AI models and AI agents.

AI regulation details: although the study acknowledges the significance of AI regulations (e.g., AI Act, Data Act), it does not provide detailed legal analysis or recommendations on compliance.

Education and workforce policies: broader discussions on systemic changes to education systems or labour policies are excluded, though references to workforce skills for AI adoption are made where relevant.

2. Overcoming European AI adoption barriers

Europe faces challenges in AI adoption, including fragmented markets, limited private investments, and dependence on external technology providers. However, with its strong talent base and diverse industries, Europe has significant untapped potential in applied AI solutions.

Admittedly, our starting point presents a challenge. Western European companies lag behind their US counterparts in AI and IT spending, with gaps ranging from 45% to 70% across all sectors. In similarly sized industries like advanced manufacturing, chemicals and construction, the lag is 45% to 55%. The disparity is even greater, 50% to 70% in sectors where the US market is significantly larger, such as healthcare, high tech, and media. (McKinsey 2024c) On the other hand, China's centralised, state-driven AI strategy and strong government-backed funding give it a long-term competitive edge, particularly in industrial AI and large-scale infrastructure projects. In tech development, Europe holds a fair market share in AI semiconductors (European companies include e.g. ASML, Infineon, and STMicro-electronics) and services development (see the examples of Aleph Alpha and Mistral AI) but has sovereignty gaps in critical AI raw materials, cloud infrastructure, and super-computing capabilities (McKinsey 2024c).

Besides sovereignty gaps, there are also funding gaps: since 2022, over 90% of funding for large language model development has taken place outside Europe. In 2023, the United States dominated global AI private investment, attracting €63.8 billion, that is, 8.7 times more than China (€7.4 billion) and 17.8 times more than the United Kingdom (€3.6 billion) (Stanford University 2024). In early 2025, US President Donald Trump, in collaboration with top tech firms, announced a $500 billion investment in AI infrastructure over the coming years (Duffy 2025). Shortly after, the EU launched its own €200 billion initiative, marking its largest AI-focused investment to date (European Commission 2025c). These staggering figures underscore the escalating stakes in the global AI race.

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In 2023, the total AI private investment in Europe was €10.5 billion, slightly surpassing China but falling significantly short of the US. Among European nations, Germany (€1.8 billion), Sweden (€1.8 billion), and France (€1.6 billion) were the only countries to rank in the global top 10, but their investments lagged far behind the leaders. Additionally, European companies contributed only 25 of the 101 AI models recognised as notable, compared to 61 models from US companies (Stanford University 2024). When, however shifting from absolute terms to per capita rankings four EU countries rank among the global top ten, including Luxembourg (#1), Finland (#5), Ireland (#6), and Sweden (#10) (Fattorini et al. 2024).

There is also a broader R&D and innovation-related problem in Europe. The economic competitiveness of Europe has significantly declined, with a growing GDP per

capita gap compared to the US (Draghi 2024), which has doubled to 30 percent due to lower productivity growth and fewer working hours (e.g. German employees work 20-30 percent fewer hours than Americans, OECD 2024). A critical issue is the corporate sector's failure to innovate, with US tech companies spending more than twice as much on R&D than their European counterparts, leading to a 40 percent increase in US tech productivity since 2005, while Europe's productivity has stagnated (Karnitschnig 2024).

Since 2022, over 90% of funding for large language model development has taken place outside Europe.

A half of Europe's R&D spending comes from Germany, with most of it directed to the automotive sector, which accounts for over 30 percent of global automotive R&D (VDA 2023), but to a large extent focuses on incremental improvements rather than transformative new market creation innovation. This over-reliance on automotive R&D, at the expense of digital technologies and AI, has left European industries poorly equipped for major technological shifts like electric vehicles and advanced digital ecosystems. In sum, Europe faces challenges in working hard enough, fostering innovation and aligning its R&D investments with transformative priorities that could drive future competitiveness.

Geopolitical and trade tensions between the U.S. and China have intensified recently, influencing the global landscape for AI and technology development. Governments increasingly view AI through the lens of national security. Under President Joe Biden, the US imposed steep tariffs and export controls, including restrictions on advanced semiconductor technologies critical for AI development, citing national security concerns (Hawkins 2025, Knight & Matsakis 2024). China has responded with warnings of "necessary actions" if these measures escalate and has begun subsidising local AI adoption, access to computing power and the purchase of domestically produced AI chips, reflecting the strategic importance of AI in global power dynamics (Reuters 2024a). The European Union has also taken steps to protect its AI and tech ecosystems, emphasising data protection, cybersecurity, transparency, user rights, and the responsibilities of gatekeeper platforms, while imposing anti-dumping duties on imports (Reuters 2024b, Swartz 2024). These actions highlight the growing competition to control AI innovation and safeguard economic, security, and sovereignty interests amid broader trade disputes.

Choosing battles to secure Europe's AI competitiveness and autonomy

In the EU context, competitiveness refers to the ability of the EU economy to achieve sustained productivity growth in critical sectors and strategic areas such as data economy, thereby driving economic expansion, increasing income levels, and enhancing overall welfare. This encompasses creating an environment where businesses can thrive, fostering innovation and ensuring efficient markets. The EU's focus on competitiveness involves implementing policies that support investment, innovation and the efficient functioning of markets to maintain and improve its position in the global economy (EUR-Lex 2025, European Commission 2025b).

Strategic autonomy, on the other hand, refers to the EU's ability to defend and promote its values and interests in a world currently characterised by geopolitical tensions and geoeconomic competition between the major global powers (Sitra 2024b). It requires the EU to strengthen its own resilience and to reduce over-dependence on key enabling and emerging technologies that are considered critical for

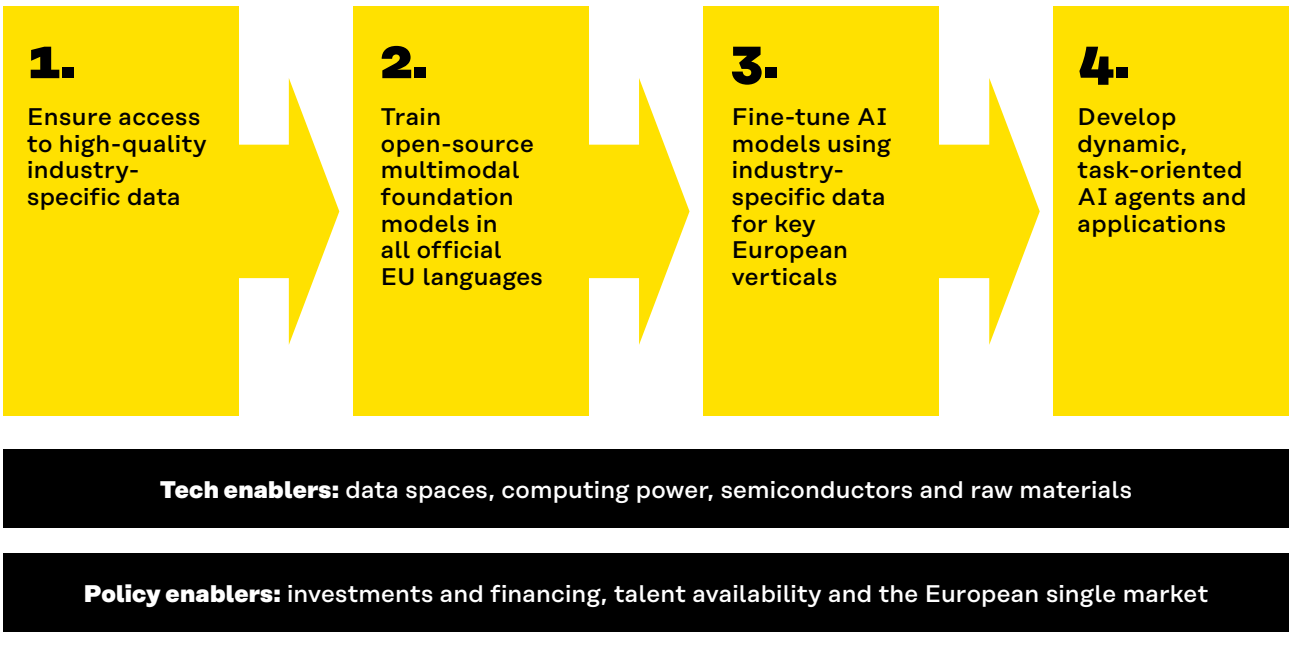
our economy, security or the democratic development of our societies (Borrell 2020, EPRS 2020). To address this, the European Commission, in October 2023, identified ten critical technology areas for the EU's economic security, such as semiconductors, quantum computing and artificial intelligence, and started a process with member states to identify vulnerabilities in value chains (European Commission 2023).

The real challenge for the EU is to navigate successfully in these circumstances. Given that our starting point with AI is far from optimal, achieving competitiveness and strategic autonomy is easier said than done. The European Union's significant investments in high-performance computing (HPC) have been a hallmark of President Ursula von der Leyen's first Commission, contributing to Europe's digital sovereignty and technological leadership. The EuroHPC Joint Undertaking has played a key role in deploying world-class supercomputers across Europe, including the LUMI supercomputer in Finland, one of the world's fastest supercomputers.

Building on this foundation, von der Leyen's second Commission is scaling up AI investments, most notably through the €200 billion InvestAI initiative, launched in February 2025, to drive AI innovation and commercialisation across Europe. At the same time, the AI Factories initiative is leveraging HPC infrastructure to develop trustworthy, cutting-edge generative AI: they serve as hubs connecting universities, supercomputing centres, industry and financial actors.

Figure 1 outlines a step-by-step path to advancing applied AI in Europe, beginning with access to high-quality data and culminating in the deployment of dynamic AI agents to automate key use cases. European companies have overall made significant progress in data management and AI development, however substantial opportunities remain in the implementation of large language models, further fine-tuning of vertical AI models and advancing AI agents to strengthen Europe's competitive position.

Figure 1. Steps for advancing AI in Europe.



As we outline later in this study, Europe should focus on choosing its battles wisely. Competing head-to-head with global tech giants – US firms in particular – in generic AI solutions or mass-consumer digital platforms is unlikely to be feasible. Instead, we encourage decision-makers to seize the significant opportunities emerging in industry-specific vertical AI solutions and task-oriented AI agents. Far from being mere "niches" of the AI market, these two segments represent a substantial portion of the AI value currently up for grabs (see Chapters 6 and 7 below for an elaboration on market sizes and opportunities).

To succeed with vertical AI models and AI agents in Europe, much work remains to be done. This includes investing in key AI-enabling technologies such as data availability, algorithms, computing power and industry-specific expertise to apply AI effectively in practice. Across the European business landscape, success will require (1) AI-native startups that capitalise on emerging AI opportunities by building scalable, AI-driven products, (2) large digital platforms that integrate advanced AI capabilities into their product and service offerings and (3) industry incumbents pursuing ambitious, scalable AI initiatives to drive growth and productivity (Hosanagar & Krishnan 2024, Sarlin 2024). At the same time, Europe must address and mitigate the potential negative impacts of AI, including risks to security, privacy, job displacement and reliance on technologies from other continents.

3. Vertical AI models and AI agents: definitions, differences, and drivers for development

Vertical AI models and AI agents are applied AI solutions critical to Europe's AI strategy. While both focus on specific use cases, their capabilities differ: vertical models deliver precision in industry-specific challenges, while agents act autonomously to execute tasks and decisions.

As AI adoption accelerates across industries, understanding the distinctions and complementarities between vertical AI models and AI agents – both part of the broader category of applied AI – is essential for leaders and policymakers seeking to deploy these technologies strategically.

What are vertical AI models?

Vertical AI models are specialised AI solutions tailored to meet the unique demands of specific industries and their use cases. Unlike general-purpose AI, these models integrate extensive industry-specific data, expertise and operational nuances to address the precise requirements and challenges of a sector. They leverage purpose-built algorithms to optimise workflows, enhance decision-making and deliver measurable value in targeted contexts.

Vertical AI models may encompass specialised LLMs, retrieval-augmented generation (RAG) techniques and tailored applications designed to meet the operational needs of particular industry segments. For instance, vertical AI in healthcare might focus on medical imaging and diagnostics, while in finance, it could specialise in fraud detection and risk assessment (see more examples in Chapter 4).

By embedding industry-specific intelligence, vertical AI models enable companies to achieve greater precision, efficiency and innovation within their fields, offering a critical competitive edge. Many industries – in Europe and globally – have already developed and implemented these models, making them a mainstream component of business operations in various sectors (Chen 2023).

What are AI agents?

AI agents are autonomous software programs designed to perceive their environment, process data and execute tasks to achieve predefined goals with minimal human intervention (World Economic Forum 2024). While humans establish overarching objectives, AI agents independently analyse available data and determine the optimal actions required to fulfil their mission. They are characterised by their ability to learn from interactions, adapt to new circumstances and continuously refine their performance.

For instance, in a contact centre setting, an AI agent might handle customer inquiries by dynamically asking questions, retrieving relevant information and delivering tailored solutions. If the query exceeds its capabilities, the agent seamlessly escalates the issue to a human representative, ensuring efficient and context-aware support.

Further, in a consumer business context, AI agents could act as "personal shopping assistants", helping users find products, compare prices and complete purchases across multiple platforms, tailored to individual preferences and budgets. AI agents exemplify the potential for automation and augmentation across industries, enhancing operational efficiency, customer experience and decision-making processes.

Similarities and differences between AI types

There are notable similarities between vertical AI models and AI agents. With both vertical AI models and AI agents, companies can improve operational efficiency, decision-making and user outcomes by automating or augmenting traditional processes. Both rely on large volumes of data for training and decision-making and use advanced algorithms to extract insights and optimise their outputs. Further, both of them are designed for specialised tasks: whereas vertical AI models focus on specific industries, AI agents aim to execute particular roles within broader contexts. Moreover, both complement human roles: vertical AI models by providing actionable insights and AI agents autonomously handling routine tasks and escalating issues when necessary. Finally, both could be developed equally by large industry incumbents and small startups.

Yet, there are also differences, particularly when compared to generative AI as a broader group of generic multi-purpose technologies. The differences are related to their scope, autonomy, integration and adaptability to various circumstances as described in Table 1.

Table 1: Key differences between AI types.

	Generic Generative AI	Vertical AI model	AI agent
Scope of application	Wide: designed to produce diverse outputs such as text, images, videos and audio across multiple domains	Industry-specific: built on specialised data and focusing on solving challenges within a particular domain	Task-oriented: designed to perform dynamic interactions across environments, contexts or industries
Level of autonomy	Non-existent: generates outputs based on prompts but relies entirely on users for interpretation and further action	Limited to moderate: Primarily supports decision-making by providing industry-specific insights but may also act autonomously in narrowly defined use cases	High: independently making decisions and taking actions to achieve goals
Integration with environment	Provides instant support for creative tasks without necessarily needing integration with other systems, real-time data or workflows within the firm	Primarily processes static, historical or unstructured data from IT systems to deliver outputs relevant to its domain; real-time data integration is increasingly feasible, especially with generative AI models	Continuously interacts with its environment and adjacent IT systems in real time, adapting actions based on new inputs
Adaptability	Generic by nature, designed for broad use, and typically not tailored or fine-tuned to specific use cases	Specialised for a narrow domain, but generative AI models enable expansion to related domains through fine-tuning	Designed to adapt dynamically to new scenarios, suitable for evolving environments

In this study, we primarily address vertical AI models and AI agents as two distinct areas of applied AI. However, it is worth considering the potential for convergence, where a specific industry segment could develop vertical AI models that integrate AI agents as part of the solution. In that case, AI agents would utilise vertical AI models as a "brain" or knowledge base, but add another layer of autonomy, decision-making and action-taking. While such integration presents an intriguing opportunity – and is already happening in various industry segments – it is not mandatory for success in either area.

When considering large language models as enablers of applied AI, a key distinction lies between open and closed models. Open large language models are typically more accessible and cost-effective for companies in Europe, allowing for greater experimentation and customisation. This accessibility makes open models particularly appealing for small firms with limited resources, as they can adapt the models to their specific use cases without restrictive licensing fees. In contrast, closed large language models, developed by major global tech giants, often come with robust infrastructure, higher levels of support and potentially more advanced pre-trained capabilities, but their use may involve higher costs and limited flexibility due to proprietary restrictions.

Both open and closed large language models require fine-tuning to address vertical industry use cases or agentic applications. Fine-tuning involves adapting the base model to incorporate domain-specific data and ensuring that the application delivers relevant insights. While open LLMs provide more freedom for such fine-tuning efforts, closed models may offer higher performance out-of-the-box but often require navigating licensing or integration constraints.

Drivers and hindrances for development and adoption

There are several reasons why companies wish to move beyond generic AI solutions and explore vertical AI models and AI agents, for instance (Treves et al. 2024):

- Applied AI solutions help firms make company-, industry- and use-case-specific data more accessible and actionable, thus unlocking the true potential of their information assets.
- For external customers, applied AI solutions typically offer highly personalised experiences, ensuring that their unique requirements are met with higher accuracy and efficiency.
- For internal customers however, these solutions enhance productivity and decision-making by delivering relevant and precise insights tailored to organisation-specific needs.
- AI-enabled elimination of manual operations (e.g. data handling and analysis work or streamlining of operational processes) allows companies to reallocate resources towards growth initiatives, such as new revenue stream creation.
- Applied AI systems can also enable companies to command premium pricing for enhanced, AI-powered platforms and services.
- Finally, and importantly, they also address privacy and confidentiality concerns that general-purpose generative AI systems often cannot similarly accommodate.

As the training of vertical AI models and the effective operation of many AI agents rely on data, access to high-quality domain- and use-case-specific data is essential (Hosanagar & Krishnan 2024), with its relevance, volume and accuracy being key determinants of AI performance. Without such tailored and reliable data, applied AI solutions cannot deliver the precision and impact necessary for transforming industry- or use-case-specific operations. This data is generated through diverse interactions across products, processes, operations and customer engagements.

For example, in healthcare, anonymised patient records, imaging data and genomics information enable AI to identify disease patterns, predict patient outcomes and personalise treatments. In industrial settings, real-time sensor readings, maintenance logs and production metrics allow AI models to optimise workflows, reduce downtime and predict equipment failures. Given the sensitivity of such data, it is typically housed securely within a company's cloud environment or in individual devices, ensuring strong data protection and preventing unauthorised access or external model training. Furthermore, compliance with legal frameworks such as GDPR and the EU Data Act is crucial to safeguarding data privacy and ensuring responsible AI deployment.

Two factors are slowing down applied AI adoption however, neither of which is a technology challenge but rather related to human factors. First, if applied AI solutions truly have the potential to rapidly solve industry-specific challenges and/or operate autonomously and thus replace entire teams and functions, it seems unlikely that managers will adopt them quickly, as such changes would bring dramatic and often unwelcome

disruptions to the company's workforce (Thornhill 2024).

Second, there are concerns about what happens when AI solutions increasingly interact with other AI solutions while humans are removed from the loop: how will this work in practice, what are the risks and vulnerabilities involved and how can trust and accountability be ensured? (Frazier et al. 2024, Thornhill 2024, World Economic Forum 2024). For instance, the first AI-to-AI transaction was already recorded when a blockchain-based AI agent – Luna by Virtuals Protocol, a decentralised platform for AI and blockchain technology – paid another AI agent a fee to create content (Mitrade 2025). This development stresses the rapid progression toward autonomous AI operations, pushing us into uncharted territory with implications for trust, oversight and human-AI collaboration.

4. Vertical AI: transforming European industries

Vertical AI models unlock tailored solutions for industries such as healthcare, manufacturing and finance. They drive operational efficiency, enhance decision-making and support Europe's goal of becoming a leader in industry-specific AI innovation.

Vertical AI models are transformative due to their capabilities of overcoming the limitations of traditional industry-specific software by delivering solutions that not only streamline workflows but also automate tasks, unlocking value that software alone could not achieve.

Previously, vertical industry-specific software was limited to companies with modern technology stacks and structured data, leaving industries reliant on unstructured data – contracts, records and multimedia – largely untouched. Now, large language models can process unstructured data (Wilson & Daugherty 2025), enabling AI to revolutionise workflows in these technologically underserved sectors and unlock opportunities in the 80% of global data that remains unstructured. Emerging multimodal models are expanding these capabilities to include diverse inputs like voice, video and images, further broadening AI's potential impact (Bean 2025, Bessemer Venture Partners 2024, Kim 2023). However, generative AI has its challenges: it can struggle with accuracy, context preservation and interpreting highly specialised or noisy data, limiting its effectiveness in some scenarios. Despite these limitations, this shift is prompting even hesitant industries to embrace AI, driven by its compelling ROI and the competitive pressure to adopt these advanced tools. In short, AI is now much more accessible and feasible for industry-specific purposes.

The adoption of vertical AI varies by industry, with the greatest opportunities in areas where AI can perform tasks previously unfeasible or too costly for humans. Successful applications often involve automating workflows and processing vast datasets beyond human capacity (Bessemer Venture Partners 2024, Hosanagar & Krishnan 2024, Wilson & Daugherty 2025).

Incorporating subject matter expertise into AI models is a key differentiator in vertical AI applications. Research indicates that a significant portion of effective service solutions cannot be derived from historical service data alone. Instead, they rely on expert-provided insights, emphasising the importance of integrating human expertise into AI datasets to enhance problem-solving capabilities (Chen 2023). Further, effective use of vertical AI requires a deep understanding of the target group, including their roles as consumers or within an organization, their daily practices and workflows, and the business processes they navigate. Tailored AI solutions that align with these roles and workflows can enhance efficiency by directly addressing specific challenges and needs.

CASE STUDY

Automating patient information documentation with AI

Documenting patient information is estimated to consume 30% of a healthcare professional´s daily working time. This process involves several steps: gathering patient history, meeting with the patient to collect current health details and manually inputting or dictating this information into the patient information system. Following the appointment, professionals must summarise the meeting, document the diagnosis and outline a care plan, all of which require further data entry.

In a pilot project conducted in Finland, AI was used to automate this process by recording doctor-patient conversations and automatically generating the necessary documentation. The time saved amounted to 13% of doctors' total working hours (Sitra 2024a). Given that there are close to two million practicing physicians in the EU, scaling this solution across Europe could free up the equivalent work effort of 260,000 doctors, significantly reducing administrative burden and improving efficiency.

CASE STUDY

Owkin: advancing healthcare with AI-driven precision research

Owkin is a French AI biotech company specialising in healthcare, using machine learning to enhance drug discovery, optimise clinical trials and improve diagnostic tools. By combining AI with human expertise, Owkin aims to decode complex biological systems and develop personalised treatments for patients.

One of Owkin's notable innovations is its application of federated learning, enabling collaborative analysis of decentralised datasets while safeguarding data privacy – a significant achievement in the healthcare sector. Additionally, its CE-certified diagnostic tool MSIntuit CRC exemplifies the company's ability to apply AI to real-world medical challenges by improving early colorectal cancer detection and treatment strategies.

Owkin continues to push boundaries with its technology platform Abstra, which aims to integrate AI and human workflows seamlessly, further advancing biomedical research. Its work shortens the time needed to bring effective solutions to patients and demonstrates the potential of AI to transform healthcare practices (Owkin 2025).

Europe's strongest industries include automotive, aerospace and defence, chemicals and pharmaceuticals, machinery and equipment, information technology and telecommunications, and the energy sector (Eurostat 2023). In addition, we have significant activity in healthcare, consumer goods production and retail, and the public sector. The following is an overview of vertical AI model opportunities in these industry segments (see also AI World 2025):

Automotive: AI is used for instance for analysing data from connected vehicles, enabling object recognition in autonomous driving, enabling smart navigation systems, and in optimising supply chains. European manufacturers like Volkswagen, BMW and Renault are leveraging these technologies to enhance efficiency and innovation.

Aerospace and defence: AI enhances aircraft performance optimisation by analysing real-time sensor data to predict maintenance needs and improve fuel efficiency. In autonomous combat systems (e.g. drones), AI enables real-time target tracking, adaptive navigation and coordinated swarm intelligence. For mission planning, AI processes satellite imagery and historical mission data to optimise deployment strategies and logistics. Key adopters include Airbus, Leonardo and Thales.

Chemicals and pharmaceuticals: AI drives drug discovery and development, process optimisation, and supply chain management. Generative AI models are transforming research processes by simulating molecular structures, predicting drug efficacy and automating regulatory documentation. European leaders such as BASF, Sanofi and Bayer are pioneering these efforts.

Machinery and equipment: AI enhances robotics and autonomous operations by enabling real-time adaptive control and intelligent process automation. In inventory management, AI optimises spare parts stock levels and procurement by forecasting demand, reducing costs and preventing supply chain disruptions. For field service operations, AI-powered diagnostics analyse equipment performance, predict failures and recommend proactive maintenance, reducing unplanned downtime. Companies like Siemens, ABB and Cargotec are at the forefront.

Information technology and telecommunications: AI enables network optimisation, real-time security, vulnerability management, anomaly detection and fraud prevention (e.g. fake subscriptions, phishing, spam). Generative AI complements these by creating real-time system reports and generating synthetic data to test network resilience. Companies like Nokia, Ericsson and Deutsche Telekom are leveraging these tools to stay competitive.

Energy: AI is used e.g. for smart grid management and optimisation, algorithmic energy trading and market analysis, and energy consumption forecasting, driving efficiency and contributing to the European green transition. Industry leaders include Ørsted, Enel and EDF.

Healthcare: AI powers automation of patient records (see case study on p. 22), medical imaging analysis, virtual health assistants and remote patient monitoring. Predictive analytics help in improving patient outcomes. Generative AI expands these capabilities by summarising complex patient records, assisting with research publications, and supporting personalised health interventions. Companies such as Siemens Healthineers, Philips and Novartis are key European players in this field.

Consumer goods production and retail: AI enhances demand forecasting, warehouse and inventory management, and quality control processes. Generative AI contributes by enabling personalised shopping recommendations, virtual try-on tools and automated customer service chatbots. Companies like Unilever (supply chain

optimisation), L'Oréal (personalised product recommendations) and Carrefour (inventory management and food waste minimisation) are adopting these solutions.

Public sector: AI improves smart city management, fraud detection (e.g. tax, procurement, welfare programs) and citizen engagement platforms. Generative AI enhances these efforts by automating content creation for public campaigns, powering virtual assistants for citizen queries and providing advanced multilingual translation services. Organisations such as the Estonian Government and the cities of Barcelona and Helsinki are early adopters of these technologies. Additionally, the public sector can leverage AI to automate legal document creation and management (see the case study below).

It is important to note that AI-native startups also play a significant role in these strong European industry segments. Emerging companies often focus on creating AI solutions for one sector only, for instance startups are automating complex workflows with AI-powered solutions, challenging established vertical incumbents. On the one hand, startups tend to lead in sectors with lower AI adoption, where their innovative, AI-native approaches can disrupt traditional practices by reimagining workflows and solving niche problems better than anyone else, on the other incumbents dominate in industries where they can leverage extensive proprietary data, enterprise trust and embedded systems to develop highly effective AI models (Hosanagar & Krishnan 2024). The landscape remains dynamic, with both startups and incumbents driving advancements in vertical AI applications (Ruokonen & Ritala 2023).

Furthermore, industry-specific data-sharing ecosystems and spaces are fundamental to the success of vertical AI models, as they enable companies to securely pool data, creating larger and more diverse datasets for training. These ecosystems foster collaboration among organisations – large and small, within the same sector – allowing the aggregation of valuable insights that individual firms cannot achieve alone. For example, in healthcare, shared patient data improves diagnostic AI models, while in manufacturing IoT data from multiple sources enhances predictive maintenance systems. By breaking down silos, these ecosystems accelerate innovation, enabling AI to deliver more precise and effective solutions tailored to industry-specific needs.

CASE STUDY

KONUX: enhancing railway operations through predictive AI

KONUX, a German AI scale-up, combines AI and the Industrial Internet of Things (IIoT) to revolutionise railway operations with a focus on sustainability. Its end-to-end solutions integrate smart sensors and AI-based analytics to provide real-time insights, enabling customers to monitor infrastructure, optimise timetables and mitigate delays. By continuously analysing the health of critical components like the trackbed and frog, KONUX delivers actionable recommendations to improve network availability and operational efficiency.

The company primarily collaborates with large industrial and rail operators, including Deutsche Bahn, to drive smarter, more sustainable rail systems (Gray 2022, Konux 2025).

CASE STUDY

AI-powered legal document automation

The legislative drafting process is complex and time-consuming, involving information gathering, document analysis and summarising stakeholder feedback. In Finland, Finnish language models have been piloted to assist legal drafters by answering questions about legislation and automatically summarising consultation feedback.

A "FinGPT-3" language model provided direct links to relevant legal provisions, while another language model called "Poro" was fine-tuned to identify key points of support or opposition in stakeholder comments. The pilots, financed by Sitra, demonstrated that AI can effectively assist in streamlining legal drafting processes, improving efficiency and enhancing the consideration of stakeholder perspectives, despite current challenges in handling complex or context-heavy documents (Sitra 2024c).

Europeans risk dependence on AI capabilities of cloud platforms

Vertical AI models however, are not void of competition from outside the EU. Currently, US-based platforms like Amazon Web Services (AWS), Microsoft Azure and Google Cloud dominate industrial firms' enablement of vertical AI models due to their AI capabilities in the cloud. AWS leads the global cloud infrastructure market with a 37 per cent share, followed by Microsoft Azure at 29 per cent and Google Cloud at nine per cent (due to data security and privacy concerns and geopolitical and trade tensions, virtually no European company uses any Chinese technologies) (Paraskevopoulos 2024).

Microsoft's close partnership with OpenAI, including hosting its models on Azure, further strengthens its position, enabling enterprises to integrate advanced AI capabilities directly into their operations. The widespread adoption of these platforms highlights their critical role in enabling scalable and advanced AI solutions across industries.

For Europe to achieve strategic autonomy, it must develop alternatives to reduce dependence on US tech giants for future vertical AI models. There are already European cloud providers such as OVHcloud, Hertzner and Scaleway, but their company sizes and market shares remain small, and they lack the vast resources needed to develop competitive AI offerings (Hosanagar & Krishnan 2024). Also, the earlier Gaia-X initiative, although well-intentioned in aiming to create a federated and secure data infrastructure, has fallen short of delivering the European sovereignty needed in this domain.

In sum, the development of vertical AI models is crucial for European companies to remain competitive in global markets, and significant progress is already being made across industries. By leveraging industry-specific AI, firms can enhance operational efficiency, reduce costs, and optimise workflows, ensuring they stay on par with or ahead of global peers.

However, many vertical AI models are already being built on non-European platforms, creating a dependency that challenges Europe's strategic autonomy goals. While fully replacing these platforms with European alternatives may not be immediately feasible, a strategic approach is necessary – one that balances the use of existing assets with investments in developing independent, Europe-based capabilities over the long term.

5. AI agents transforming businesses and societies

AI agents are evolving as transformative tools, capable of automating workflows, interacting with systems and delivering actionable outcomes. They have a great potential to revolutionise industries and strengthen Europe's competitiveness in this rapidly growing market.

There is significant buzz around AI agents at the moment, with awareness and interest growing rapidly. Some commentators have even begun referring to a "billion agent future" where a massive number of these agents work in the background, supporting us without our direct awareness (Exponential View 2024). Further, Sam Altman, the CEO of OpenAI predicts the rise of a "one-person unicorn" – a billion-dollar enterprise run by a single individual harnessing the power of an army of AI agents. While undoubtedly extreme, this is a clear example of the immense scalability that AI agents can potentially bring to company operations.

AI technologies are increasingly being integrated into various digital platforms in a more structured way. Unlike earlier language models that only assisted humans by suggesting actions, these agents will autonomously complete entire tasks (Wilson & Daugherty 2025) such as resolving customer complaints. A new term, Agentic Process Automation (APA), is currently emerging to describe this shift. Unlike traditional Robotic Process Automation (RPA), which is restricted to rule-based tasks, APA employs AI agents to dynamically design and oversee workflows, enabling sophisticated decision-making that adapts to changing conditions (The AI Navigator 2024).

Moreover, instead of a single AI assistant handling many tasks, companies will deploy multiple specialised interacting AI agents (Bankless 2024), each trained for a specific role, thus the term multi-agent system (MAS) (World Economic Forum 2024). Over time, we are transitioning toward the "Agentic Web", a digital ecosystem where tasks and power are redistributed among humans and AI, enabling collaboration and transactions in unprecedented ways – for instance with AI agents navigating, negotiating and transacting entirely without human involvement (Bankless 2024, Gate.io 2024). This development comes with its own ethical risks regarding preservation of European values, but this consideration has been scoped out of this study.

AI agents offer promising advantages across several dimensions. They can operate at exceptional speeds, scale with available computational resources, and parallelise tasks to manage substantial workloads efficiently (Exponential View 2024). One key advantage of AI agents is their ability to integrate into workflows and processes, leveraging diverse data sources, including CRM systems, financial management tools and unstructured data such as PowerPoint presentations or PDF documents. Looking ahead, some researchers speculate about the possibility of an "agent mesh" – an interconnected network of agents that could collaborate to share tasks, messages and knowledge across an enterprise to address complex challenges (Marshall 2024). While such transformative opportunities remain on the horizon, the current generation of AI agents already offers significant potential for improving efficiency and decision-making within organisations.

At their current stage of development, AI agents typically (1) have a specific objective set by a human, (2) autonomously define the steps and resources needed to achieve that objective, (3) iterate and learn as they progress toward their goal, and (4) transparently explain to their developers what they have considered, attempted and learned (Wilson & Daugherty 2025). However, ongoing advancements in AI agent development are aimed at increasing their autonomy and automation capabilities. Over time, these agents are expected to operate with minimal human intervention, becoming even more independent and capable (Bankless 2024).

In the future: effortless travel planning with the Agentic Web

Imagine planning an international vacation with the help of the Agentic Web. Instead of juggling multiple websites and apps, a network of AI agents works together seamlessly to handle the entire process. They book flights and trains based on your preferences, secure accommodation close to the attractions you want to visit and organise activities and restaurant reservations tailored to your interests. Meanwhile, another agent tracks your budget, manages currency exchange and ensures you are covered with travel insurance. All of this happens in the background, requiring minimal input from you, delivering a fully personalised travel experience. While effortless travel planning like this is not yet a reality, it is likely to emerge in the future.

CASE STUDY

Mistral AI: empowering dynamic agent-based automation

Mistral AI, a French generative AI startup, aims to make advanced AI accessible to developers, businesses and organisations across industries, enabling seamless integration of AI capabilities into diverse products and services. The company focuses on creating advanced AI models and tools that can be seamlessly integrated into diverse applications. Its offerings include two primary methods for building agents, (1) La Plateforme Agent Builder, a user-friendly interface for creating and configuring agents and (2) Agent API, a programmatic solution enabling developers to integrate agent creation into existing workflows or applications. These solutions help clients automate complex workflows, enhance decision-making processes and improve operational efficiency by enabling agents that adapt dynamically to user needs and environments. In 2023, Mistral AI secured significant funding to accelerate its AI initiatives, highlighting Europe's growing presence and technological sovereignty in the AI landscape (Mistral AI 2025).

Large language models often serve as the backbone for AI agents by enabling natural language understanding, decision-making and task execution through their ability to process and generate human-like text based on vast amounts of data (Wilson & Daugherty 2025). Latest models, such as OpenAI's o3, have excelled in tests emulating human reasoning, making them particularly well-suited for enabling AI agents capable of adapting to sophisticated tasks (Frazier et al. 2024).

Yet, while LLMs have enhanced the capabilities of AI agents, they are not a mandatory component. AI agents can function effectively using alternative AI methodologies, depending on the requirements of the application. For instance, reinforcement learning enables agents to learn optimal behaviours through trial and error, independent of language processing capabilities. Various learning paradigms can also be used in parallel (World Economic Forum 2024).

Automation transforming people from performers to supervisors

AI agents, with their ability to perform autonomous operations, represent a revolutionary technology shift. Unlike traditional software solutions, AI agents have the potential to replace specialists or even entire teams. This impact manifests in two ways, (1) companies developing AI agents can operate as lean, dynamic teams, leveraging AI-driven automation to scale their businesses rapidly without significantly increasing headcount (see the idea of a "one-person unicorn" above) and (2) clients of these developers can integrate advanced AI agents into their own operations, effectively replacing certain specialist roles and teams, or mitigating existing workforce shortages.

Soon more advanced AI agents, equipped with greater capability and broader expertise, will be able to act on behalf of their users, with their permission. Or possibly, workers might take on more supervisory roles, approving actions and managing exceptions, as AI agents increasingly handle end-to-end execution (Exponential View 2024, Yerramilli-Rao et al 2024). In some cases, a human could become subordinate to an AI agent, following instructions on which tasks to perform, when and how – representing a significant disruption to established roles in human-AI collaboration (Bankless 2024). With traditional AI, this dynamic is already evident in industries like food delivery and logistics.

However, a critical bottleneck for developers is the scarcity of highly skilled talent needed to strategically select, design, implement and maximise the potential of AI agents in practice. Thus, while AI agent development will create new employment, especially technically and strategically advanced ones, it will simultaneously disrupt existing jobs, roles and business models, with the latter impact likely outweighing the former.

The EU AI Act and other existing frameworks do not fully address the unique challenges posed by AI agents, such as autonomous decision-making, multi-agent collaboration, and liability for errors.

As AI agents are still an emerging phenomenon, their operations and the broader market remain largely unregulated as a distinct category. While the EU AI Act and other existing frameworks provide some governance, they do not fully address the unique challenges posed by AI agents, such as autonomous decision-making, multi-agent collaboration, and liability for errors. This raises critical questions. What happens if biased data leads an agent to make an incorrect decision, which is then amplified by interconnected other agents? If an AI agent

collaborates with a human and an error occurs, who is accountable: the developer, the deployer, or the human operator? These and many other challenges are beginning to surface, highlighting the urgent need for clear guidelines and best practices. Lawmakers and AI developers must work together to establish robust governance frameworks that ensure AI agents function reliably, ethically, and without unnecessary risks.

A heterogeneous, immature market of big and small players

The European AI agents landscape faces significant competition. Microsoft has already started to build a massive enterprise AI agent ecosystem, with over 100,000 organisations creating or editing AI agents through its Copilot Studio since its launch. Microsoft will allow enterprises to use any of the 1,800 prebuilt or custom-built Azure AI models from within Copilot Studio and integrate its platform with over 1,400 enterprise systems and data sources. As a result, developers worldwide have access to an extensive repository of technologies to enhance their AI agents (Marshall 2024).

Similarly, in November 2024, Google announced a Google Cloud AI agent ecosystem program to help partners build and co-innovate AI agents with technical and go-to-market resources from Google Cloud (Ichhpurani 2024). Moreover, Amazon is pushing forward its own Amazon Bedrock Agents within AWS. Thus, similarly to the early days of mobile app platforms, the development and delivery of AI agents are shaping up to be an ecosystem-driven game.

Tech giants hence see their generative AIs, copilots and cloud platforms as major user interfaces for people and companies to access AI agents in the future, but naturally, other options also exist. It is likely that while the big AI companies, like Microsoft, OpenAI, Google and Amazon are developing general-purpose agents that anyone can use, small startups take much responsibility of creating more specialised AI agents for business (Thornhill 2024). The latter is a new emerging opportunity for Europe. However, the market for AI agents is still very immature and its further developments are hard to predict at this stage.

The development and delivery of AI agents are shaping up to be an ecosystem-driven game.

To summarise, AI agents are transforming companies by enabling scalability, automation and efficiency, with the potential to replace entire teams or empower lean organisations to scale rapidly. Across industries, they integrate into workflows, into autonomously handling specialised tasks and facilitating a shift toward interconnected ecosystems like the "Agentic Web". At the societal level, AI agents hold the promise of fostering new types of collaboration between humans and AI, while also potentially reducing human involvement in certain processes.

6. Sizing the markets and investments in applied AI

The global AI market is expanding rapidly, offering Europe a chance to lead in applied AI. An overview of market sizes for generative AI, vertical AI models and AI agents shows that substantial investments are required for Europe to secure a competitive position.

There is currently only limited data available on the sizes and growth of the different markets for applied AI solutions. Further, it's important to note that market valuations can vary across different reports due to varying definitions and scopes of what constitutes the AI, generative AI or LLM markets, let alone vertical AI solutions or AI agents. However, what we do know at this stage is that the global market opportunities and potential for different AI solutions seem to vary significantly.

Large and fast-growing global AI markets

The global AI market was valued at approximately €180 billion in 2023, with a projected compound annual growth rate (CAGR) of ~30 per cent from 2024 to 2030 (Grand View Research 2024b, Statista 2024a). This massive and fast-growing market is composed of several distinct segments, each with its own dynamics and growth opportunities. Among these, generative AI, vertical AI models and AI agents stand out as key areas of interest for businesses and policymakers alike.

Generative AI (incl. LLMs) market

The generative AI market, including large language models, was valued at approximately €30-40 billion in 2023 and is projected to grow at a CAGR of 40 per cent from 2024 to 2032. Within this broader category, the LLM segment was valued at €4-5 billion in 2023, with a projected CAGR of 36 per cent from 2024 to 2030 (generative AI also includes many technologies beyond text-based large language models, for instance, image, video, audio, code, product design and 3D models generation). (Grand View Research 2024c, Fortune Business Insights 2024, Statista 2024b) Generative AI serves as a foundation for many firms to develop applied AI solutions tailored to specific use cases. Many generic generative AI technologies are readily available and relatively affordable for companies, making them springboards for further innovation.

Vertical AI model market

Vertical AI models represent industry-specific solutions that fall outside the scope of generic generative AI or AI agents. Given the total global AI market as a backdrop, vertical AI models likely account for tens of billions of euros and are growing rapidly. This segment offers the largest opportunity for European businesses, enabling both large incumbents and startups to create value and drive innovation within their industries. Vertical AI models are particularly well-suited to Europe's strengths in specialised and industrial applications (see Chapter 4), making them a key area of focus.

AI agent market

The market for AI agents was valued at €3.7 billion in 2023, with a CAGR of 45% projected from 2024 to 2030 (Grand View Research 2024a, MarketsandMarkets 2024). While this segment remains relatively small compared to the total AI market (in fact, quite closely

comparable to that of the LLMs market, as discussed above), its rapid growth underscores its potential. It is still unclear whether this market size estimate fully captures the current business of AI agents or how the market will ultimately evolve. Based on current figures, AI agents are not yet the largest opportunity within the broader AI market (see the vertical AI models market above), but they represent a significant and very rapidly growing segment. At present, AI agents are a somewhat nascent area of interest and development, not quite mainstream yet.

The European edge: investing where it matters most

The costs and investments of developing AI technologies also vary significantly, having different orders of magnitude across different categories.

Generative AI (LLMs)

Creating large language models like GPT-4 involves substantial investments, often reaching tens of millions of euros per model. For instance, training prime AI models can require over 3 million graphics processing unit (GPU) hours (the combined amount of time spent running the training process), leading to significant financial investments in computing capabilities (Coherent Solutions 2024). Further, building a large language model requires extensive data preparation, significant R&D investment, and a highly skilled team to experiment with architecture, hyperparameters and training strategies to achieve optimal performance. On various occasions, Sam Altman, the CEO of OpenAI has stated that the cost of training their GPT-4 was more than $100 million, emphasising the high expense of such efforts. However, in late 2024, a Chinese AI lab announced that it had developed its open and powerful DeepSeek V3 language model in just two months at a cost of approximately €5 million (Wiggers 2024), indicating that the time and financial effort required to train large language models might decrease over time. Yet, this optimistic estimate has been challenged, with some analysts arguing that the reported cost excludes significant expenses, such as labour-intensive research, experimentation and the true cost of GPU ownership, suggesting that the actual price of DeepSeek's model could be at least several hundred million euros when fully accounted for (Lambert 2025).

If the EU were to invest in ten large language models in native European core languages, it would likely require hundreds of millions of euros (though recent developments suggest that costs for training such models may vary widely, depending on the approach, available data, and technical resources) and involve direct competition with global tech companies already developing such models in various languages. Despite these challenges, it is clear that large language models should be available in all official European languages because:

1. they are critical enablers of applied AI,
2. Europe cannot rely solely on big tech firms to address all local needs and
3. local languages reflect unique cultures, values and specificities, making their use in LLMs a vital means of countering US or Chinese AI hegemony.

Whenever LLM development is done in Europe, efforts should prioritise investing in localised large language models (see Janin 2024) tailored to our specific linguistic and cultural needs, rather than pursuing generic solutions. In February 2025, an OpenEuroLLM project was announced, with a budget of €54 million and 20 contributing institutions, to advance open-source large language models that reflect European values (Macaulay 2025) – a promising step forward. In sum, LLM development is expensive, yes – but essential for Europe to strengthen its AI implementation capabilities and achieve greater technological sovereignty.

Vertical AI models

Development costs vary based on complexity and data requirements but are generally lower than those for large language models, as they focus on narrower applications in a specific industry context. Estimates range between €300,000 and one million euros per model (Coherent Solutions 2024). In these estimates, we assume that the foundational technology, such as machine learning or large language models, is already in place and available for industry-specific tailoring without incurring significant additional costs.

Following the logic above, if the EU were to invest in ten vertical AI models for its core industry segments (see Chapter 4 above), it would require a minimum investment of approximately €10 million. Such an investment would enable a few industry-specialised companies, both large and small, to leverage AI and strengthen their market position. (The EU's role would likely focus on encouraging and supporting firms to scale up their investments while mitigating risks, given that many large companies are already spending millions on industry-specific AI solutions.) However, it is important to note that there is no upper limit to how much can be invested per each vertical AI model, as greater financial input can lead to increased sophistication and differentiation. Further, given the rising investment volumes in key competing non-European markets (Duffy 2025) and the diversity of European industry verticals and their specific needs, this figure is merely a starting point – the true scale of funding required in Europe is likely to be several orders of magnitude higher than what was indicated above.

AI agents

The costs of developing AI agents, such as advanced autonomous chatbots or virtual assistants, range from tens of thousands of euros to €100,000, depending on complexity (Anglen 2024, Sharma 2024). Most advanced AI agents cost hundreds of thousands of euros per each (Sharma 2024).

If the EU were to invest in ten AI agents for selected cross-industry use cases, it would require a minimum investment of approximately €1 to 5 million – a very modest amount. (Also in this case, the EU's role would likely focus on supporting and complementing European companies that are already investing in AI.) A key assumption here, however, is that instead of a single AI agent covering wide-ranging tasks, very many specialised agents will collaborate. Consequently, the total cost of building an "Agentic Web" is expected to be significantly higher, likely involving the development of thousands of specialised agents and requiring investments of at least hundreds of millions of euros. Additionally, given the relatively low costs per AI agent and the resulting low barriers to entry, we anticipate a highly heterogeneous market of very many competing agent providers, including both global tech giants and local players, and differentiation will be key. Also, an important factor to consider in investment calculations is: once an initial investment in an AI agent has been made, how well could such an agent be leveraged, expanded and scaled to new use cases and markets?

In summary, while developing large language models is the costliest of the three areas explored in this study, it is essential for enabling applied AI solutions. Vertical AI models are significantly less expensive, and AI agents are relatively inexpensive to develop. However, the sheer number of vertical AI models and AI agents required across Europe's many industry segments and use cases amplifies the overall investment needed. All three are critical, and ensuring adequate funding for each is essential to advancing AI innovation in Europe. Given the high stakes in the global AI race (Duffy 2025), the recent launch of the €200 billion InvestAI initiative marks a major step forward (European Commission 2025c), but Europe must ensure that funding is sustained and strategically allocated in the coming years to maintain a competitive position over the long term.

Fostering the next wave of European AI unicorns

Europe has an opportunity to foster AI-driven unicorns in the coming years, particularly in vertical AI models and AI agents, which present more accessible development costs and significant market opportunities compared to generic generative AI solutions (as estimated above). It is reasonable to anticipate the emergence of over 100 unicorn-sized companies globally focused on vertical AI models and AI agents in the near future (Y Combinator 2024). (Naturally, existing industry incumbents across various sectors are also poised to benefit significantly from these technologies.)

Key EU regulations shaping the AI landscape

The EU's regulatory framework plays an important role in shaping the investment environment by fostering trust, enabling data access and ensuring fair competition – all essential drivers of AI innovation and growth.

General Data Protection Regulation (GDPR), in force since 2018, protects personal data and privacy, establishing a global standard that influences AI-driven data use across industries.

Cybersecurity Act, in force since 2019, strengthens the EU's cybersecurity framework by introducing certification schemes to ensure the security of AI systems and infrastructure.

Digital Markets Act (DMA), in force since 2022, promotes fair competition by preventing gatekeeper platforms from unfairly prioritising their own services, restricting interoperability or exploiting data advantages. These measures create opportunities for smaller European AI companies to innovate and compete in markets traditionally dominated by larger tech giants.

Data Governance Act (DGA), in force since 2022, enables secure data sharing across the EU, fostering the creation of trusted data spaces for AI-driven applications.

Digital Services Act (DSA), in force since 2022, introduces new obligations for online platforms, enhancing transparency, accountability and user rights. These measures are essential for AI-powered digital services to ensure that automated decision-making processes align with these principles and build user trust.

European Chips Act, in force since 2023, aims to strengthen Europe's semiconductor ecosystem, ensuring a resilient supply chain for critical technologies – including AI – by mobilising over €43 billion in public and private investments.

NIS2 Directive, in force since 2023, expands the scope of cybersecurity requirements across sectors, enhancing the resilience of EU critical infrastructure. It also imposes obligations on digital service providers such as search engines, cloud operators, and online marketplaces.

Digital Operational Resilience Act (DORA), in force since 2023, ensures that financial institutions and their technology providers maintain operational resilience, minimising the risks of digital disruptions and cyberattacks.

Data Act, in force since 2024, gives individuals and businesses the right to access the data produced through their utilisation of smart objects, machines and devices. Users of connected products may choose to share this data with third parties, unlocking new opportunities for innovation and service development.

AI Act, in force since 2024, establishes a comprehensive framework for AI development and deployment, categorising AI systems by risk to ensure safety, transparency and accountability.

Cyber Resilience Act (CRA), in force since 2024, introduces mandatory cybersecurity requirements for products with digital elements, ensuring their security throughout their lifecycle.

AI Liability Directive (AILD), under legislative review, proposes harmonised rules for liability and evidence disclosure in cases involving AI systems, aiming to ensure accountability and trust in AI adoption.

French billionaire and prominent Mistral AI investor Xavier Niel recently emphasised Europe's potential to independently create some of the world's leading AI companies, provided they resist selling too early. According to Niel, Europe could develop competitive AI models with investments of just "a few hundred million euros" (Robson 2024) – a relatively modest figure compared to the staggering sums already invested by America's tech giants and the recent announcements on future investments (Duffy 2025). Our calculations in this study suggest that the "ticket to the game" – the minimum investment required for local language models, vertical AI models and AI agents in Europe – far exceeds Niel's estimate. When considering the full scope of European AI development over the long term, the necessary funding is likely to run into many billions of euros annually.

Recent data indicates a resurgence in venture capital investments in European AI startups, with deal values in 2024 expected to surpass the previous year's totals of €11.4 billion by 20 per cent (Hodgson 2024). Mistral AI, for instance, achieved a valuation nearing €6 billion within just a year of its founding. In the Nordic countries, we saw the acquisition of Silo AI by AMD in 2024 for over €650 million. These two examples highlight the rapid growth and significant potential of Europe's AI sector.

In 2024, thirteen European startups reached a billion-dollar valuation – an increase of seven from the previous year but still far below the peak of 69 in 2021 and 47 in 2022 (Lewin 2025, Nicol-Schwarz 2024). Many of these new unicorns were in the digital domain, focusing on software platforms, algorithms, mobile apps, data management solutions or quantum computing.

To summarise this chapter: vertical AI models and AI agents represent two rapidly growing segments within the global AI market. With the right and significant investments and strategic focus, Europe has the opportunity to capture these markets and incubate many fast-growing companies that can drive European leadership in AI.

7. Two AI opportunity areas for European firms to compete in

Europe's greatest potential lies in two applied AI areas: vertical AI models tailored to industry needs and AI agents for task automation. This chapter identifies these opportunities, offering insights for innovation and growth in both B2B and B2C applications.

So far, we have explored applied AI from the perspectives of market size and investment potential. Next, we turn our focus to identifying the opportunities within these markets. This shift thus moves our analysis from macro-economic trends to microeconomic specifics, examining the tangible AI solutions that European companies might find promising to develop.

To start with, it is good to understand that the AI ecosystem seems to be currently settling into three layers, (1) applications (e.g. Duolingo and Netflix), (2) AI models (e.g. OpenAI and Gemini) and (3) infra-structure (e.g. Azure and AWS) (Hosanagar & Krishnan 2024, Galloway 2025). As discussed earlier in this study, Europe is active in both the AI model layer – such as developing LLMs in local languages – and the infrastructure layer, represented by smaller European cloud providers. However, global competition in these areas remains intense. Out of these three layers, the greatest potential for Europe is seen in the applications layer.

Table 2: Three categories of AI opportunities.

	Obvious mass-consumer digital solutions	**Non-obvious unpredictable mass-consumer digital solutions**	**Highly specialised AI-native digital solutions**
Examples of AI solutions	Solutions for common, simple everyday tasks, such as creating and managing documents, editing photos, writing emails and searching for information	Solutions similar to Uber, Airbnb and Spotify that use AI for specific consumer tasks traditionally handled manually or analogue, soon AI-enabled	Industry-specific or cross-industry solutions, typically B2B, such as automating or augmenting work in customer service, manufacturing, healthcare, sourcing, HR, marketing and e-commerce
Competitive dynamics among AI providers	Likely dominated by global tech giants leveraging their large language models. Startups may struggle to compete and risk being acquired by these giants. Not so feasible for industry incumbents	Likely pioneered by startups due to higher risk and limited alignment with the strategic focus of global tech giants. Incumbents with strong technical capabilities might also enter	Likely developed by AI-native companies with deep domain expertise and/or by technically capable industry incumbents. Global tech giants may lack specialised knowledge to compete effectively

In the applications space, vertical AI models and AI agents present three distinct categories of opportunities (see Table 2): (1) obvious mass-consumer digital solutions, (2) non-obvious unpredictable mass-consumer digital solutions and (3) highly specialised AI-enabled and AI-native digital solutions (Y Combinator 2024; see also Ruokonen & Ritala 2023).

While the global AI market and its various sub-segments are expanding rapidly, not all AI opportunities are equally accessible or suitable for European firms. Global tech giants are likely to dominate the obvious mass-consumer opportunities, developing solutions that align closely with their current strategies and core strengths, such as extensive data repositories and advanced algorithms (Ruokonen & Ritala 2023). These capabilities will naturally position them to capitalise on predictable, large-scale consumer applications.

European companies, however, have a stronger potential to excel in less predictable, non-obvious mass-consumer digital solutions and in highly specialised AI-native digital applications.

European opportunity area 1: Non-obvious unpredictable mass-consumer digital solutions

Historically, many innovative business-to-consumer (B2C) solutions – such as Spotify, Uber and Airbnb – have emerged from startups that successfully identified emerging consumer needs, harnessed modern technologies and scaled rapidly. In the current AI age, we might be witnessing the emergence of a new wave of similar consumer innovations which could be described, a bit playfully, as "service-as-a-software". Unlike traditional software-as-a-service (SaaS), this approach transforms human-intensive services by layering AI on top, enabling scalability with significantly less reliance on human labour. (Galloway 2025)

The following questions help in mapping the B2C opportunity space of unpredictable mass-consumer digital solutions:

- How can we predict emerging consumer behaviours and trends that align with AI capabilities such as optimisation, automation and augmentation? For instance, what underutilised datasets could uncover innovative consumer applications for AI?
- Which everyday tasks or routines could be reimagined or automated using AI? Could AI augment or replace manual, repetitive tasks to improve convenience and efficiency for consumers (for instance, see the effortless travel planning example above)?
- What unmet consumer needs could AI address in unexpected ways, beyond traditional use cases? For example, how might AI create entirely new emotional, sensory or social experiences for individuals?
- Where are the market gaps where global tech giants have yet to dominate? For instance, could combining AI with physical products outside of big tech's reach create hybrid AI-driven consumer experiences (a concept now referred to as "physical AI")?
- What entirely new markets or consumer behaviours could AI unlock that do not currently exist?

European opportunity area 2: Highly specialised AI-native digital solutions

In the business-to-business (B2B) space, however, breakthroughs often come from startups with deep industry-specific expertise and access to valuable data or from established industry incumbents leveraging their decades of experience and significant resources to drive innovative business development (for an overview of opportunities per European industry segment, see Chapter 4 above).

CASE STUDY

Contentsquare: optimising digital experiences with AI insights

Founded in 2012 in Paris, Contentsquare exemplifies how European companies can excel in specialised AI-driven B2B solutions. The company provides AI-powered tools to analyse user behaviour on digital platforms, enabling businesses to optimise customer experiences and improve conversion rates. Its offerings include heatmaps that visualise user engagement, session replays for tracking user journeys and automated insights that uncover patterns and highlight improvement areas. These solutions help businesses understand how users interact with their websites and apps, offering actionable data to enhance usability and performance.

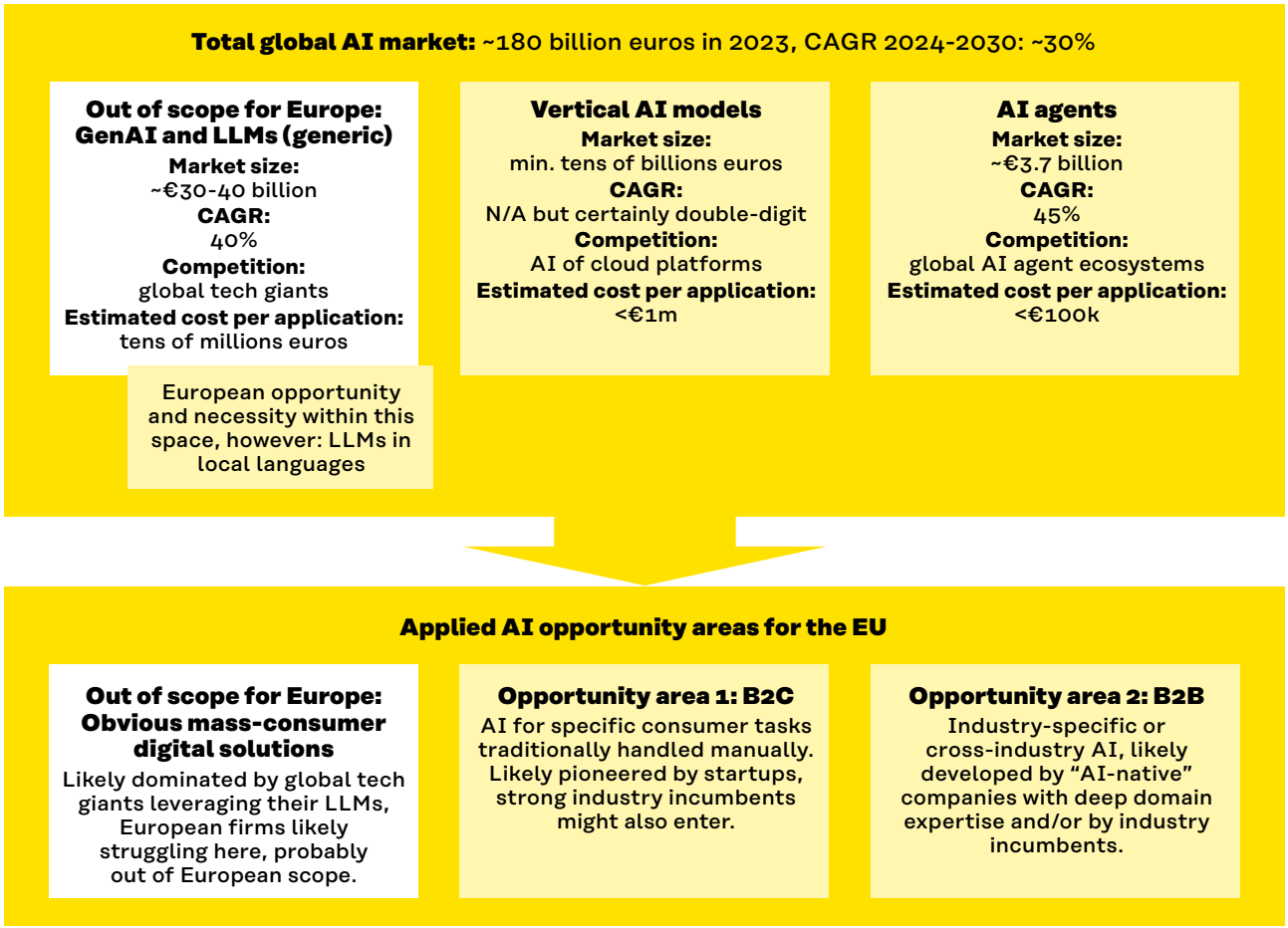
Serving over 1,300 enterprise clients – including global brands like Zoom, Bose, Converse and Visa – Contentsquare processes interactions on more than one million websites. The company has secured substantial funding, achieving a valuation of $5.6 billion as of July 2022 (Contentsquare 2025).

The following questions help mapping the opportunities for highly specialised AI-native digital solutions, independent of which the B2B industry segment is being analysed:

- What AI opportunities exist in areas like B2B sales, marketing, customer service or logistics? How could optimisation, automation or augmentation unlock value in these common operations?
- Which industry-specific problems could be addressed more efficiently with AI, especially those currently deemed too costly or time-intensive? Do B2B-focused industries with lower levels of digital adoption present untapped opportunities in particular?
- How can domain-specific expertise be leveraged to develop AI solutions tailored to niche B2B markets? For example, could a combination of human expertise, advanced data utilisation and AI-driven insights improve decision-making?
- What B2B partnerships or collaborations are essential to access the data or expertise needed for highly specialised AI applications?
- Which recurring or highly complex B2B workflows in industries like manufacturing, healthcare or finance could be completely transformed with AI? What new efficiencies or capabilities could this unlock?
- Are there B2B operations in the physical world that could benefit from advanced AI technologies such as sensors, image and video recognition, and simulations? Could these operations be transformed to enhance efficiency, safety and sustainability?

Figure 2 consolidates insights from earlier discussions, presenting a two-level view of the applied AI market. It first illustrates how generative AI, vertical AI models and AI agents fit within the overall global AI market, highlighting their respective market sizes, growth rates and high-level competitive landscapes. The second part identifies the most promising opportunity areas for European companies within these segments, distinguishing between B2C and B2B applications.

Figure 2. Market potential and strategic AI opportunities.



CASE STUDY

AI in the European industrial sector

European industrial companies are increasingly integrating vertical AI solutions to enhance their services and operations. For instance, KONE, a Finnish engineering and service company, has developed a generative AI tool that enables maintenance technicians of elevators and escalators to quickly access answers to their queries, thereby improving maintenance efficiency and quality (Palmen 2024).

Similarly, Henkel, a German chemical and consumer goods company, has implemented AI-driven systems to automate processes and enhance supply chain management, leading to improved operational efficiency (Dominguez 2024). Industrial firms typically focus on identifying a small number of high-impact AI use cases, then build, buy or tailor algorithms to meet their specific needs.

Building Europe's AI flywheel for growth

As discussed above, the applied AI market remains uncertain, with no clear winners yet established. While vertical AI models have a longer history and are somewhat more mature, the AI agent market is still in its formative stages, with its (likely very heterogeneous) structure only beginning to take shape. Each industry segment or use case will likely see multiple players competing for market share. The strategies of various AI developers remain unclear, making it difficult to predict how markets and competition will evolve. While dominant monopolistic firms may eventually emerge to control specific verticals or use cases, such outcomes are still a distant possibility. If Europe acts swiftly, it still holds a good opportunity to establish itself as a significant player in applied AI.

For now, the most successful firms in all AI solutions will likely be those that create a robust "AI flywheel", where more data improves predictions and outcomes which enhance the user experience, driving further adoption and generating even more data – a self-reinforcing cycle of growth (Hosanagar & Krishnan 2024, Ruokonen & Ritala 2023, Sarlin 2024). While the flywheel concept originates from traditional machine learning, it can be adapted to generative AI which relies more on diverse, high-quality data than iterative feedback, as well as to vertical AI models and AI agents where domain-specific feedback and dynamic workflow integration are key drivers.

For European companies, critical priorities include ensuring access to valuable data assets and customer bases and developing sophisticated algorithms. These factors are essential for building superior products that can compete effectively on the global stage. Naturally, access to talent and financing further enables these firms to amplify the impact of their flywheel.

The identified B2C and B2B opportunity areas align closely with the objectives of upcoming EU initiatives like "AI Factories" and "Apply AI Strategy". Ideally, these initiatives should support industries and companies in testing new applied AI technology with target customers, identifying their niche AI markets, and scaling their innovations successfully, all while adhering to European values and guidelines, such as a human-centric approach and robust personal data protection.

8. Conclusions and Sitra's key recommendations

To succeed in the global AI race, Europe must act decisively. This chapter summarises the findings of the study and presents actionable recommendations to enhance competitiveness, foster innovation and secure strategic autonomy in AI.

We should recall the transformative power of the 1990s when the Internet emerged as a groundbreaking technology, reshaping businesses, industries and societies. Early applications were limited to simple web pages and general-purpose tools like Google for information search. It took over a decade, alongside the development of complementary technologies such as smartphones and mobile networks, for entrepreneurs to create industry-defining innovations like Spotify (2006), Airbnb (2007), and Uber (2009). Nowadays, we cannot imagine conducting business without the Internet.

Today, AI is at a similar inflection point (Bean 2025, Frazier et al. 2024). We are at an early stage of the AI era, the technologies are evolving very fast (Yerramilli-Rao et al 2024) and soon the use of AI will be common in almost every industry, function and process (Barney & Reeves 2024). It is reasonable to assume that the current rapid development phase of AI solutions will last for at least the next 20 years. Businesses that fail to harness the potential of AI may fall behind, face obsolescence or even encounter failure – while those that embrace it can remain competitive and significantly boost their productivity.

Early generic applications, such as OpenAI's ChatGPT or Microsoft's Copilot, are already available and many companies have started developing their specific AI solutions. However, the next wave of industry and use case-specific innovations – similar to the Internet's evolution – has yet to take hold, leaving the winners and losers of this new AI era still undecided. The launch of the open and powerful Chinese DeepSeek model in late 2024 (Lambert 2025, Wiggers 2024) demonstrates that AI development does not have to be dominated by the US tech giants; instead, there is still room for companies from other regions to compete successfully. This moment presents significant opportunities for European companies to shape and benefit from the emerging AI landscape, and it is important that Europe jumps on that bandwagon. Can we imagine all the possible application areas, whether vertical and industry-specific or horizontal and use case-specific, and build the applied AI solutions that people, companies and societies need?

Many companies are already introducing "bots", "assistants" and "copilots" to their processes and applications, thereby augmenting human-centred workflows (Ritala et al. 2024, Wilson & Daugherty 2025, Yerramilli-Rao et al 2024). Even though the extent of ongoing fine-tuning and improvement required for applied AI models remains an area of further exploration, it is evident that the competitive advantage in today's business does not stem only from generic tools but from the strategic use of unique data paired with applied AI solutions. Like the transition from standard office tools to specialised applications, the real value lies in how uniquely tailored AI models can amplify the utility and impact of proprietary data, setting a new bar for competitive differentiation.

The greatest untapped potential for Europe lies in vertical AI models and AI agents, both in

B2C and B2B. To strengthen competitiveness and achieve strategic autonomy, we recommend prioritising these areas. We propose the following six recommendations for Europe to win in the AI race.

1. Europe needs to strengthen its strategic autonomy in AI and harness the power of its large single market

Europe must enhance its sovereignty and autonomy in critical AI technologies, particularly cloud infrastructure, raw materials and semiconductor development. There are several potential avenues to achieve this. First, European private companies in these fields need backing to stay competitive and expand within and beyond the single market. Second, public investments should play a strategic role in developing critical AI technologies, ensuring that Europe does not fall behind in key areas. Additionally, the European public sector itself should lead by example, by procuring innovative European AI technologies and services. Regardless of the approach taken, achieving strategic autonomy is a long-term endeavour – the time to act is now.

To enable a supply of sovereign AI solutions in the EU, Europe must also make the most out of its own single market. Competing with the US and China requires a shift from fragmented local markets to a cohesive, innovation-driven European AI ecosystem that supports rapid internationalisation. Regulations and standards should prioritise fostering innovation and startups, enabling cross-border collaboration, and supporting rapid scaling across member states. While European values such as privacy and human-centric design remain foundational in European AI, there is a need to remove the remaining legal and technical barriers to data sharing and reuse, such as interoperability challenges and legal uncertainties around liability and intellectual property rights, particularly with regards to the relationship between AI and the GDPR, as well as copyright legislations. Additionally, the broader emergence of regulatory technology solutions should be strategically enabled to help especially smaller companies streamline the interpretation and application of complex AI legislation and related reporting requirements.

2. Affordable and sustainable computing resources are fundamental in enabling the creation of AI applications

Europe must invest in energy-efficient, sustainable resources to meet the demands of AI development while supporting the EU's green transition. It is vital to ensure affordable and widespread access to high-performance computing resources for businesses, researchers and industry verticals. While European AI Factories have already been launched, there is still significant work to be done in raising awareness and providing guidance to ensure that stakeholders can fully and effectively leverage them in practice.

3. Ensure availability of large language models in all EU languages

The EU must support the development of open-source, pre-trained large language models in all official EU languages to ensure accessibility and inclusiveness. These local models, designed to reflect and serve Europe's diverse cultures and languages, will form the foundation for applied AI solutions, including vertical AI models and AI agents. The ongoing Open Euro LLM initiative will play a major role in fulfilling this need.

Expanding multimodal capabilities in AI models, incorporating text, audio and video will further enhance their versatility. Additionally, fostering partnerships with global actors that align with European AI principles – such as trust, transparency and sustainability – will be key to building competitive AI solutions.

4. Ensure access to high-quality industry-specific data

European data spaces must become reliable sources of high-quality data for AI models, including data from public-sector sources. Establishing robust, industry-specific

data-sharing ecosystems can help boost collaboration across critical European verticals. Investments in advanced data collection, integration and analysis infrastructure – including public-sector data – are needed to support AI applications.

A key component of data sharing is trust between parties, and Europe could implement several mechanisms to strengthen it. One possibility is a European Data and AI Rulebook, outlining common principles and best practices on data-sharing ethics, fairness and human-centricity. Additionally, preliminary rulings of the European Court of Justice could help companies proactively address data confidentiality concerns, thus reducing legal uncertainty and preventing disputes before they arise. To unlock the full potential of European data sharing, the EU must explore a range of trust-building mechanisms that encourage collaboration while ensuring compliance and security.

5. Invest in the substantial evolution of AI-related workforce skills

Programs designed to upskill the European workforce and improve AI literacy are essential to ensure readiness for AI-driven economies (McKinsey 2024a). Additionally, stronger partnerships between universities and industry are needed with joint R&D initiatives, targeted funding and seamless talent exchanges that can bridge the gap between academic research and practical applications.

While broad workforce upskilling is crucial, retaining top AI researchers is equally important. Currently, 22% of the world's leading AI researchers are educated in Europe, but only 14% remain in the region. Furthermore, in 2023, salaries for software developers in the US were two to four times higher than in Europe (McKinsey 2024c). This trend cannot continue if Europe aims to remain competitive. To counteract this, Europe must further simplify the visa processes to attract international AI talent, among others. Finally, Europe must focus on attracting talent that aligns with its vision of ethical and responsible AI development. One approach could be the launch of an "AI Made in Europe" label: a branding initiative that promotes Europe's distinct AI values globally, signalling to researchers and professionals that Europe is committed to trustworthy and human-centric AI.

Europe must establish AI competence centres or "talent hubs" to bring together the best minds – akin to how Silicon Valley fosters innovation and collaboration in the US.

6. Securing adequate financing for applied AI is a strategic opportunity for the EU

As highlighted in this study, Europe lags behind the US and China in private AI investment. It is thus essential to channel targeted resources toward developing local-language LLMs (Janin 2024, Macaulay 2025), vertical AI models for key industries and many AI agents for diverse use cases. These investments are vital not only to fostering innovation but also to bolstering Europe's technological sovereignty and ensuring that critical AI solutions remain under European control.

As the global AI race accelerates in both speed and magnitude, Europe must plan for sustained annual investments exceeding €10 billion in AI, and adjacent enabling technologies to remain competitive (European Commission 2025d). The launch of the €200 billion InvestAI initiative (European Commission 2025c) in February 2025 marked a significant step forward, with the potential to drive applied AI adoption and foster the emergence of European AI unicorns. Additionally, France's recently announced large-scale AI investment plan, along with similar national initiatives, can further accelerate the scaling of applied AI across Europe (Heikkilä et al. 2025). It thus seems that financing has now been secured – the next critical step is to allocate it quickly and efficiently to AI infrastructure and competence development and scale it so that it translates into tangible progress and truly enables sovereign applied AI to flourish in Europe.

Strategic collaboration is the key to Europe's AI future

In summary, while Europe faces significant challenges in AI, it also possesses many of the key building blocks too. As some of the wealthiest nations globally, European countries indeed have the required financial resources for AI investments and the February 2025 launch of the €200 billion InvestAI initiative (European Commission 2025c) demonstrates a clear commitment to accelerating AI development across the continent. Further, Europe has world-class education systems, strong academic institutions and a highly skilled workforce in place – ready to support AI implementation when needed. Moreover, Europe's strong and technologically capable industrial verticals are continuously and consistently generating valuable, unique data to power AI models. Finally, the EU operates in almost all societal sectors, having many opportunities to set policies, support activities and drive development.

However, possessing these assets alone is not enough: Europe must integrate, harmonise and scale them strategically. By its very nature and historical context, Europe is fragmented rather than unified, which hampers the efficient creation, implementation and global commercialisation of AI technologies. To fully realise AI's potential, Europe must leverage what it already has while fostering greater collaboration and scaling initiatives across the continent (for example through public-private partnerships and collaboration among member states). Achieving this requires a systemic approach – one that aligns with the six key recommendations outlined in this study and ensures that investment, talent, infrastructure and governance work together in a cohesive AI strategy.

For Europe to compete in the global AI market, the most realistic path to achieving competitiveness and strategic autonomy is to capitalise on opportunities in vertical AI models and AI agents, where the race is still wide open, and Europe can leverage its strengths. We must act fast and decisively. We must act now.

References

AI World. 2025. AI world: navigate tomorrow's intelligence today. CEPS think tank on EU affairs.

Aleph Alpha. 2025. Company webpage

Anglen, J. 2024. What is the cost of building AI agents? Rapid Innovation.

Bankless. 2024. "Society of AI agents", Jansen Teng (Virtuals Protocol)

Barney, J.B., Reeves, M. 2024. AI won't give you a new sustainable advantage Harvard Business Review.

Bean, R. 2025. 6 Ways AI Changed Business in 2024, According to Executives Harvard Business Review.

Bessemer Venture Partners. 2024. Part I: The future of AI is vertical

Borrell, J. 2020. Why European strategic autonomy matters

Chen, S. 2023. Vertical AI: The next revolution in generative AI Forbes.

Coherent Solutions. 2024. How much does it cost to develop an AI solution? Pricing and ROI explained

Contentsquare. 2025. Company webpage

Dominguez, L. 2024. Henkel is tackling 'more than 800 projects' as part of its supply chain optimization Consumer Goods Technology.

Draghi, M. 2024. The future of European competitiveness (PDF)

Duffy, C. 2025. Trump announces a $500 billion AI infrastructure investment in the US CNN.

EPRS / European Parliamentary Research Service. 2020. On the path to 'strategic autonomy' - The EU in an evolving geopolitical environment. (PDF)

EUR-Lex. 2025. Competitiveness (summary of EU legislation)

EuroHPC. 2024. Selection of the first seven AI factories to drive Europe's leadership in AI

European Commission. 2023. Joint communication to the European Parliament, the European Council and the Council on "European Economic Security Strategy"

European Commission. 2024. Commission receives seven proposals for AI Factories which will boost AI innovation in the EU

European Commission. 2025a. AI Factories (EU policy)

European Commission. 2025b. Competitiveness (EU policy area)

European Commission. 2025c. EU launches InvestAI initiative to mobilise €200 billion of investment in artificial intelligence

European Commission. 2025d. European approach to artificial intelligence

Eurostat. 2023. Key figures on European business – 2024 edition (PDF)

Exponential View. 2024. From ChatGPT to a billion agents

Fattorini, L., Maslej, N., Perrault, R., Parli, V., Etchemendy, J., Shoham, Y., Ligett, K. 2024. The global AI vibrancy tool, November 2024 (PDF)

Fortune Business Insights. 2024. Generative AI market size, share & industry analysis, by model (generative adversarial networks or GANs and transformer-based models), by industry vs application, and regional forecast, 2024-2032

Frazier, K., Rozenshtein, A. Z., Salib, P. N. 2024. OpenAI's latest model shows AGI is inevitable. Now what? The Lawfare Institute.

Galloway, S. 2025. 2025 Predictions

Gate.io. 2024. Web 4.0: The agentic web

Grand View Research. 2024a. AI agents market size & trends

Grand View Research. 2024b. Artificial intelligence market size & trends

Grand View Research. 2024c. Large language model market trends

Gray, C. 2022. Top 10 companies innovating with AI in Europe AI Magazine.

Hawkins, A. 2025. Biden admin's global AI chip regime Politico.

Heikkilä, M., Abboud, L., Gara, A. 2025. Macron unveils plans for €109bn of AI investment in France.

Hodgson, L. 2024. European AI enjoys a surge of VC mega-rounds PitchBook.

Hosanagar, K., Krishnan, R. 2024. Who profits the most from generative AI? MIT Sloan Management Review.

Ichhpurani, K. 2024. Build, deploy, and promote AI agents through Google Cloud's AI agent ecosystem Google Cloud.

Janin, M. 2024. EuroLLM: Pioneering European Open Source AI Interoperable Europe.

Lambert, N. 2025. DeepSeek V3 and the actual cost of training frontier AI models Interconnects AI.

Kaltheuner, F., Saari, L. 2024a. Our projection for 2025 EU AI Industrial Policy Monitor.

Kaltheuner, F., Saari, L. 2024b. The EU's new commission: What the first 100 days mean for AI industrial policy EU AI Industrial Policy Monitor.

Karnitschnig, M. 2024. Europe's economic apocalypse is now Politico.

Kim, C. 2023. Vertical AI: Why a vertical approach is key to building enduring AI applications

Knight, W., Matsakis, L. 2024. US to introduce new restrictions on China's access to cutting-edge chips Wired.

KONUX. 2025. Company webpage

Lewin, A. 2025. The 13 European startups that became unicorns in 2024

Macaulay, T. 2025. European AI alliance unveils LLM alternative to Silicon Valley and DeepSeek The Next Web.

MarketsandMarkets. 2024. AI agents market by agent role - global forecast to 2030

Marshall, M. 2024. Microsoft quietly assembles the largest AI agent ecosystem - and no one else is close Venture Beat.

McKinsey. 2024a. A new future of work: the race to deploy AI and raise skills in Europe and beyond

McKinsey. 2024b. Charting a path to the data- and AI-driven enterprise of 2030

McKinsey. 2024c. Time to place our bets: Europe's AI opportunity

Mistral AI. 2025. Company webpage

Mitrade. 2025. AI agents are the new trend in crypto; why are they taking over crypto?

Nicol-Schwarz, K. 2024. All the new European unicorns of 2024 Sifted.

OECD. 2024. Hours worked

Owkin. 2025. Company webpage

Palmen, J. 2024. Artificial intelligence impressed Kone's employees – "None of the test users wanted to stop using it" Tivi Magazine.

Paraskevopoulos, D., Lueth, K. L., Wegner, P. 2024. Global cloud projects report and database 2024

Reuters. 2024a. China warns of 'necessary actions' if US escalates chip curbs

Reuters. 2024b. EU countries back duties for Chinese titanium dioxide

Robson, K. 2024. Xavier Niel: 'don't cash out' — Mistral backer urges Europe's AI startups to resist early exits and compete globally CNN.

Ruokonen, M., Ritala, P. 2023. How to succeed with an AI-first strategy, Journal of Business Strategy, Vol. 45 No. 6, pp. 396-404.

Sarlin, P. 2024. Winners in the AI game and opportunities for Europe

Sharma, R. 2024. AI agent development cost: how much does it cost to build?

Sitra. 2024a. AI in social and health services.

Sitra. 2024b. Ensuring European leadership in the data economy: ten priorities for the European Union

Sitra. 2024c. Generative AI to support and enhance law drafting – 4 + 1 lessons from pilot projects

Stanford University. 2024. Artificial intelligence index report 2024 (PDF)

Statista. 2024a. Artificial intelligence – worldwide

Statista. 2024b. Generative AI – worldwide

Swarts, J. 2024. Something's got to give: European regulators crack down on AI as U.S. tech companies plunge into the market MarketWatch.

The AI Navigator. 2024. What is agentic process automation (APA)?

Thornhill, J. 2024. The future of AI agents is lucrative but surprisingly dull Financial Times.

Treves, L., Ruokonen, M., Ritala, P. 2024. How to build strategic differentiation with customized GenAI. A work-in-progress research paper by LUT University Business School.

VDA. 2024. German automotive industry invests more than €250bn in R&D worldwide by 2027

Von der Leyen, U. 2024. Europe's choice: political guidelines for the next European Commission 2024-2029 (PDF)

Wilson, J. H., Daugherty, P. R. 2025. The secret to successful AI-driven process redesign Harvard Business Review.

Wiggers, K. 2024. DeepSeek's new AI model appears to be one of the best 'open' challengers yet TechCrunch.

World Economic Forum. 2024. Navigating the AI frontier: a primer on the evolution and impact of AI agents (PDF)

Y Combinator. 2024. Vertical AI agents could be 10X bigger than SaaS

Yerramilli-Rao, B., Corwin, J., Li, Y., Lakhani, K. R. 2024. Strategy in an era of abundant expertise Harvard Business Review.

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