AI at German SMEs – unlocking opportunities

German SMEs are increasingly recognising AI as a key technology governing competitiveness and productivity. In the view of the Chief Economists, the economic potential of AI lies in the optimisation of processes, logistics, production, marketing and risk management. The setting-up of the new Federal Ministry for Digitalisation and Government Modernisation unlocks economic growth opportunities. In order to double the production potential of AI, decisive political challenges must be overcome quickly:

- These include the country's shortage of skilled workers. Successful deployment of AI presupposes well-trained personnel. At SMEs, in particular, this requires targeted training measures.

- The buildout of digital infrastructure is associated with heavy investment spend. Innovation-friendly regulation can play a salutary supportive role here.

- The complexities of integrating AI into existing IT systems, an unclear legal situation, (in some cases) excessive data-protection requirements, a lack of data quality and new organisational forms, corresponding to the innovative work processes being brought about by AI, are further, highly specific challenges.

- The deployment of AI often necessitates a new type of corporate culture, particularly in terms of "trial and error". Such a shift requires learning processes both at companies and with regard to framework-setting legislation.

04th July 2025

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AI as a key factor for Germany's SMEs

Within a very short space of time, artificial intelligence (AI) has morphed from being a visionary research idea into one of the key baseline technologies underlying the global economy. It is transforming value chains, business models and working environments to an unprecedented extent and provides major growth opportunities. For German SMEs – the backbone of the German economy, distinguished by millions of employees, a high level of innovation and strong regional roots – integration of AI into their corporate reality is becoming a crucial issue: it will determine whether companies can remain competitive in an increasingly data-driven world, open up new markets and secure sustainable growth.

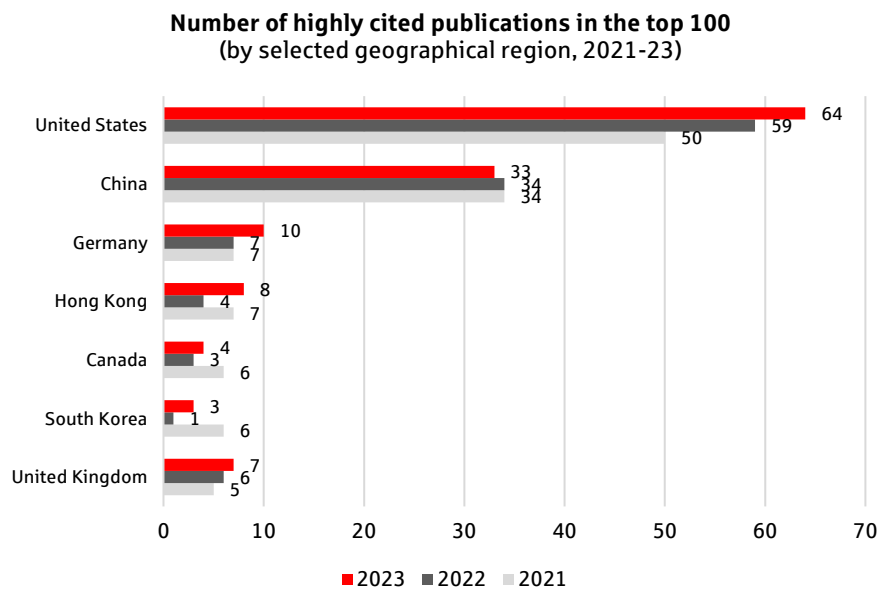*AI is more than just a trend, but rather a real opportunity – including SMEs*

The Savings Banks Financial Group and particularly the Chief Economists regard themselvesas a progressive thinker, active partner and pioneer in this transformation process. As a major financial group in Germany, marked by deep roots in the SME sector and by a nationwide presence, the Savings Banks Financial Group is in a position to support the AI transformation process not only financially but also in a counselling and technological capacity.

Germany's Savings Banks regard themselves as AI partners for the country's SMEs

Current status: German SMEs in the era of AI

In the view of the Chief Economists of the Savings Banks Finance Group, the general consensus is that Germany is, in principle, not at all badly positioned in the international race for supremacy in the AI sphere (see, for example, the Federal Republic's ranking in the [Stanford AI Index Report](#)). Especially in terms of scientific output and applied research in its corporate sector, Germany numbers among the world leaders and, thanks to its industrial business model, likewise enjoys access to a large potential of high-quality machine data, in principle at least. The German institutional research landscape – entities such as the German Research Centre for Artificial Intelligence, the Max Planck Society, the Helmholtz Association and the Fraunhofer Society – is also very efficient in the AI field. With regard to SMEs, however, the criticism has to be levelled that the available data is often inadequately processed and structured, which makes such data difficult to use for AI applications and means that the existing potential has only been able to be partially exploited so far.

Germany is a scientific pioneer in the AI domain

Number of highly cited publications in the top 100
(by selected geographical region, 2021-23)

Region	2023	2022	2021
United States	64	59	50
China	33	34	34
Germany	10	7	7
Hong Kong	8	4	7
Canada	4	3	6
South Korea	3	1	6
United Kingdom	7	6	5

■ 2023 ■ 2022 ■ 2021

Source: AI Index Report 2025

The current "AI Preparedness Index" modelled by the International Monetary Fund (IMF) provides further economic evidence of Germany's strong position in the international stakes. In this global comparison, which tracks the readiness of 174 countries to introduce and deploy artificial intelligence based on factors such as digital infrastructure, innovative capability, human capital and regulatory framework conditions, Germany ranks ninth and is therefore among the international frontrunners. Alongside other European countries such as the Netherlands, Estonia, Finland and Switzerland, Germany is rated as having, in particular, an advanced infrastructure, a highly-qualified workforce and an innovation-friendly environment. This survey underscores that the Federal Republic is not only very well positioned in the scientific and industrial sectors, but also in terms of the overall social and economic conditions governing the use of AI.

AI adoption at German SMEs is gaining noticeable momentum, but is still lagging behind utilisation levels in the economic nations leading the international league-table. According to the latest AI Index published by the German SME Association, around 33% of the country's SMEs are already using AI solutions productively, while a further 24% are running projects which are currently in the test or pilot phase. Almost a quarter are planning to introduce AI technologies, or expand existing applications, within the next twelve months. This new departure is remarkable, as German SMEs have traditionally been reluctant to introduce new technologies in the past.

According to a recent survey of 552 German industrial enterprises conducted by Bitkom, the industry association for the German information and telecommunications sector, 82% of the companies questioned believe that AI is going to be crucial to the competitiveness of German industry in

One third of Germany's SMEs are already using AI

the future. At the moment, AI is most frequently used in analytics for machine monitoring (32%), the next biggest area of application being robotics (19%). The survey in question concludes that the greatest growth potential lies in the field of energy management: only 7% of companies in this sector are currently running AI applications, but 64% are in the planning or discussion phase.

Despite this, a certain reserve still remains with regard to AI. According to a study by the European Commission, 74.2% of small and medium-sized enterprises (SMEs) were still displaying a low to very low level of digital intensity in 2023 – a higher figure than in the previous year. The proportion of Germany companies actually using AI therefore remains below the European average. A certain reluctance to wade into the AI domain is also reflected in the current "Industry 4.0 Barometer". On the basis of a study by MHP Management- und IT-Beratung and Ludwig-Maximilians-Universität München (LMU), 81% of the companies surveyed view Industry 4.0 applications, i.e. the use of digitally networked technologies in production, as an opportunity, but only 19% of German industrial companies are actually planning to employ AI to boost efficiency or reduce production costs.

By international standards, German SMEs are in danger of falling behind. While the USA (with such projects as "Stargate") and China are both funnelling hundreds of billions into investment on AI infrastructure and research, Germany is lagging far behind with planned AI funding. Back in 2018, the German government of the time published an AI strategy focusing on a holistic approach involving twelve fields of action, including research, education, business and ethics. Although the originally planned investment volume of 3 billion euros is scheduled to have been topped up to a total of 5 billion euros by year-end 2025, this amount seems (to say the least) rather minimalistic in an international context. The planned expansion of AI infrastructure, in particular of high-performance data centres and service centres, within the framework of the new federal government's infrastructure programme is therefore to be welcomed.

The heterogeneity of AI use is striking: while sectors such as information and communication technology or the manufacturing industry are already implementing advanced applications, the construction and retail sectors still have quite some catching up to do. Regional disparities are also in evidence: in southern Germany, digital and AI readiness is much more pronounced than in eastern Germany, which is reflected in the availability of broadband internet access, data centres and skilled workers.

The technological basis and AI methods

Amid all the hype surrounding ChatGPT, people forget that there is no such thing as AI in a monolithic sense. AI more closely resembles a periodic table

There is no such thing as AI in a monolithic sense

4

of chemical elements involving numerous combinable sub-entities. Which of these elements is used depends on the area of application at the company concerned.

Machine learning has been the most important AI method for quite some time now. At German SMEs, machine learning is primarily used to analyse large batches of data and for the purposes of pattern recognition. For example, mechanical engineers utilise AI-based systems for predictive maintenance by evaluating acoustic signals so as to receive early warning of impending failures. In the automotive industry, AI supports the identification of spare parts on the basis of photographs, which reduces the error ratio and speeds up processes. In the domains of sales and marketing too, machine-learning processes enable targeted customer segmentation and the optimisation of pricing strategies.
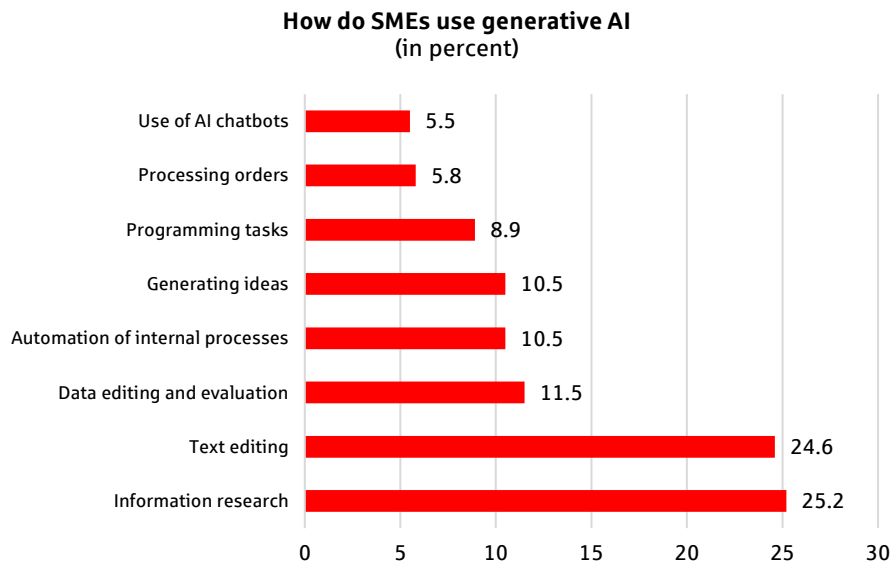
Machine learning

Deep learning is an important sub-form of machine learning based on multi-layered neural networks. Deep-learning models go one step further, providing solutions for particularly complex tasks, for example in the spheres of image and speech recognition. Deep learning is particularly relevant in areas of research in which humans are unable to perceive any kind of pattern with the naked eye. Deep learning therefore helps in the search for the proverbial needle in what is a huge (data) haystack. It holds out the prospect of new opportunities for research-intensive companies, in particular. Examples include cancer research in the pharmaceutical industry, image recognition in the process of developing autonomous driving, or the evolution of chatbots and the prevention of fraud and money laundering in the financial sector. Another example is automated quality control on the production front: camera systems that work with deep learning detect even the smallest deviations or errors that would escape the human eye. In the human-resources department, AI algorithms support the pre-selection of applicants by objectively matching profiles with requirements.

Deep learning models

Since the launch of ChatGPT in November 2022, generative AI (GenAI) has gained widespread attention. GenAI is a special form of deep learning, enabling companies to create texts, images or even videos virtually at the touch of a button. Small and medium-sized companies benefit from this, for instance, through the use of chatbots that automatically answer customer inquiries, fill out forms or generate offers. In the logistics field, generative AI is employed to analyse return rates and optimise stock levels, thereby contributing to more efficient supply-chain management.

Generative AI

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How do SMEs use generative AI
(in percent)

Use	Percent
Use of AI chatbots	5.5
Processing orders	5.8
Programming tasks	8.9
Generating ideas	10.5
Automation of internal processes	10.5
Data editing and evaluation	11.5
Text editing	24.6
Information research	25.2

Source: DZ Bank

GenAI is also the basic platform for the "agentic AI" and "physical AI" layers which build on it. AI agents are AI software programmes connected in series that carry out complete work processes autonomously. "Agentic AI" is likely to become particularly important in terms of programming machines and coordinating the interaction of machines in factories. AI agents perform repetitive tasks, for example in accounting or customer service.

Agentic AI and physical AI

AI-controlled robots come into play in the manufacturing sphere, monitoring production processes and reacting flexibly to new requirements. Going forward, robotics and industrial AI, in particular, are likely to be given further leverage by "physical AI" methods, which involve AI models learning independently by observing their physical environment. Agentic and physical AI stand to be essential for German SMEs when it comes to developing new business models so as to hold their own in the increasingly fierce international competition relating to networked industry (Industry 4.0) and industrial AI. GenAI in the sense of chatbots is likely to progressively percolate through into the everyday office life of German SMEs as a new everyday tool.

Another trend that is particularly relevant for SMEs is the use of open-source AI models. These allow companies to flexibly adapt AI solutions to their own needs, and they can be operated in an enterprise's own data centre without having to rely on international cloud providers. Cloud-based "AI-as-a-Service" offerings likewise play a major role, as they facilitate access to AI and are in a position to alleviate the existing shortage of skilled workers.

Open-source AI models

AI as a growth driver and productivity booster

Major technological changes have repeatedly led to significant growth spurts over the centuries. This economic potential exists for AI as well. Thus the trend in productivity growth and the trajectory of technological progress are decisive for the level and growth rate of the macroeconomic production potential in the long term. So far, little is known about how technological progress can be systematically promoted and productivity growth increased. The proper institutional underpinnings are crucial. Unfortunately, modern growth research has still not clarified exactly what these prerequisites are and in what context.

Against this background of ignorance, it is not surprising that a significant slowdown in productivity growth has been observed in recent years despite what feels like the rapid growth in the use and diffusion of modern digitalisation, information and communication technologies. Such waning productivity growth has been empirically observable in all developed countries since the outbreak of the financial crisis, at the latest, and in Germany and other European countries, in particular. In the view of the DSGV Chief Economists, this "productivity puzzle" has not yet been solved.

The elusive productivity puzzle

There are many indications that the relatively low productivity growth being logged has various interacting causes. Possible reasons for this could be overblown expectations about new technologies, the fact that creating new ideas now demands greater outlays than in the past, but also measurement errors due to the lack of measurability of many (intangible) components in an increasingly digital economy. The greater weighting of low-productivity service industries is also likely to play a role, as are time-lag effects pertaining to the adjustment of corporate organisations – adjustments without which the new technologies cannot unfold their full effect.

The 2024 "Draghi Report", analysing the causes of Europe's competitive weakness and offering potential remedies, concludes that the productivity gap between Europe and the USA is almost exclusively due to the lower level of digitisation in the economy on this side of the Atlantic. Germany is also being haunted by a phenomenon that has lately been stalking the digitalisation of the local music industry: although the MP3 standard was originally developed in Germany, it has been U.S. companies that have shown the shrewd business sense to translate this technology into concrete products on the market. In the AI stakes too, we in Germany are currently running a similar risk: although the theoretical foundations are already in place in Germany, or in the wider European context, or have even been developed here, we are being paralysed above all by focusing on the risks associated with this new technology rather than opening ourselves to the opportunities which it can unlock.

Obstacles to technology transfer

Regardless of this, AI is considered a key technology for enhancing productivity and tapping into new value-creation potential for German SMEs. A recent study by PricewaterhouseCoopers (PwC) demonstrates that the use of AI could increase Germany's gross domestic product by up to 11% by 2030 – that would correspond to additional value added of around 430 billion euros and would therefore exceed the relevant potential of many other European economies in percentage terms. AI unleashes its impact not only by increasing efficiency and reducing costs, but also by evolving new business models and strengthening international competitiveness. The bottom line: AI must be a strategic priority for corporate management.
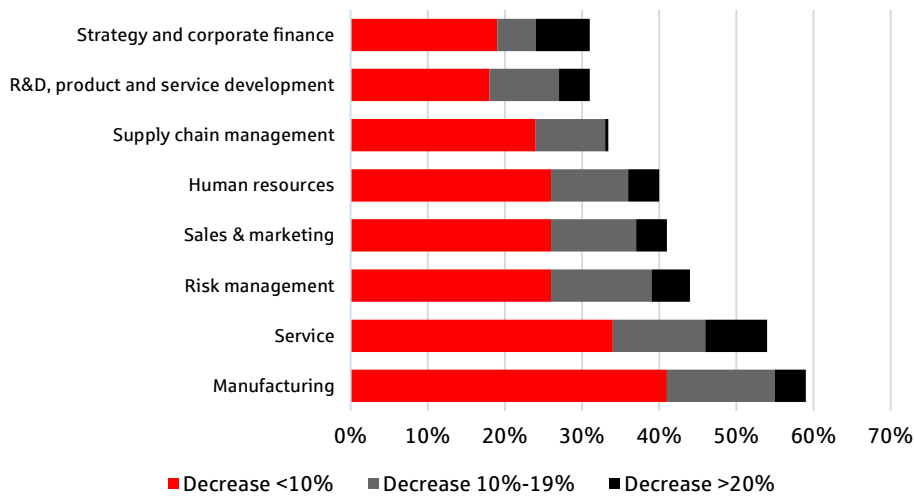
If AI technologies are mobilised and deployed in a responsible manner, they can boost productivity in many sectors. At a macroeconomic level, the Cologne Institute for Economic Research (IW Köln) forecasts annual productivity growth of 0.9% for Germany for the period between 2025 and 2030, potentially increasing to 1.2% p.a. during the next decade. By comparison, the growth rate in the 2020s to date has only been 0.4%. AI applications can therefore increase the potential growth rate of the German economy, even if there is no "productivity miracle" in the sense of a stellar growth spurt. International comparisons in fact suggest that the potential could be even greater: in the case of the USA, it is considered possible that productivity growth could be ramped up to 3 percent over the next ten years.

The greatest productivity gains through AI are currently being achieved in the domains of production, marketing and sales as well as risk management. In the production field, 16% of companies report an increase in turnover of more than 10% by virtue of AI. Another 16 percent see potential upside of 6 to 10 percent, and around a third estimate the additional utility there to be unlocked at up to 5 percent. In addition, 55% of companies state that they have driven down their production costs thanks to AI. 54 percent report savings in the services area and 44 percent in the risk-management sphere. On the production side, the strength of AI lies in its capacity to process large amounts of data, for example with respect to machine monitoring, process optimisation and predictive maintenance. On the sales and marketing front, AI enables a more precisely targeted customer approach and superior evaluation of market trends. In the risk-management arena, AI improves the detection of fraud and the management of business risks.
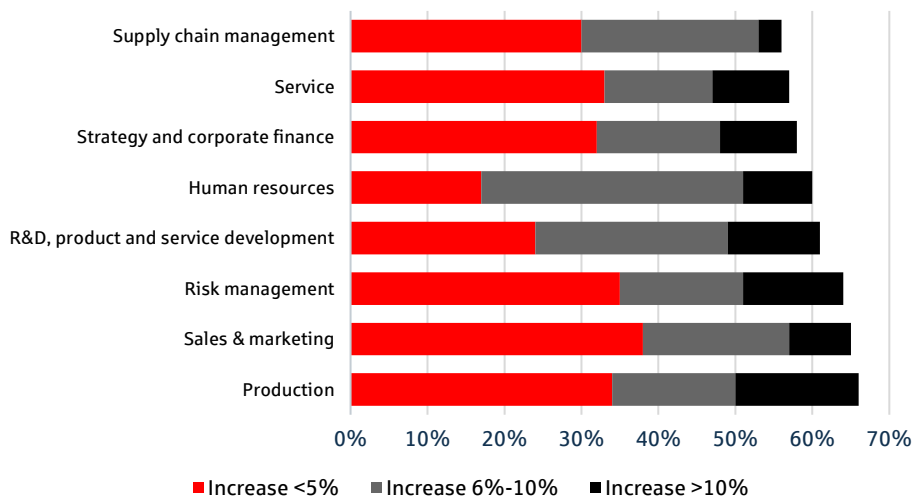
Cost reduction potential through AI by field of application

Categories (top to bottom): Strategy and corporate finance; R&D, product and service development; Supply chain management; Human resources; Sales & marketing; Risk management; Service; Manufacturing

Legend: ■ Decrease <10% ■ Decrease 10%-19% ■ Decrease >20%

Sales potential through AI by field of application

Categories (top to bottom): Supply chain management; Service; Strategy and corporate finance; Human resources; R&D, product and service development; Risk management; Sales & marketing; Production

Legend: ■ Increase <5% ■ Increase 6%-10% ■ Increase >10%

Source: Stanford University 2024, based on data from McKinsey & Company, LBBW Research

If an environment conducive to AI investment is created, the Chief Economists of the Savings Banks Finance Group are – all in all – cautiously optimistic that German macroeconomic growth can be positively influenced and productivity growth ratcheted up again and doubled to over one per cent – albeit not enough in order to compensate for other, generally speaking, negative effects on the economy's potential growth rate and on productivity growth (e.g. demographic ageing). For this shortfall to made up, then, there is additional need for ramped-up investment, particularly with regard to computer technologies, research & development, industrial robots and when it comes to creating a pro-investment, innovation-friendly environment in general. It is, furthermore, important that we learn to incorporate stochastic elements into processes in order to render our systems more flexible, adaptable and resistant to uncertainties and

unforeseen disruptions.

AI at SMEs – challenges and obstacles

A variety of challenges and obstacles face German SMEs when introducing AI applications and seeking to use them productively. These range from technological and organisational hurdles to regulatory uncertainties to cultural issues.

The shortage of skilled workers in the Federal Republic is one of the biggest obstacles to AI transformation at SMEs. No fewer than 36% of the country's companies are complaining about the scarcity of IT specialists, particularly in the field of AI, and 31% lack specific AI expertise. Many German SMEs have neither the financial resources nor the organisational prerequisites to hire data scientists, AI engineers or machine-learning experts. At the same time, there is often a lack of internal training opportunities and systematic skills development for in-house teams. Dependence on external service providers can lead to further dependencies and know-how losses.

Implementing an AI rollout presupposes considerable investment – in infrastructure, software, data management and personnel. For many SMEs, the high up-front investment and running costs involved constitute a major hurdle. What is more, the economic benefits of AI projects often only become apparent after a comparatively lengthy start-up phase. Many companies shy away from such a risk and are unable to clearly quantify the business case for AI investment. To date, government funding programmes have only been drawn on by a third of the country's companies, even though such funding is specifically available for digitalisation and AI projects.

The technological complexity of AI solutions is another factor which puts many SMEs off. 29% of the companies surveyed see complexity as a central obstacle. The integration of new AI systems into existing IT landscapes is often difficult, especially if the latter have grown up over time in a piecemeal and haphazard way and are far from standardised. Incompatibilities, a dearth of interfaces and the long service life of existing machinery and systems make it all the more difficult to introduce AI-based solutions.

The quality and availability of data is a basic prerequisite for successful AI projects. Indeed, the defining characteristic of GenAI is that it is capable of analysing and processing unstructured data. The point is that data is frequently unstructured, distributed or only available in incompatible formats. On this front, SMEs are faced with the challenge of integrating data from different sources, cleansing it and harnessing it to the task of training AI models. Many SMEs use less than 20 percent of their operational data in a systematic fashion. A lack of data standards, inadequate data maintenance and uncertainties when it comes to the handling of personal data make it
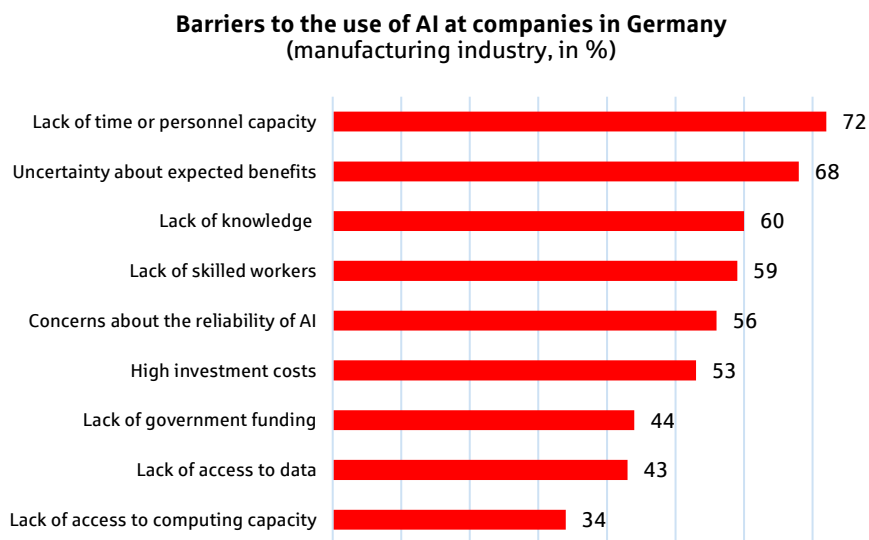
more difficult to develop and train powerful AI models.

Data protection is a double-edged sword for many companies. On the one hand, the EU's General Data Protection Regulation (GDPR) creates trust and legal certainty; on the other, it confronts smaller companies, in particular, with considerable challenges. Stringent regulatory requirements and uncertainty in dealing with new laws (e.g. the EU AI Act, laying down harmonised rules on artificial intelligence) are causing companies in the sector to hold back, provoking an investment logjam. The fear of losing control over sensitive company data, especially when having recourse to foreign cloud or AI providers, is widespread. Moreover, compliance with data protection and ethical guidelines triggers organisational and financial costs.

Barriers to the use of AI at companies in Germany
(manufacturing industry, in %)

Barrier	%
Lack of time or personnel capacity	72
Uncertainty about expected benefits	68
Lack of knowledge	60
Lack of skilled workers	59
Concerns about the reliability of AI	56
High investment costs	53
Lack of government funding	44
Lack of access to data	43
Lack of access to computing capacity	34

Source: ZEW Business Survey Information Economy Q3 2023

Another problem is that many SMEs do not have a clear digital or AI-related strategy. They have failed to generate a systematic assessment of their own AI readiness, of target images or of a roadmap mapping out the introduction process. The plethora of possible fields of application and uncertainty about the actual benefits make prioritisation and decision-making difficult. In addition, scepticism towards AI still prevails at many companies, along with resistance to change and fear of job losses. Unrealistic expectations about rapid success often lead to disappointment and the abandonment of pilot projects.

Caught in the triangle of opportunities, risks and ethical responsibilities

AI indubitably opens up enormous potential for SMEs; at the same time, though, the implementation of AI systems entails considerable risks as well as profound ethical issues.

At this point, we prefer to refrain from debating the extreme risk that AI could end up wiping out humanity. One of the current risks is that the arsenal of automated tools available to criminals with GenAI is growing. GenAI therefore poses a whole range of new, often not yet understood risks for small and medium-sized enterprises. It is crucial for SMEs to take these factors on board at an early stage, to actively manage them and to integrate them into a comprehensive AI strategy.

Responsibility for data-protection breaches or erroneous AI decisions lies, in principle, with the companies that develop, operate or use AI systems. Compliance with all legal provisions and careful documentation of AI applications are therefore indispensable in order to minimise liability risks and meet regulatory requirements.

Increased use of AI significantly increases the risk of cyberattacks, data leaks and the theft of business secrets. In addition to the traditional dangers known from the past, the threat of false identities and of new windows of opportunity for fraud is looming larger – for example, when image-generation programmes are used to create fake purchase receipts and then submit them for billing. In order to protect sensitive information and ensure system integrity, it is essential for companies to secure their data infrastructure and to provide employees with targeted IT-security training.

Due to imperfect training data or technical decisions taken during the development and introduction phase, AI systems can exhibit systematic bias to the detriment of marginalised groups, leading to unfair or discriminatory outcomes - for example, regarding the selection of applicants or insurance decisions. Reducing bias and ensuring fairness is not only a regulatory requirement, but also reinforces the trust of customers, employees and investors alike. Successful strategies call for diverse development teams, regular bias checks, independent audits and the establishment of corporate digital responsibility (CDR) as axiomatic principles of governance.

Bias and fairness in AI

Many AI models, especially deep learning and GenAI systems, are reckoned to be a "black box" – their decision paths are very often difficult, or even impossible, for normal mortal users to comprehend and interpret. To make matters more complicated still, GenAI is quite capable of giving different answers to the same input question (prompt) from the user, rendering it more difficult to assess the accuracy and reliability of the results. This makes it harder for human agents to accept, keep tabs on and put their trust in such systems, especially when it is a question of critical business processes or regulatory requirements. The risk of "hallucinations" (incorrect but plausible-sounding answers from AI chatbots) and bias (systematic distortions) is real and can given rise to reputational damage or legal problems.

In this context, it is important to understand that, according to leading AI experts, the large language models (LLMs) on which GenAI models are based will act as new operating systems in the future. They will control virtually all digital user interactions. These LLMs will no longer have a deterministic character, i.e. delivering the same result for every input request. Instead, they will function probabilistically: the same prompt will engender different results. LLMs do not therefore work like pocket calculators, but rather like probability calculators for the sequence of word parts. They are inherently associated with error rates, producing answers that sound plausible but are not necessarily correct. This "hallucination" problem is unlikely to be resolved in the foreseeable future.

Although capable of solving complex problems, AI challenges conventional notions of predictability and liability. In the short term, the main risks emanating from GenAI arise from new sources of disinformation and new cyber risks. Recent studies show that LLMs ought not to be used for questions that presuppose correct analysis. A challenge facing companies is therefore to make decision-making processes as transparent as possible and to implement explanatory mechanisms. Only in this way can they comply with regulatory requirements, minimise liability risks and strengthen user trust.

New sources of disinformation and new cyber risks

Training AI models on large amounts of data entails the latent risk of using copyrighted content without a license. The (possibly unintentional) use of personal or otherwise sensitive information made use of in the model-training context further exacerbates data-protection issues. It is incumbent on companies to ensure that they do not infringe the rights of third parties so as to avoid legal disputes and damage to their corporate image.

AI is changing job profiles and can lead to the automation of both cognitive and manual tasks. While new job profiles are emerging, routine cognitive jobs, in particular, are at risk. The effects of the AI paradigm shift on the labour market have not yet been conclusively clarified. Adaptability and continuous training are inevitably becoming key success factors. Companies have a responsibility to actively accompany this revolution – through further-training options, transparent communication and the involvement of employees in the AI transformation process.

The operation of large AI models is energy-intensive and can lead to significant CO_2 emissions. It is estimated that generating an image with GenAI uses up as much energy as charging a smartphone. It is therefore up to companies to carefully take into account the sustainability of their AI projects and to prioritise energy-efficient solutions.

AI can be used to generate deepfakes and disinformation, which harbours both social and political risks. Companies need to live up to their responsibility and to take measures conducive to prevention and

When appearances are deceptive – AI and deepfakes

enlightenment. Another problem is that dependence on non-European AI providers can jeopardise digital sovereignty. Building up in-house expertise and using European solutions are important steps towards minimising risks.

Despite (or indeed because of) the high degree of automation involved, human responsibility remains central. The "golden rule" for users of AI models must be that AI makes mistakes. Companies need to ensure that AI systems do not decide autonomously on critical issues, and that AI decisions can invariably be overruled by an in-built human supervisory body. Only in this way can the opportunities offered by AI be used sustainably and responsibly. To enable the responsible use of artificial intelligence at SMEs, it is therefore advisable to firmly anchor ethical guidelines and CDR principles in company statues. Only if ethical values and social responsibility are construed as an integral part of a company's corporate strategy can AI be employed in a sustainable and trustworthy manner. On top of this, regular risk assessments and independent audits should be carried out in order to identify potential weaknesses at an early stage and to ensure compliance with both legal and internal company requirements. AI agents – i.e. AI models that carry out work processes autonomously – should be tested within the context of extreme risks for the company and should only be used in clearly defined environments.

Another success factor is transparent communication vis-à-vis both internal and external stakeholders. Training programmes can be used to sensitise employees to the opportunities and risks of AI and to turn them into active agents in the digital transformation process. In order to avoid systematic bias and discrimination, it is essential to factor bias controls and fairness indicators into the development and application of AI systems.

In addition, data protection, data security and adherence to all compliance requirements must be guaranteed at all times. Last but not least, SMEs should proactively address the issues of sustainability and social responsibility. This includes carefully pondering the ecological impact of AI projects and feeding a given project's social implications into decision-making processes at an early stage.

Artificial intelligence is revolutionising the job market

It has already been pointed out above that the use of artificial intelligence marks a radical paradigm shift in the world of work. It is still unclear, however, what economic impact generative AI will have on the employment situation in Germany in the future. Although automation of many cognitive activities is tending to lead to job losses, numerous new professions and activities are springing into being at the same time.

GenAI is distinctly more adaptive than traditional machine learning and has

implications for a wider range of professions. Thanks to its plug-and-play nature, it can be integrated into company structures much faster than previous baseline technologies. According to a [Bitkom](#) study, 67 percent of Germans were using GenAI in 2024, 45 percent of them in the workplace. The necessary digital infrastructure is usually available, and access is via natural language instead of complex programming languages. In accordance with this, there are already numerous applications.

Modern AI systems are increasingly dialogue-oriented, context-sensitive and capable of independently asking users questions in the event of unclear queries. As a result, human-skill requirements and workplace design are also both shifting in the digital age. While some jobs are disappearing as a result of technological change, new job profiles are simultaneously emerging. Given that GenAI reprocesses information and thus devalues knowledge, interpersonal relationships and their maintenance are becoming more important – at SMEs as well. Particularly in areas where human strengths are at a premium – for example in the care and health-care professions or in skilled trades – novel fields of activity are opening up and the relevance of interpersonal relationships is increasing.

Up to now, automation has mainly affected low- to medium-skilled activities, while merely supplementing the work of high-end experts. GenAI, by contrast, is also increasingly having a substitutive effect with regard to highly-qualified activities, as it can capture and process expert knowledge faster than humans can. [Empirical studies](#) show that highly-qualified people, and women in general, in metropolitan regions are particularly affected.

According to forecasts by [McKinsey](#) and the [World Economic Forum](#), around 30 percent of today's working hours could be automated or transformed by AI by 2030. While millions of jobs will be lost worldwide, new jobs will be created – especially in the domains of technology, data management, STEM professions and healthcare. In Germany's case, around 1.6 million traditional jobs could be lost by 2030, while 2.3 million new jobs may well be created – a net increase that will, however, presuppose extensive qualification and further-training measures. All in all, we are cautiously optimistic that the increasing use of AI methods and the associated automation of routine intellectual jobs will not lead to more pronounced negative disruptions on the German labour market, but can be perceived as a chance for the economy .

Germany's SMEs, which, for years now, have been suffering from a shortage of skilled workers, can prove beneficiaries of AI: automation can relieve them of routine tasks and allow them to focus on value-adding, creative and counselling tasks. AI systems can safeguard the knowledge of experienced employees and make it accessible to new employees – a factor of particular importance in industries where demand for skilled workers is heavy. Digital

learning platforms and carefully tailored further-training courses enable employees to gain individual qualifications, ranging from basic digital skills to advanced IT and programming capabilities.

At the same time, AI-driven automation does entail potential risks: the wage structure could be disrupted and social inequalities could increase. Targeted retraining and qualification programes for particularly affected groups and people in structurally weak regions are therefore of essential importance.

A prerequisite for successful integration of AI is active change management: employees need to be involved in the process at an early stage, their fears need to be addressed and a positive learning culture needs to be established. Transparent communication and active workforce participation are key to creating acceptance and to enabling the process of change to be navigated and shaped collectively.

AI as a future driving force for German SMEs

Artificial intelligence is on the verge of establishing itself as a new baseline and cross-sectional technology that – rather like electricity or the internet – will permeate all sectors and areas of business. For German SMEs, AI is therefore unlocking the kind of opportunity which only comes once a century. The leaps in productivity made possible by AI are increasingly decoupling from human labour, being based instead on the scalability of intelligent technologies. AI-supported systems work around the clock, crunch huge amounts of data, generate forecasts and prepare decisions that were previously only possible as a result of considerable human effort. This makes AI a central growth driver – especially in times of demographic challenges and fiercer global competition.

AI is morphing into a baseline technology

In social terms, it is important to promote acceptance of AI, involve citizens in the transformation process and ensure both transparency and trust. AI can only develop its full potential if it is conceived as a tool benefiting mankind, and if it is handled responsibly.

Evolution of AI technologies is making rapid headway. Companies that invest in AI now, build up expertise and single-mindedly recalibrate their organisation digitalisation-wise will be among the winners of the transformation process. Funding programmes, networks and partnerships can support Germany's SMEs when it comes to mastering the challenges and taking advantage of the opportunities. At the same time, AI is not an end in itself: it must pay off, contribute clear value-added and be embedded in the given company's corporate strategy. According to the Fraunhofer Institute, not every AI project takes a lot of time to realise and costs a lot of money. GenAI investments pay off more quickly than conventional AI methods because the productivity potential slumbering in GenAI is

AI must not become an end in itself

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decidedly high. The good news is that Germany's federal government, state governments and chambers of industry and commerce offer special funding programmes and conceptual support to facilitate the introduction of AI solutions. The biggest risk confronting SMEs is not overinvestment in AI but, on the contrary, underinvestment. One could almost argue: "AI or Die" – the future of German SMEs is digital, and AI is the key to open the door to, and successfully build, this future.

The role being played by the Savings Banks Finance Group

The Savings Banks Finance Group (Sparkassen-Finanzgruppe) regards itself as a driver of innovation and digitalisation in Germany, focusing in this context on the value-oriented, responsible use of artificial intelligence. With over 200,000 employees, the Group is one of the largest employers in the country and is deeply involved in the development and introduction of AI solutions – for example, the digital assistant S-KI-Pilot (S-AI-Pilot in English), which will have been introduced in around 190,000 workplaces by the summer of this year. The aim here is to automate routine tasks, increase efficiency and improve service quality.

A key element of the AI strategy is the operation of sensitive applications in our own data centres and the further development of open source models with specific Savings Bank data. This ensures high data protection and security standards as well as digital sovereignty. The Savings Banks also specifically promote the development of expertise in the field of AI – for example through further training programmes, research partnerships with universities and the acquisition of specialised companies.

Promoting digital sovereignty and data protection

Being the most important financing partners for SMEs, Germany's Savings Banks support the country's small and medium-sized enterprises not only with conventional loans, but also through carefully forcused investment in innovative projects and start-ups. Thanks to their strong regional roots, the Savings Banks are in a position to promote cooperations between local companies, universities and research institutions, thereby contributing to the buildout of regional ecosystems. They also offer counselling and access to funding, with the objective of driving forward the digital transformation of SMEs.

Enabler, innovator and partner for AI solutions at SMEs and start-ups

By putting on offer digital services such as Linda+, a chatbot for our retail customers, and by developing practical AI applications, Germany's Savings Banks are strengthening trust in new technologies and contributing to the acceptance of AI in society at large. Our role as a link between SMEs, research and public funding makes us a major protagonist in Germany's digital transformation.

Strengthening customer orientation through AI-related innovations

A positive tailwind from politics is blowing

The introduction and scaling of AI solutions at German SMEs is a complex transformation process that requires strategic foresight and farsightedness, technological expertise and an innovation-friendly environment. Digital infrastructure is the template for the development, implementation and scaling of AI applications.

Determined political landmark decisions are needed in order to ensure that Germany manages to keep pace in the international AI stakes. The focus has to be on building out the country's digital infrastructure: fast internet on a nationwide basis and state-of-the-art data centres are the basic prerequisites for the development and scaling of AI applications – at SMEs, in particular. Although progress has undeniably been made, there are still serious shortfalls and shortcomings, especially in rural regions. Policymakers should therefore devote a significant portion of the planned funds from the newly launched special infrastructure fund specifically to the expansion of the country's fibre-optics infrastructure and to network modernisation. Equally important is the buildout of high-performance data centres and cloud infrastructures so that small and medium-sized companies too can gain access to scalable AI solutions without having to shoulder heavy up-front capital expenditure themselves.

Another key cornerstone of the new architecture is energy infrastructure. AI applications are energy-intensive and require a reliable, sustainable energy supply. The expansion of renewable energies and the modernisation of energy networks must therefore go hand-in-hand with the digitalisation push in order to safeguard supply security and sustainability.

In this context, it makes eminent sense for Europe to pool its various comparative forces. In principle, the European Commission's action plan to create an "European AI continent" by mobilising 200 billion euros is to be welcomed. The plan to use 20 billion euros of this investment spend to set up five AI gigafactories – AI ecosystems involving massive computing power, secure data rooms and a safe power supply – and the plan to improve access to data distributed across Europe add up to a very good approach. Our hope is that this project proceeds beyond such laudable declarations of intent, and that the overregulation of AI enforced in the EU AI Act will not get replicated here.

The comprehensive AI offensive planned by the new federal government in Berlin, within the framework of its special infrastructure fund, to make Germany the leading "AI nation" is an important step in the right direction.

Key measures on this score include massive investment in the expansion of cloud and AI infrastructure, in particular through the setting-up of a national AI gigafactory housing at least 100,000 graphics processing units

(GPUs), which will provide research institutions and universities with access to high-performance computing centres. In addition, AI real-world laboratories are to be set up right across Germany, where innovative AI applications can be tested under real-life conditions in order to support, in particular, small and medium-sized enterprises and start-ups when it comes to developing and scaling AI solutions. This programme is being complemented by innovation-friendly regulation, by implementation of the EU AI Act without additional bureaucratic burdens, as well as by targeted funding for start-ups, quantum technologies and the buildout of data centres and cloud infrastructures.

In our opinion, the landscape of institutions dealing with AI and digitalisation in Germany is still excessively fragmented. Up to now, the digital agendas of various ministries have been bundled in the Federal Chancellery (a body whose function is to assist the chancellor in coordinating the activities of the federal government). The creation of the new Federal Ministry for Digitalisation and Government Modernisation is therefore to be welcomed as this sends out a strong signal that the "Artificial Intelligence (AI) made in Germany" brand that the Berlin government is striving to forge is actually being realised. In view of how rapidly AI is developing, it is also worth considering making funding processes and research policy more agile in order to enable quick reactions to new developments.

The creation of an independent digital ministry is to be welcomed

In this context, it is worth turning one's gaze for a moment at the United States. Over in the USA, the Bayh-Dole Act of 1980 is regarded as the decisive stimulus that triggered a wave of explosive innovation, particularly in Silicon Valley. This piece of legislation made it possible for the first time for universities and other research institutions to hold the rights to patents from government-subsidised research themselves and to license these to companies on an exclusive basis. This created clear incentives to translate research results into marketable products – precisely for those who are bearing the entrepreneurial risk and stumping up the investment for project commercialisation. In this way, the fruits of publicly-subsidised innovations could be harvested by those actors whose aim it was to bring them to market maturity.

Invest if you want to harvest: Clear incentives and rights will promote AI innovations in the SME sector

If this idea is transposed to Germany and the topic of AI at SMEs, the question arises as to whether the current incentive structures are indeed sufficient. Although numerous funding programmes and initiatives for research and transfer are available to be tapped in the Federal Republic, transformation into marketable products and broad use at SMEs frequently fall short of expectations. One reason for this could be that the assignment of rights and the exploitation of publicly-subsidised innovations are often handled in a less entrepreneurial and flexible fashion in Germany than in the USA. Patents created at universities and research institutions often end up in a drawer or else are licensed too restrictively, making transfer into the

real-world business sphere more difficult.

Especially in the case of AI at SMEs, it is crucial that those who bear the market-launch risk – i.e. start-ups, SMEs or consortia – are also in a position to benefit from any commercial successes. On this count, more carefully targeted incentives, clearer property rights and more professional technology transfer – along the lines of the Bayh-Dole Act – could help to close the gap between research and application and spur the momentum of innovation.

In short, the question of who reaps the fruits of publicly-subsidised innovations is not a mere side show, but rather a central lever enabling more knowledge transfer, more entrepreneurship and ultimately more value creation on the basis of German AI research – at SMEs, in particular.

Along with public-sector investment, private-sector funding is essential to accelerate innovation and to achieve the necessary scaling. In the USA, AI research programmes are, for the most part, financed privately. In 2025 alone, the major private-sector technology companies will channel around USD 700 billion into such programmes. The U.S. administration's new "Stargate" project, aimed at revolutionising the USA's AI infrastructure, is planned to entail AI-related expenditure totalling USD 500 billion – a large proportion of which will, again, be ponied up by private investors.

Private-sector investment as an AI turbo: scaling innovations, breaking down barriers, and safeguarding competitiveness

In the light of this, it is to be welcomed that the new German government is placing AI at the centre of its economic-policy and technology-policy strategy. According to the 2025 coalition agreement, Germany is to become the leading AI nation in Europe by dint of targeted infrastructure investment, innovation-friendly regulation and close cooperation between state, industry and science. AI is no longer being hazily glimpsed as a future technology, but rather viewed as a cross-sectional technology that will decisively change important areas of social and economic coexistence. It is therefore important to continuously prioritise promotion of AI on the economic-policy front.

Regulatory hurdles need to be removed, planning and approval procedures speeded up and tax incentives – such as special depreciation allowances – created. State-supported venture-capital funds and promotional loans can act as a catalyst, particularly for start-ups and innovative AI projects. International parallels, such as the massive investments which have been announced by the USA and China and their various tech companies, reveal the scale of AI infrastructure investment required if we are to remain globally competitive.

Another key field of action is safeguarding the supply of skilled workers. Policymakers should facilitate and actively promote focused immigration of highly-qualified IT and AI experts. At the same time, AI competence – ranging from basic digital knowledge to ethical issues to application-

Safeguarding the supply of skilled workers for AI: education, immigration and cooperation are key

related skills – needs to be systematically integrated into school and vocational-training programmes. Universities should include more AI-relevant courses in their curricula and seek to offer more interdisciplinary programmes. State-supported further-training programmes and certifications in the fields of AI and data science would give an additional boost to skills development. It is particularly important to promote cooperation between companies, universities and research institutions with the aim of developing practical, needs-based further-training formats.

A sustainable supply of skilled workers in the spheres of artificial intelligence and digitalisation is inconceivable without carefully-managed reinforcement of training opportunities in the STEM (science, technology, engineering and mathematics) subjects. Regardless of the vagaries of the economic cycle, STEM specialists persistently remain in short supply, and this problem is being further exacerbated by demographic change: every year, tens of thousands of STEM experts reach retirement age and withdraw from the active workforce, whereas there are not enough young people engaged in vocational training and higher education to fill the resulting gaps. Against this backdrop, it is crucial to enhance the attractiveness and quality of STEM education at all levels. The starting-point here is systematic and comprehensive STEM education at school level, which will spark enthusiasm for mathematics, technology and natural science at an early age and provide goal-oriented career guidance. Particularly in view of the fact that Germany's PISA scores are getting worse again in the mathematics and science domains, it is high time to finally assign the topic of STEM education the priority it deserves. If people just starting out on their career journey are weak in the basic subjects, it would not be surprising if they failed to show great innovative strength later in their professional lives.

A STEM offensive to benefit the future of AI

In particular, dual training in STEM professions (i.e. parallel training in the workplace and at vocational school) needs to be strengthened and positioned as an equivalent alternative to studying, as three-quarters of all vacancies in STEM professions are for skilled workers with vocational-training backgrounds. Companies, chambers of commerce and politicians are called upon to take joint measures designed to attract more young people – not least girls and women – to STEM professions and to provide them with appropriate backup during their training. Estonia's endeavours on this front may serve as a role model here. At the same time, greater efforts need to be made to familiarise Germany's increasingly ageing workforce with AI methods.

Legal framework conditions must also be made innovation-friendly and given a practical orientation. The European AI Act forms an important basis here, but needs to be transposed quickly and comprehensively into national law. Precisely small and medium-sized enterprises are in need of concrete support, for example through central contact points, comprehensible guidelines and checklists, in order to be able to implement the complex

Innovation-friendly regulation is key

regulatory requirements efficiently. Regulation should be regularly reviewed, and adapted to bring it into line with the dynamic evolution of technology. What is more, it is not the technology that should be regulated, but rather individual applications of AI models. AI models are simply a new tool that can be utilised by citizens and companies; it is not the tool per se that should be regulated, but rather the applications based on it. Already now, these applications have to comply with the relevant legal regulations in the respective areas of application (e.g. health). Logically, then, specific AI applications should additionally be monitored for possible risks and, if necessary, regulated. The European legal jungle also needs to be pruned, as many laws are not AI-specific but definitely AI-relevant.

The relationship between data protection and AI application utility needs to be reassessed (quality, security, availability). This involves a substantial trade-off between data protection and availability, as the availability of quantitatively and qualitatively high-quality data is a basic prerequisite for AI applications. It is very likely that we will have to abandon the goal of using Germany's historically evolved sensitivity with regard to data protection as a comparative advantage and getting it accepted as the standard for AI applications at an international policy level.

Germany needs to adopt a pragmatic approach to AI applications

Germany's overfulfilment of European regulatory requirements (so-called "gold plating") has already done the Federal Republic no good in the GDPR (General Data Protection Regulation) field. Although the Federal Republic certainly needs to actively promote the development of an EU-wide AI strategy based on European values at a European level, it must at the same time devise a more pragmatic approach to data-protection requirements.

Europe has effectively lost out in the market for communication and business relationships between companies and private individuals (B2C platform market) to the USA. Every effort must therefore be made to create the B2B platform market in Europe which is of such paramount importance for German industry. On account of the escalating geopolitical and technopolitical battle being fought out between the U.S. and Chinese power blocs, our main competitors in the industrial-manufacturing arena, Germany needs to seek its niche in industrial AI. Competition policy also needs to play a role here.

Competition policy for a digital age

In view of the current geopolitical challenges and of the importance of a strong pan-European AI ecosystem, there should be a greater focus not only on the promotion of industrial AI applications in the B2B sector but also on cooperation in the "AI for retail consumers" field. Franco-German cooperation opens up great potential here to buttress Europe-wide AI solutions and make them internationally competitive.

A highly promising illustration of this is the French start-up Mistral with its AI chatbot "Le Chat", which is already meeting with broad acceptance in

France and is indeed regarded as a European benchmark. "Le Chat" demonstrates how innovative European AI products can be successfully positioned on the market – in the B2C sector as well. Close cooperation between Germany and France could facilitate further development and scaling of such solutions on a joint basis, and could accordingly augment Europe's digital sovereignty.

Against this backdrop, it would make sense to not just limit the Franco-German partnership to industrial AI applications, but to simultaneously strengthen the consumer market as a strategic dimension. That would strengthen the European AI location as a whole and create an alternative to the U.S. and Chinese providers who are currently dominating the landscape.

The creation of a "European AI continent" is feasible: Germany is strong in the industrial AI field and has competitive capacities in semiconductor production that could be stepped up further. France currently has probably the only competitive AI company in Europe in the shape of the start-up Mistral. In the form of the ASML Group, the Netherlands boasts the world's most important producer of machines for chip production. What is more, Central and Eastern European partner countries are strong when it comes to developing cyber-security instruments and defense AI. It would therefore makes eminent sense to pool these various strengths.

Pooling strengths in order to create a European AI continent

Financing of innovative AI projects in the SME sector continues to be dampened by a lack of venture capital, even though Germany does possess sufficient assets. Politicians have recognised this and have launched a broad package of measures under the flag of the WIN initiative ("Growth and Innovation Capital for Germany"), which encompasses tax incentives, higher investment ratios for institutional investors and support for the venture-capital market. Nevertheless, the task remains to further improve framework conditions and to mobilise both private and institutional investors to a greater extent.

AI at SMEs and venture capital

It is important to take on board here that a functioning venture-capital market requires not only capital, but also stable, transparent and reliable framework conditions. Policymakers should therefore work single-mindedly to put in place an innovation-friendly environment that enables sustainable growth.

Conclusion

Technology policy is growth policy. It is also becoming increasingly clear that it is also an instrument of geopolitics. For the major power blocs in the global economy, precisely AI applications have become an instrument securing their future dominance. As a result, a corresponding race is going on, especially between the two leading AI nations, the USA and China. Germany, and Europe in general, have to find an answer here if they wish to become digitally sovereign rather than be degraded to a mere "digital

colony". In view of the dominance attained by the major U.S. tech companies in the AI domain, the race for consumer-focused platforms has basically been lost already. However, Europe, and Germany especially, have an opportunity to carve out a market niche for themselves in the industrial-applications segment. This is because mainly German companies possess a wealth of expertise and, above all, data treasures that can be exploited for AI applications, even if is admittedly becoming increasingly tough.

German companies rank second only to the USA in terms of patent applications. Pleasingly, computer technology, including AI, saw a boost here during 2024. According to the European Patent Office (EPO), computer technology became the leading technology field for European patent applications last year for the first time. Furthermore, the trend towards open-source models such as the French Mistral benchmark, towards smaller language models that require fewer resources and are geared to specific applications, as well as towards large database models that access companies' proprietary data, is making it easier for both start-ups and more established companies to craft new business models. Open-source technology not only makes things easier for basic university research, which is excellent in Germany, to develop alternatives to those marketed by U.S. providers. Open source also makes it easier for companies to cooperate in projects as competitors and partners. The future scheme of things is likely to involve companies building their own AI models based on open-source models and proprietary data.

Laying the foundations and framework conditions for the success of AI requires strong support from political policymakers. Yet it needs to be remembered that rules often have unintended consequences. Recent research shows that excessive regulation could severely hamper Europe's productivity potential. As argued above, it is not the technology that should be regulated, but rather individual applications of AI models. In this context, the European Commission's "AI Continent" action plan sounds exactly the right note.

In our opinion, it is also imperative to push ahead with the buildout of broadband technology in rural areas. On the education-policy side, it would be well worth weighing up whether to follow the example of Estonia by already introducing AI methods at the school level. A more pragmatic approach to data protection than in the past is also very important: the better their access to data, the better AI models learn. Promoting the Capital Markets Union in the EU in order to boost the financing of start-ups is also of great importance. It should be remembered too that the current U.S. administration's rigid immigration policy hands Europe an opportunity to recruit AI talent as part of the EU's "Choose Europe" project.

Thanks to the excellent quality of their basic research, Germany and other European countries definitely have the wherewithal to become a greenhouse for start-up hubs. In order to achieve this, a reduction and standardisation of bureaucracy in Europe is required. At the most fundamental level, Germany and its European partners need to put a stronger focus on improving framework conditions for the continent's companies.

Disclaimer

This position paper by the DSGV Chief Economists does not necessarily reflect the position of all institutions affiliated with the Savings Banks Finance Group (Sparkassen-Finanzgruppe).