Finanzgruppe Deutscher Sparkassen- und Giroverband

STANDPUNKTE DER CHEFVOLKSWIRTE

Artificial intelligence: Growth driver of Germany's economy?

Berlin, 23rd January 2019

Digitalisation and artificial intelligence (AI) provide enormous opportunities for the German and the European economy in global competition. In the view of the chief economists of the Savings Banks Finance Group, the year 2019, in particular, will be pivotal for setting the right course in economic policy to strengthen Europe and Germany as business and financial centres because in a "winner-take-all market" – like that for AI – quick implementation of political measures will be extremely important to advance AI. The following factors will determine the success of a sustainable AI strategy:

→ Artificial intelligence and digitalisation must serve the interests of people. If they do, they will provide opportunities for strengthening productivity and competitiveness. In this context, the relationship between data security and AI applications will have to be clarified to ensure cyber security.

→ The German government has earmarked a total of 3 billion euros for the implementation of the AI strategy between now and the year 2025. These funds will need to be extended to make the structural change sustainable.

→ The financial sector can play a leading role in digitalisation. There are many fields of application which can be optimised through the

Authors

Uwe Burkert, Dr. Guido Zimmermann - LBBW
Uwe Dürkop - Berliner Sparkasse
Jochen Intelmann - Haspa
Dr. Ulrich Kater - DekaBank
Christian Lips - NORD/LB
Dr. Jürgen Michels - BayernLB
Dr. Gertrud Traud - Helaba
Prof. Dr. Carsten Wesselmann
 - Kreissparkasse Köln

Coordination

Dr. Reinhold Rickes
Reinhold.Rickes@dsgv.de
Dr. Sonja Scheffler
Sonja.Scheffler@DSGV.de

use of technology. The Savings Banks Finance Group has considerable potential to foster the development of the markets through innovation based on digitalisation and artificial intelligence. It therefore seems advisable to explicitly include the financial services sector in the German government's AI strategy .

→ Significant improvements need to be made to Germany's digital infrastructure. The auction of the 5G licences will provide the opportunity to reduce the discrepancy between urban and rural areas and to ensure nationwide coverage. The envisaged funding scheme can therefore only be a beginning.

What is "artificial intelligence" (AI)?

Currently there is no generally accepted definition of AI. AI mainly involves the recognition of patters in huge volumes of data. These patterns are then used to draw logical conclusions and obtain findings that support people in their decisions and actions. With this in mind, AI at its current stage of technological development has for the most past less to do with artificial "intelligence" – as commonly understood when we refer to human intelligence. Instead, AI has essentially to do with methods of automatically generating statistics and forecasting.

In general, a distinction can be made between "strong" general AI and "weak" AI. Strong AI is the attempt to emulate all forms of human intelligence, including consciousness, self-awareness and emotion. Strong AI is still a vision.

Weak AI emulates human intelligence only in a limited specific field. It is designed to solve a specific problem. In recent years, considerable progress has been made in the development of weak AI. This has been mainly due to the surge in the availability of data because AI systems "learn" better when more data are available for learning. Other factors that have contributed to this development include the use of increasingly powerful computers that can perform elaborate data analyses and the growing use of cloud services that also enable smaller enterprises to apply AI methods. In the past few years, there has also been a growing understanding of how to develop commercially successful applications of AI (examples include the algorithm-based business models of Netflix, Spotify, and Amazon).

AI has made considerable progress

The term "big data" designates data volumes which are so large, complex, generated so quickly ("in real time"), so weakly structured or so interconnected that it is impossible to analyse them using manual and conven-

tional data processing methods. "Machine learning" of empirical patterns in Big Data involves another sub-form of AI, referred to as "Deep Learning", which plays an enormously important role, particularly in speech and image recognition.

While methods of conventional machine learning can be used, for instance, to recognise new patterns in the structures of an SME's customer base, which enable the SME to offer customised products to customers. Deep Learning is particularly relevant in research areas in which patterns are not visible at all to the human eye. In other words, Deep Learning helps to find the needle in a gigantic (data) haystack. It provides new opportunities, in particular for research-intensive enterprises. Examples include cancer research in the pharmaceutical industry, image recognition in the development of autonomous driving, the development of chatbots, and the prevention of fraud and money laundering in the financial sector.

Machine learning can help enterprises in their customer analysis

The importance of artificial intelligence (AI) for the German economy

Effects on productivity growth

Recent growth research suggests that Deep Learning might prove to be not only a cross-cutting technology like other AI methods, but that it might become what is referred to as a general-purpose technology (GPT) (comparable to electricity), which will raise GDP growth rates to a consistently higher level by increasing productivity. GPTs are technologies which are applied in all sectors, which help to reduce costs over time, and which make it easier to invent new products and processes.

In the long term, the level and growth of potential output are only determined by the development of productivity growth and by technological progress. Little is currently known about how technological progress can be systematically supported and how productivity growth can be accelerated. The institutional environment plays a crucial role. What this means precisely and in what context has unfortunately not yet been answered by modern growth research.

In light of this ignorance, it comes as no surprise that, despite the perceived rapid growth of applications and the dissemination of modern infor-

mation and communication technologies in the past ten years, the pace of productivity growth has slowed down significantly. This applies to all the developed countries, beginning with the outbreak of the financial crisis, or even earlier. This "productivity mystery" has not yet been solved.

There is some evidence that relatively slow productivity growth has been caused by several interacting factors. Possible causes include unrealistic expectations about new technologies, greater efforts made than in the past to create new ideas, as well as measurement errors due to the fact that many (intangible) components of a digital economy are not measurable. The growing importance of less productive services sectors probably plays just as important a role as delays in the adjustment of business organisations, while new technologies cannot yet take full effect.

Slow productivity growth despite many technological innovations

The following chart on productivity growth in the German manufacturing sector shows, on the one hand, the downward trend in productivity growth rates, and on the other hand, the sharp drop caused by the financial crisis, from which productivity growth rates have not yet fully recovered. Nevertheless, productivity researchers and policymakers in particular expect significant positive growth effects from applications of artificial intelligence (AI). In a best-case scenario, AI applications are expected to help businesses to return to their pre-crisis productivity growth rates or to their historical mean growth. Rough estimates by research institutions and consulting firms indeed suggest that there is upside potential in this order of magnitude

Productivity growth per man-hour,

Percentage change against previous year

- Moving 10-year average
- Productivity growth in manufacturing
- Average since 1992
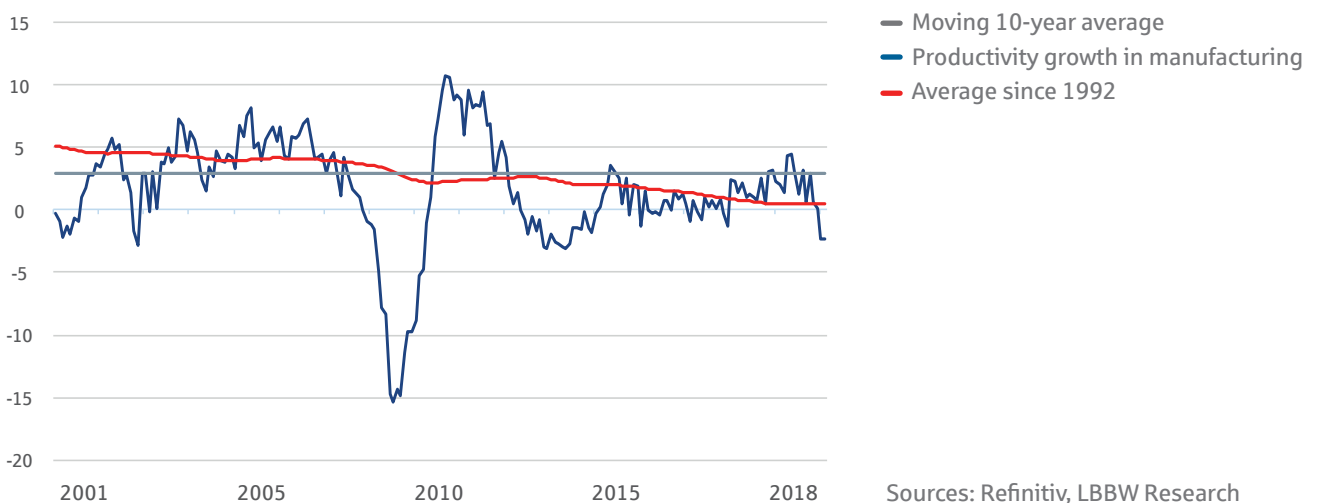
Sources: Refinitiv, LBBW Research

On the other hand, recent studies have shown that Germany was a special case during the financial crisis in that its growth rates and employment levels recovered quickly, compared with other European countries. Decentralised credit institutions like Savings Banks also contributed to this success

by supporting small and medium-sized enterprises during the crisis. The considerable digitalisation efforts made by German businesses in recent years have probably had less of an impact on higher productive growth and more of an impact on the strong performance of the labour market and GDP growth after 2009. In addition, businesses lack digital and AI-specific skills and specialists. Since such specialists are not available in the labour market at affordable wages, these specialists will have to be trained primarily by small and medium-sized enterprises themselves through in-service training programmes.

Enterprises need to train their own data scientists

At the same time, there are certainly fears in academia, among policymakers and in society that AI might lead to major upheaval in the labour markets and in enterprises in the form of job losses and greater wage disparities, the emergence of (not yet understood) new ethical problems, as well as new geopolitical challenges. The fact that, for most people, AI is a "black box" that can only be grasped by people with specialist knowledge certainly also contributes to these fears – although AI is already part of everyday life in many areas. This applies, for instance, to the use of standard satellite navigation software to navigate cars, the use of digital assistants to recognise and process voice commands, and search suggestions made by Amazon.de and Netflix with regard to products or series that might be of interest for consumers.

In addition, there is a phenomenon that has recently become apparent in the digitalisation of the music industry. Although the MP3 standard was developed in Germany, companies like Apple were the players that were able to translate this technology into marketable products. With reference to AI, we are currently running the risk that, while the theoretical foundations are available or have been developed in Germany and Europe, we might be paralysed by focusing more on the risks and less on the opportunities provided by this technology.

However, contrary to the German government's expectation, AI methods will probably not provide a spectacular growth stimulus in the foreseeable future. This was also stated by William D. Nordhaus, who was awarded the Noble Prize in economic sciences in 2018. However, like the US Federal Reserve, we are optimistic that the accumulation of many small-scale AI applications is likely to have a positive impact on growth and might help to increase productivity again – although it may not be enough to compensate for other factors which tend to have a negative impact on potential and productivity growth (e.g. demographic ageing). What is needed in Europe therefore is a higher level of investments, in particular in information and communication technologies, research & development, industrial robots, and generally the creation of a favourable environment for investment.

AI is not expected to stimulate exorbitant growth

Effects on the labour market

While no jobs have so far been lost in Germany on balance, no additional jobs have been created in the sectors characterised by a high degree of automation. On the other hand, real wages have stagnated in Germany because the new jobs created in other sectors are characterised by lower wages. By comparison, an analysis of productivity data in the United States has shown that, so far, machine learning methods have not had a negative impact on wages in the United States. On the other hand, automation has led to job cuts in some sectors in the United States.

Generally speaking, it is unclear what effects AI methods will have on employment in Germany in the future. The automation of numerous activities will tend to have a negative impact. At the same time, many new jobs and occupations are also likely to be created – however, mainly in areas where human beings have comparative advantages over computers, e.g. in nursing – where employees tend to be paid less well. Demographic ageing and the associated growing demand for qualified personnel will have a positive impact on the labour market. The significant immigration of low-skilled workers will lead to a greater supply of low-skilled labour. In this segment, unemployment can be expected to grow because simple activities might increasingly be automated. In addition, the regions – and hence the regional labour markets – will be affected by automation to highly varying degrees.

AI will also create new jobs

All in all, we are cautiously optimistic that the increasing use of AI methods and the associated automation of intellectual routine jobs will not lead to major upheaval in the German labour market. This is also borne out by historical comparisons

Unemployment Rate, in Percent*
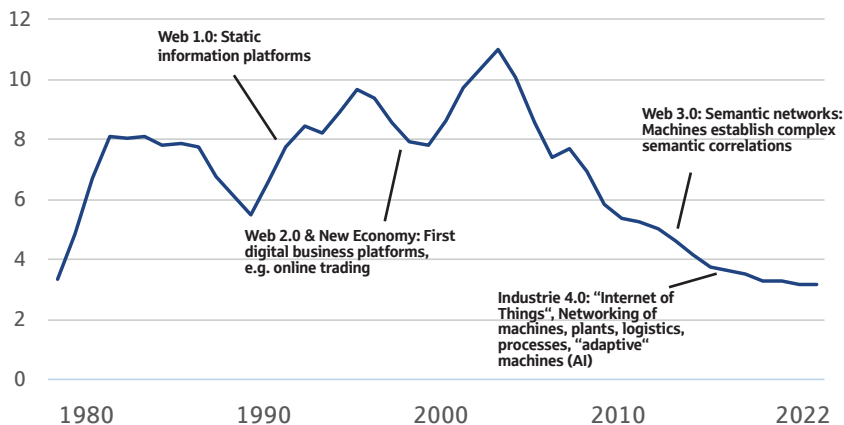
Source: IMF, own representation,
*2018 – 2023 forecast of IMF

The high unemployment rates in the early 2000s were due, on the one hand, to cyclical factors and, on the other hand, to the fact that the registration of

unemployed persons had been adjusted in the course of the Hartz-IV labor market reforms. The IMF's medium-term forecasts suggest that unemployment in Germany will not rise in the short term.

The importance of artificial intelligence (AI) for the financial sector

The Savings Banks Finance Group is an important pillar of resilience in the German economy. This applies in particular against the background of an increasingly turbulent and uncertain business environment. Savings Banks are long-standing financing partners that have always supported Germany's small and medium-sized enterprises, even in times of crisis.
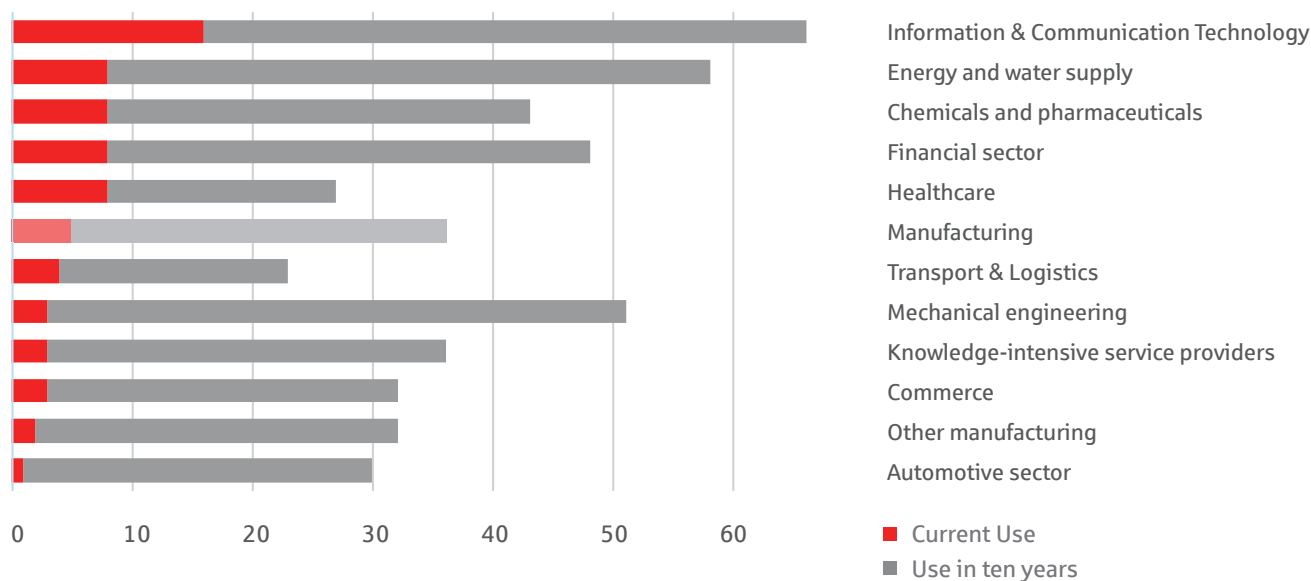
It is extremely important for the Savings Banks Finance Group that policy-makers lay the foundations that will enable AI to flourish in Germany. At the same time, Savings Banks and Landesbanken will step up their own efforts to understand the implications of these new methods and applications for their business clients and to implement these methods and applications themselves to be able to remain a reliable financing partner for Germany's SMEs.

The digitalisation of the German economy means that financial institutions will increasingly use AI to transform the information available about customers into knowledge and to automate processes. In a survey recently conducted by the Center for Financial Studies (CFS), 90 percent of the respondents in the financial sector stated that they will consider AI technologies to be one of the key topics for the financial sector in future. AI innovations will lead to efficiency and effectiveness gains in the core processes of credit institutions. Successful implementation can have self-enhancing effects and therefore spread rapidly. Competition at the customer interface will probably be characterised by innovative AI applications. In response to the CFS's question regarding the most important fields of application of AI in banking in future, 77 percent of the respondents first cite central functions (Risk Management, Controlling, etc.). This is followed by Asset Management (76 percent) and Retail Banking (73 percent); 53 percent of the respondents cite the capital market business.

Financial institutions will increasingly use AI

According to the "Monitoring Report Wirtschaft DIGITAL 2018", published by Germany's Federal Ministry for Economic Affairs and Energy, German financial institutions expect digitalisation to accelerate significantly. This refers not only to AI and blockchain technology but generally to the importance of the share of digital processes, investments in digitalisation, the level of digitalisation of products and services, and the effect of digitalisation on business success. According to this report, the application of digital processes will increase significantly in the financial sector until 2028.

Use of AI by Sector, in Percent

Information & Communication Technology
Energy and water supply
Chemicals and pharmaceuticals
Financial sector
Healthcare
Manufacturing
Transport & Logistics
Mechanical engineering
Knowledge-intensive service providers
Commerce
Other manufacturing
Automotive sector

■ Current Use
■ Use in ten years

Source: Federal Ministry of Economics
and Energy, Monitoring-Report Wirt-
schaft DIGITAL 2018

The segment of automated advice in the retail business (robo advising),
which currently accounts for 2 billion euros compared with a total of 3 trillion
euros directly invested in funds, is still relatively small in the Savings Banks
Finance Group. However, as demonstrated by the growth of suppliers and
market growth, this development has just begun. For technology-savvy
customers, the Savings Banks Finance Group has already developed an at-
tractive solution for digital asset management: the robo-advisor "bevestor".
It is also conceivable that "robo customers" will seek advice from a customer
relationship manager on complex topics in the course of their "financial life".
Within the framework of the financial concept, the relationship manager can
then also explain the advantages of active asset management.

Savings Banks and Landesbanken are currently facing new challenges: the
development of new business and financing models as well as services for
retail customers and business clients, new forms of organisation, the elimina-
tion as well as the development of job profiles of employees to take into ac-
count the customers' changing and increasing expectations to provide them
with personalised customer experience. And last but not least, cultivating the
extremely important trust that customer data will be handled with care.

The German Savings Banks Association would like to actively participate in
the discussion about compliance with ethical standards and the principle of
non-discrimination by algorithms, e.g. in lending decisions. We want to de-
velop an AI strategy for the Savings Banks Finance Group, including binding
rules for the use of AI. These rules, which we plan to apply both internally and
externally, will provide security with regard to the use of artificial intelligence.

The task of policymakers is to ensure a level playing field. The regulated savings bank and banking sector will not – and cannot – use the customer data available as extensively for data analyses as non-financial enterprises or enterprises that do not hold a banking licence. Fairness implies that these players should not be given market access on special terms within the framework of a naive market liberalisation ideology. At the same time, they must be obliged to subject their data to the same regulatory rules that are mandatory for banks and savings banks.

Appeal to policymakers: Strengthening the focus on AI funding

It is generally agreed that, by and large, Germany is not badly positioned in the global race for predominance in the field of AI. Germany is one of the global leaders, in particular in terms of its scientific output, and also has considerable potential for high-quality machine data because of its industrial business model. Germany's institutional research landscape – including the German Research Center for Artificial Intelligence, the Max Planck Society, the Helmholtz Association, and the Fraunhofer-Gesellschaft – is also very capable in the field of AI.

Germany is scientific pioneer in AI – however, there is a lack of infrastructure for cost-effective implementation

Against the backdrop of the hopes for AI-driven higher productivity growth and the enormous geopolitical implications of the AI strategies pursued by China and the United States, the long overdue AI strategy published by the German government on 15 November 2018 is to be welcomed. The decision on this course of action in industrial policy can generally strengthen the competitiveness of Germany and Europe. The AI strategy addresses many questions. At present, however, it is merely a beginning.

In our view, it remains crucial to clearly define the areas of AI in which the government should become active. The development of AI applications can only be accelerated if the elements of a strategy – public versus private goods – are identified and if the necessary market structures are created. These include in particular:

→ **Fast Data highways**
The development of AI systems requires in particular the handling of large volumes of data. The main obstacle hindering the digitalisation of Germany is the lack of a well-developed broadband network, which is a key infrastructure requirement. The broadband expansion that has been promised is still completely inadequate. The upcoming auctions of 5G licences, for instance, must be focused on helping small and medium-sized enterprises in rural areas and on overcoming the discrepancy between urban and rural areas.

→ **Data privacy**

The relationship between data privacy and AI applications needs to be clarified, not least in light of the recent hacker attack aimed at the data of politicians (quality, security, availability). This requires a substantive trade-off between data privacy and data availability because the availability of large quantities of high-quality data is a basic prerequisite for AI applications.

The objective must be to leverage the data privacy concerns that have evolved in Germany and Europe as a comparative advantage and to enforce this data protection standard for AI applications at an international political level. Germany must actively campaign at European level for the development of an EU-wide AI strategy that is based on European values.

The risks posed by AI to society result, first, from biased algorithms that lead to (unintentional) discrimination and, second, from the growing inequality in income distribution as the profits generated by AI applications are primarily collected by the employees of big tech companies or by a 'caste' of AI developers. Furthermore, useful projects like Open Data need to be supported. Another public responsibility is to give greater priority to practical public assistance for enterprises in their implementation of cyber defence measures.

→ **Data spacialists**

Educational initiatives in the field of AI need to be supported. In this context, the appointment of the planned new 100 AI professors is a good beginning, but not more. It is important that Germany has a strong position in international competition, in particular as a country which is strong in research and innovation. However, another factor that is critical for success is that talents are not only trained but also retained in Germany and Europe.

In addition, "data scientists" will primarily have to be trained in the SMEs themselves because data science projects would probably not have much of an impact without the necessary specialist know-how and sector expertise. At the same time, consideration should be given to public contact points for enterprises, i.e. data science help desks, which can give advice, in particular, to small and medium-sized enterprises encountering problems with the implementation of data science projects.

→ **Acceptance in society**

More than one in three enterprises perceive society's reluctance to accept new technologies as an obstacle to innovation. It is essential to foster trust – and, if possible, better awareness of the positive opportunities provided by new technologies. The variety of support options available for small and medium-sized enterprises should be transparently described. In this context, knowledge about AI should be broadly disseminated in society. One option would be to convey basic knowledge along with practical experience already at general schools, which would subsequently be deepened at vocational schools and at universities. In addition, the basis for Germany's future success in the field of AI will not be data science as such, but conveying basic mathematical knowledge because mathematics is the basis for a great many AI-based applications and methods.

→ **Competition policy**

Another factor to be considered is whether, when building platforms, traditional competition policy concepts still serve Germany's interests with regard to AI funding and whether such concepts are still up to date. This applies in particular in light of the very active implicit and explicit industrial policy pursued by China and the United States with regard to the creation of digital platforms and in view of the great importance of the first-mover advantage and the winner-takes-all principle. Europe has practically lost the market for communications and business relationships between businesses and consumers (B2C platform market) to the United States. Every effort will therefore have to be made to create a B2B platform market in Europe, which is so important for German industry.

Competition policymakers in Germany and Europe will need to adjust their guiding principles and the resulting measures in the field of digitalisation. Economies of scope (cooperation networks), in particular, can strengthen effective competition. On the other hand, the growing trendency to use economies of scale in order to create monopolies or tight oligopolies (e.g. with regard to platforms) should be warded off, so that competition can provide benefits for consumers.

→ **Public funding**

AI experts like Jürgen Schmidhuber of the Dalle Molle Institute for Artificial Intelligence (IDSIA) believe that the German government's funding framework of 3 billion euros is insufficient in light of the enormous sums spent by the leading AI nations, i.e. China and the United States. The German government has earmarked a total of 3 billion euros for the implementation of the AI strategy between now and 2025. According to the AI Index 2018 Report recently published by Stanford University, Europe produces more scientific publications than the United States and China.

Unfortunately, however, Europe spends far less than these two countries. It will now be crucial to see to it that AI funding is available in the long run. This is the only way to cope with structural change in a sustainable manner.

China is planning to create an AI market by 2020 with a volume of USD 14.7 billion. Their aim is to achieve market leadership by 2030. In the United States, AI research programmes are primarily privately financed. In 2017 alone, the big technology groups Amazon and Alphabet invested USD 16.1 billion and USD 13.9 billion, respectively. In the United States, the total budget of the public funding programmes of the National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA) and the Department of Transportation (DOT) amounts to USD 5.3 billion in 2019. The European Union has a budget of USD 1.7 billion for R&D funding in the field of AI in the period from 2018 to 2020, and a budget of USD 10.4 billion for the Digital Europe Programme for the period from 2021 to 2027. These relatively small amounts will not be sufficient to win the global "war for talent" in the field of AI. It is therefore important that, irrespective of potential budgetary constraints in the future, AI funding decisions should primarily be made from an economic policy perspective.

Nevertheless, the planned establishment of a Franco-German Centre for Artificial Intelligence and the European Commission's Action Plan to foster the use of AI technology are important additional steps, which are also stressed in the German government's AI strategy. Only in cooperation with the other European countries will Germany be effectively able to provide the necessary resources required for AI infrastructure to compete successfully with the United States and China.

Unfortunately, it is not really clear currently whether the funds will be directed to the "right" areas, i.e. the more recent research topics such as Deep Learning, or whether the money will tend to be spent on older AI methods. In addition, the organisational structure of the institutions dealing with AI and digitalisation in Germany is too fragmented. Currently, the digital agendas of the various ministries are bundled via the Chancellor's Office. What is needed is a clearer focus. During the Grand Coalition's mid-term review later this year, the German government could decide to establish a dedicated Digitalisation Ministry in addition to the Minister of State for Digital Affairs in the Chancellor's Office. This would be a strong message that the trademark envisaged by the German government – "Artificial intelligence (AI) made in Germany" – will actually be implemented. In view of the rapid development of AI, thought should also be given to becoming more agile in funding processes and in research policy to be able to respond quickly to new developments.

Disclaimer

The present position paper of the Chief Economists does not necessarily correspond to the attitude of the DekaBank or the attitude of the respective Landesbanken and Savings Banks or the DSGV.