Lernende Systeme
GERMANY'S PLATFORM FOR ARTIFICIAL INTELLIGENCE

Position paper

Securing the future with AI – Approaches for increased resilience and digital sovereignty

Key Facts

- **The Corona crisis** highlights the opportunities offered by digital technologies and Artificial Intelligence (AI) for crisis management and to ensure our future viability.
- **Catalyst for AI:** The crisis accelerates digitalization as an enabler for AI technologies.
- Innovative AI technologies strengthen resilience and support our **digital sovereignty.**
- **Digital ecosystems, platforms and secure (data) infrastructures** are the key to **powerful AI systems.**
- **Trustworthy AI** – a prerequisite for the acceptance and success of AI systems – can become a distinguishing feature and competitive advantage for European solutions.
- **The certification of AI systems** can provide important impulses for their use and help to exploit the potential benefits to society in a secure and charitable way.
- **Competence development and transfer:** The development of AI competencies is pivotal for the digital sovereignty and competitiveness of Germany and Europe. Strengthening the transfer of AI knowledge in research, teaching and business is essential for this.

Corona crisis as a catalyst

„With the Artificial Intelligence (AI) strategy of the German Government, Germany and Europe will become a leading AI location and a driver of innovation worldwide. Together we want to promote technological sovereignty in Germany and Europe. For an „AI made in Europe", we are continuously working on networking at European level. Based on our European values, we will further strengthen Germany's leading role in AI research: For example, by promoting the AI competence centers as a unique research network or by supporting small and medium-sized enterprises for a direct transfer to application. In doing so, we will focus on a responsible, public-interest and people-centered development and use of Artificial Intelligence. After all, it is about how we all want to shape and improve our lives with the help of Artificial Intelligence."

Anja Karliczek, Federal Minister of Education and Research and Co-Chair of Plattform Lernende Systeme

The Corona crisis continues to have the world firmly in its grip. It highlights the **vulnerability and fragility of globally networked economies.** Existing structural problems are relentlessly exposed, and new demands on politics, business, science and society are clearly emerging. At the same time, the crisis shows that digital technologies and Artificial Intelligence (AI) can make a significant contribution to crisis management and to improving the status quo in terms of increased sustainability.

The crisis is having an **accelerating effect on technology development.** It is driving digitalization as an enabler for AI technologies and the use of Artificial Intelligence in many areas. However, the crisis also opens new ways for learning, working, managing and exchanging information today and in the future. Even more important is the fundamental change of assessment regimes. Nursing robots, for example, which perform fetch and bring services for nursing staff and help to reduce contacts that are not absolutely necessary, can suddenly become stabilizing elements in highly tense work situations.

On the other hand, the Corona pandemic shows that AI deployment in unforeseeable crises can be difficult. The reason is the **lack of adequate learning data from similar situations.** A crisis-like disruption reveals that no suitable system response can be expected to individual questions. In case of weaknesses in digitalization, i.e. missing, incorrect, unstructured data and bottlenecks in transmission and processing, AI cannot always be used as a supporting method. Conversely, AI has an important supporting function in the fight against the pandemic: Machine Learning algorithms can identify, compare and categorize many millions of molecules, thus enabling humans to find promising **drug candidates for new drugs and vaccines** faster and more efficiently and to make them rapidly accessible to humans.

Discussion of potentials of AI technologies and creation of trust in secure AI systems

„AI technologies make an important contribution to ensuring the future viability of the economy and society in times of rapid technological developments. However, the relevance of new technologies only comes into play if people can assess the opportunities and risks so that they can accept and shape their use individually and socially or reject it in an informed way. Therefore, it is necessary to involve society in an early and competent opinion-forming process when shaping new fields of technology and to discuss the potentials and risks of technologies in a balanced way. A prerequisite for the creation of trust and social acceptance of AI technologies is thus the understanding of these technologies among the general public, as this is the only way to ensure that the potential benefits to society can be exploited safely and in the public interest."

Karl-Heinz Streibich, President of acatech – National Academy of Science and Engineering

There are clear **benefits** that justify and accelerate the use of AI. The crisis is a catalyst for broad application in business, science and society. Plattform Lernende Systeme has repeatedly demonstrated in its contributions how AI can serve people in industrial environments, in education and training or in medical diagnostics, and how trust can arise from the responsible and beneficial development and application of AI (e.g. Huchler, 2020; Plattform Lernende Systeme 2019a; Heesen et al. 2020a).

A successful response to the Corona crisis can mitigate the course of the pandemic and help deal with its consequences. At the same time, it also entails the responsibility to **contribute to the future viability** of Germany and Europe: Innovative AI technologies strengthen resilience and support the path to digital sovereignty. Even more important is unrestricted access to all competencies, infrastructures and technological elements (hardware and software) along the AI value chain.

The present position paper formulates – based on a review of the current situation – starting points for the future-oriented design of AI in Germany and Europe in order to strengthen competitiveness and to be able to better face future crises – also and especially with the help of AI.

„The pandemic clearly shows us that we have gained many new opportunities thanks to digitalization and AI. In many economically relevant areas of society, digital platforms are not just alternatives to physical interaction, but superior solutions – automated maintenance via cloud, AI-based assistance systems or telematics services. The global crisis forces us to question dogmas – including those of an ethical nature – and to reinvent ourselves comprehensively. At the same time, we see that people are not made for pure interaction with machines. Human closeness and social interaction are the essence of being human."

Dr. Andreas Goppelt, Ottobock SE & Co. KGaA

Strengthen resilience and digital sovereignty

Germany is so far well positioned in crisis prevention and crisis management. However, **resilience** can be further strengthened through AI. This can also help to strengthen the future and competitiveness of Germany and Europe. The Corona crisis shows how digitalization is penetrating more and more areas of life in business and society. But it also illustrates the dependency of Europe on non-European partners and providers and the importance of **digital sovereignty** as the key to competitiveness and individual freedom (see Kagermann/Wilhelm 2020).

The **digitalization** of various areas of life and everyday working life allows to increase efficiency and acceleration of processes and systems, increasing the robustness of the economy and society (e.g. home office options, telemedical health care) and expanding the capacity to act (e.g. transparency of supply chains or bed capacities). Central to this is that digitalization is a **key enabler for AI technologies.** Artificial Intelligence, on the other hand, can provide assistance in recognizing trends and turning points (e.g. propagation course), in identifying correlations (e.g. effectiveness of measures), in making forecasts and in estimating the effectiveness of measures, and in accelerating innovation (e.g. identification of promising active ingredients, adaptation of supply chains, products and services).

> **Resilience**
> Resilience means the ability to prepare for suddenly/unanticipated adverse, sometimes unknown events, to ward them off if possible, if they occur and recover quickly in the event of damage. Resilience also includes the ability to take account of external shocks, learn lessons from crises and take precautions (see acatech 2020, Thoma 2014).

Not least with the help of digital technologies and AI, the Corona crisis enabled basic functions by state, economy and society. For this, **efficient, secure (data) infrastructures** are the decisive prerequisite. These are robust data networks for the gigabit age, capable of handling external shocks and sudden increases in usage. Central to this are secure and open cloud infrastructures and data rooms. This involves robust data networks for the gigabit age, capable of handling external shocks and sudden increases in usage. Secure and open cloud infrastructures and data rooms are pivotal to this.

Further elements for increased resilience are **innovation and adaptability**, especially of companies. Ultimately, the aim is to proactively use crises as opportunities for change and innovation, rather than just returning to the starting point (see Bendiek 2020). Innovative companies with an agile organization can generally react better and more flexibly to external shocks. Digitalization and AI are drivers for innovative technologies and new business models. However, innovation and adaptability are also elements of resilience in other areas – such as public administration, private living environments and social contexts. This also means that in the event of a crisis, it can be reacted quickly to changes in demand and resources and that products and services can be adapted as quickly as possible.

For example, **complex supply chains** that had been affected by the crisis could be maintained and logistics adapted with the help of AI systems. AI technologies also enable the remote monitoring of machine and component functionalities – during the crisis and beyond – and foresighted planning of maintenance measures. In this way, production losses and damage can be minimized and the resilience in manufacturing and production can be specifically increased (cf. Plattform Lernende Systeme 2020: 14–15). AI systems will also be able to make a valuable contribution to **forecasting (infection) hotspots** in the future through simulations based on health data, among

other things. Automated image analyses as well as automated diagnostic procedures based on AI applications can also be used for diagnosis and therapy decisions. The AI-supported systematization of large volumes of data and images can thus concretely increase the efficiency of medical processes. Due to the global spread of the Corona virus, a great deal of new data is available. With the help of Machine-Learning-based analysis of pandemic and epidemic histories, epidemiological models could thus be supplemented with evidence-based insights and draw important conclusions for preventing and preparing for future viral outbreaks. The innovation effects of AI in the healthcare system have been highlighted by Plattform Lernende Systeme previously (see Plattform Lernende Systeme 2019a).

At the same time, the **diversity of the economy** also contributes to resilience. It reduces dependence on individual industries and suppliers, so that external shocks can be better cushioned. One example is the dependence on individual sectors of the economy, such as tourism. In addition, the diversity of the economy already hints at the advantages of digital sovereignty: It is about freedom to shape and decide on the digital transformation and the choice of technology.

> „Machine Learning and Artificial Intelligence increase the resilience of systems such as supply chains and logistics networks: predictive analytics predicts risks of failure of suppliers or logistics routes (e.g., due to strikes, severe weather, political turbulence) or means of transport (e.g., prediction and avoidance of machine failures in airplanes, trucks, trains and ships), web mining finds new suppliers to replace failed suppliers and AI systems suggest alternative logistics routes and modes of transportation."
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> **Ralf Klinkenberg**, RapidMiner GmbH

For **interdisciplinary collaboration**, which is especially relevant in crisis situations – for example, between data scientists and virologists – it is also desirable to make data analysis tools easily accessible and comprehensible. This can accelerate analysis processes and make results more comprehensible. In this way, not only will a contribution be made to greater resilience, but more transparency will be created and confidence in the knowledge gained through AI can also be increased.

Global, geopolitical and technological changes are amplified by the Corona crisis. Therefore, a broadening of the **sovereignty debate** in Europe is necessary. Europe must not only strengthen its technological (and thus also its digital) sovereignty by gaining greater independence in the area of various important technologies, which include digital technologies. Europe must also become more self-reliant and expand its competencies regarding access to and handling of data. Such digital sovereignty extends to individual citizens, who must be empowered in dealing with digital technologies and their own data and enabled to act sovereignly.

This is not about compartmentalization, but about regulatory sovereignty and the active shaping of alternatives: It is important to build up and maintain our own capabilities and to avoid or reduce one-sided, structural dependencies on other economic areas. To this end, technologies critical to welfare, competitiveness and the state's ability to act must be defined, maintained and further developed (Fraunhofer ISI 2020: 4; Schieferdecker & March 2020).

> „Digital sovereignty is the basis for trustworthy AI. Only with an independent digital infrastructure is it possible to implement the principles of transparency, neutrality and integrity in such a way that AI is supported by a broad social consensus. This promotes a greater willingness on the part of all stakeholders to provide and use data – an essential basis for unlocking and further developing the potential of AI. Certainly, companies, science, the German Government and the European Union must intensify their efforts. Investments are of great importance, but by no means everything. It is about attracting bright minds and promoting collaborations. Our activities must therefore flow into a successful transfer of AI research results into real applications on an independent data infrastructure."

Dr. Tanja Rückert, Bosch Security and Safety Systems Germany

The **concept of technological sovereignty** is congruent with increased investment in the resilience of Europe's economic and social systems, so that they can both recover quickly from shocks and adapt rapidly to changing contexts (Fraunhofer ISI 2020: 6f.). To this end, the platform has already formulated initial starting points for securing technological sovereignty – for example, regarding the interoperability or the design of interfaces (cf. Plattform Lernende Systeme 2019c). For the technological sovereignty of our society, the technical infrastructure should also be understood as part of the provision of services of general interest, also in order to be able to offer effective alternatives to private-sector providers. An adequate reference architecture should not only be designed to be interoperable, but should also be characterized by modularity, openness and transparency, and should enable the implementation of various business models (cf. Kagermann/Wilhelm 2020).

The European Union's actions in the Corona crisis have made it clear that only **coordinated** action in Europe will enable a sustainable economic recovery in the post-Corona period. At the European level, various reference points and initiatives should be highlighted that pay attention to digital sovereignty – such as the European Data Strategy (European Commission 2020) or the European Data Sovereignty Initiative (EIT Digital).

Digital sovereignty
Digital sovereignty encompasses the ability of individuals, companies and policymakers to freely decide how and according to which priorities the digital transformation should be shaped. Three aspects are important: 1. the availability of suitable data and technologies in the sense of control and/or access. 2. the competencies of all citizens, companies, businesses, public administration and professionals to assess, review and apply technologies. 3. a European (digital) single market, which allows companies to successfully scale new business models, products and services. (cf. Kagermann/Wilhelm 2020). This can be supported by an agile regulatory system that allows the rapid adaptation of technological advances without compromising social values and norms.

The **various levels of technological sovereignty** offer starting points: technological sovereignty starts with raw materials and components and extends through communications infrastructures and infrastructure-as-a-service to platform-as-a-service, European data rooms and software technologies. The various levels are framed by the European legal and value system. It is important to identify dependency chains and to deal with possible weak points in a targeted manner.

> „Today, more than ever, the ability to act politically is also a question of technological sovereignty. Artificial Intelligence is a key factor here. For Germany and Europe, this means translating existing domain knowledge into pioneering, deployable applications and business models, expanding application-oriented training with learning labs and innovative research groups, and thus promoting sustainable and value-oriented value creation.‟
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> **Prof. Dr. Reimund Neugebauer**, Fraunhofer-Gesellschaft e.V.

At the same time, it is also a matter of developing a **new generation of AI systems** – and thus securing a top position for Germany and Europe in research and application (cf. Wahlster 2020a, 2020b). This means that not only large volumes of data can be used for AI, but increasingly small volumes of data can also be analyzed with increasing reliability. Domain-specific knowledge, which was initially only usable by humans in the form of reference books, manuals, teaching material, and scientific journals in exponentially increasing volumes, can be automatically transformed into usable back-ground knowledge for software systems for the first time by the latest AI systems using automatic information extraction, machine language understanding, and document analysis. This makes it easier to meet challenges in crisis situations – for example, due to a lack of learning data – but also to develop completely new products and services.

Hybrid AI systems represent a **further development of cognitive systems** that combine Machine Learning from data with the application of causal model knowledge. Germany has a decisive advantage in this area due to its wealth of engineering knowledge in the various industrial sectors, because this special know-how has been acquired over decades, especially in small and medium-sized enterprises, and can now be made available in digital twins for AI software (cf. Wahlster 2000b). The goal of this advancement of AI systems is to enable the automation of context-dependent reasoning by integrating a variety of different AI methods that lead to autonomous system behavior that is safe and comprehensible to humans, even in the presence of contradictory, incomplete, ambiguous, or vague information.

> „Pupils and students learn not only from mass data, but also by reading textbooks and technical literature and in dialog with teachers and experts. Breakthrough innovations in language-understanding systems are putting automatic knowledge acquisition on a broader footing, comparable to human learning, for the next generation of AI systems. By actively leveraging domain knowledge and field-proven models from science and industry in AI systems, misinterpretations of data in statistical and neural learning can be avoided, completely novel situations can be handled autonomously even in the absence of data, and due to the active use of automatically extracted knowledge graphs, the cognitive capabilities of AI systems can be drastically increased."
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> **Prof. Dr. Wolfgang Wahlster**, German Research Center for Artificial Intelligence

Further develop framework conditions

A key factor to securing the future viability of Germany and Europe is the further development of suitable framework conditions for resilience and digital sovereignty. The aim is to reduce the vulnerability and dependency of society and the economy by **taking targeted action at various levels.** The following dimensions offer starting points for the further development of framework conditions:

Secure data rooms and platforms

Data is a key resource for business, science and society. The use, linking and evaluation of data is the basis for **innovations and data-driven business models**. In this context, big data is a prerequisite for AI applications and platform-based solutions. It is therefore important to create large, networked, open and secure data spaces in Europe. Initiatives such as GAIA-X or the International Data Spaces (IDS) Initiative are blueprints for domain-specific and cross-domain data access and exchange. Both hyperscalers and niche providers as suppliers of digital infrastructures and their users (e.g., large corporations, small and medium-sized enterprises (SMEs) or public administration) can benefit from a distributed cloud infrastructure: This is because the hierarchical and geographic distribution of cloud applications creates redundancies which increase the resilience of the overall system (cf. Plattform Lernende Systeme 2020: 20–21). These initiatives must be expanded in the direction of an AI Space with digital services. An AI Space should provide the results of AI research in the form of reusable services and applications and serve as a development platform for cooperative R&D-projects by science and industry – especially for German SMEs.

> „We need new value propositions that can be delivered through the innovative use of data: greater sustainability, better health, resource-efficient mobility and much more. Based on data and supported by Artificial Intelligence, companies create innovative products and services, strengthen the resilience of businesses and lead to a sustainable economy and society ‚Made in and Operated by Germany'."
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> **Frank Riemensperger**, Accenture GmbH

One example for implementing of secure data spaces in Germany and Europe is the **Mobility Data Space**. The goal is to network heterogeneous data and services and thus enable user-friendly and sustainable mobility solutions as well as new data-driven and/or AI-based business models (B2B and B2C). The prerequisite for this is in particular the creation of a level playing field for all stakeholders as a basis for the cooperation and participation of all relevant actors. Important approaches to this can be found in the mobility scenarios and papers of Plattform Lernende Systeme (see Plattform Lernende Systeme 2019b).

Digital ecosystems

Ecosystems – especially data-based ecosystems – are key to the speed and performance of digitalization and AI. AI offers both large companies and SMEs as well as start-ups a wide range of options for increasing efficiency and implementing data-driven and platform-based business models. Usually, individual companies do not have all the necessary competencies and system components. It is therefore becoming increasingly important to establish flexible value networks instead of rigid value chains and to cooperate in value networks – as accentuated by Plattform Lernende Systeme and illustrated by concrete application examples (cf. Plattform Lernende Systeme 2020). The cultivation of digital ecosystems and the support of start-ups and SMEs – for example in technology transfer from research to application or in growth financing (cf. Achleitner 2019) – are of great importance.

> „Digital ecosystems can help companies, especially during the crisis. We need to open digital ecosystems for business relationships between companies as a core competence of a crisis-proof and sustainable German and European economy. Digital ecosystems offer companies the opportunity to disruptively change entire industries with new business models."
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> **Dr. Hanna Köpcke**, Webdata Solutions GmbH

There are considerable differences in the **use of AI** depending on the type of company: While almost every second start-up uses AI, SMEs rely on AI to a much lesser extent (cf. Bitkom Research 2020, Fraunhofer IAO 2019). At the same time, there are areas in which a great deal of AI is already being used – for example, in production-related environments (Allianz Industrie 4.0 Baden-Württemberg 2019: 14). Plattform Lernende Systeme has recognized these challenges and therefore sees itself as a information hub for information and tailored offers, especially for SMEs.

Trustworthy AI

AI systems are shaped by the legal and value system of the country in which they are developed. These frameworks differ widely internationally, which is why there are initial efforts to harmonize the development and application of AI systems (cf. OECD 2019). For the European community, it is important to design a **European path** for the development and use of AI along common values and standards and to implement trustworthy AI. Trustworthy AI is an important factor for the acceptance of AI systems – and thus for their success. Moreover, trustworthy AI can become a distinguishing feature and competitive advantage for European solutions (cf. Heesen et al. 2020a, Huchler et al. 2020). In this context, Plattform Lernende Systeme offers concrete approaches for a reflective development and application of AI systems with the ethics briefing (cf. Heesen et al. 2020b).

> „The trustworthiness of AI systems is not the same as the trust of users or stakeholders in the technology. Trustworthiness must be established. To this end, AI systems must not only be safe, transparent and ethically unobjectionable, the users of the systems must also be aware of the opportunities and limitations of the AI systems in order to be able to use them reliably. If AI is trustworthy, this can engender trust."
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> **Prof. Dr. Regina Ammicht Quinn**, University of Tuebingen

Trustworthiness consists of three essential elements: AI systems should be **legitimate, ethical, and robust** against disruption, failure, tampering, malfunction. Ethical principles of respect for human autonomy, prevention of harm, fairness, and explainability are thereby in the foreground. Decisions that are made with the help of AI systems represent – depending on the intensity of the involvement of such systems (AI-involved, AI-assisted, AI-guided decisions) – different demands on comprehensibility and explainability.

This suggests a risk-adapted regulatory approach (criticality levels for the use of AI) – increasing risk potentials of AI systems are linked to increasing depths of intervention of regulatory instruments (Data Ethics Commission 2019:169 ff., 173 ff.). Various core requirements for the development and use of AI can be derived from this: It is about the primacy of human action and human oversight, technical robustness and security, data privacy and data quality management, transparency, diversity, non-discrimination and fairness, societal and environmental well-being, and accountability (see EU High Level Expert Group 2019; AI Ethics Impact Group 2020; OECD 2019). The requirements for the trustworthiness of AI thereby formulate starting points for the certification of AI systems.

Certification of AI systems

Certification can provide important **impetus for the use of AI systems**. For many AI systems, it can help to exploit the potential social benefits in a safe and public welfare-oriented manner. However, to ensure that certification procedures do not prove to be an obstacle to innovation, it is important to guarantee certain standards of AI systems, while at the same time avoiding overregulation and enabling innovation. Successful certification enables the fulfillment of important social and economic principles – such as legal certainty (e.g., liability and compensation), interoperability, IT security, or data protection. In addition, certification can create trust, lead to better products, and influence national and international market dynamics (cf. Heesen et al. 2020a).

An important aspect in this context is the determination of the **criticality of AI systems** in their application context. Decisive for the criticality are the extent of possible violations of legal rights and human lives using an AI system, as well as the extent of the individual's freedom of action in its selection and use. From this the need for regulation can be determined. Numerous instruments are available for regulating AI systems – these range from no regulation at all, to voluntary commitments and seals of approval, to certification or licensing procedures, or even a ban (cf. Heesen/Müller-Quade/Wrobel et al. 2020., Krafft/Zweig 2019, Data Ethics Commission 2019). In this context, the results of Plattform Lernende Systeme will be integrated into current standardization processes – such as the AI standardization roadmap.

> „With the use of AI, major advances are becoming possible in many areas. In safety-critical applications such as medicine, industrial control, and automated driving, we must be able to trust correct functioning. The competence to be able to certify AI systems will become a significant differentiating factor in the future."
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> **Dr. Reinhard Ploss**, Infineon Technologies AG

With the **Standardization Roadmap for Artificial Intelligence**, which is being developed in a joint project by the German Institute for Standardization (DIN) and the German Commission for Electrical, Electronic & Information Technologies (DKE) and implements an objective of the German government's AI strategy, Germany is the first country worldwide to present a comprehensive analysis of the stock of and need for international standards and norms for this key technology (cf. Wahlster/Winterhalter 2020 i. E.). Initiatives to certify AI systems can help to increase trust in them and contribute to the expansion of the brands „AI made in Germany" and „AI made in Europe" (Fraunhofer IAIS 2019). In addition, standards can accelerate the transfer of results and open international markets, especially for SMEs and start-ups.

Resilience and prevention

Preparation is a key aspect of resilience and the **differentiated response to external shocks**. This involves identifying relevant factors for resilience, assessing them and protecting them. Tools include scenarios, forecasts and early warning systems. This enables crisis prevention to be strengthened and (forward-looking) measures to be better planned and implemented. At the same time, more targeted and differentiated measures can be taken in the event of a crisis: The social, economic and legal consequences can be better assessed and – in the best case – rigid measures such as a national lockdown or the closure of borders can even be avoided.

> „A crisis sheds light on the vulnerability of systems, the Corona pandemic shakes almost all areas of our society. For research, this raises urgent questions, to address the crisis. In the longer term, we can learn from crises when it comes to research on system knowledge, early detection, redundancy analyses and monitoring. One challenge of precautionary research is that in crisis situations, hitherto unknown systemic effects occur. AI can help here because we can use it to identify patterns in large amounts of data that can be used to increase the resilience of the systems. With this precautionary research we should start now."
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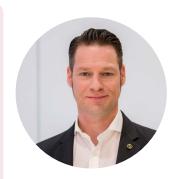> **Prof. Dr.-Ing. Holger Hanselka**, Karlsruhe Institute of Technology

AI can make an important contribution here – for example, through simulations of crises or as a decision-making aid in the event of a disaster. The digitalization of processes in the economy, society and public administration, including the corresponding infrastructure, is a necessary but not sufficient condition for the **use of AI in the event of a crisis**. In this context, it is important to enable access to all competencies, infrastructures and technological elements (hardware and software) and to be able to create a suitable database as a learning basis for AI in unforeseen situations as quickly as possible. Consistent European quality and security standards are just as much a basic prerequisite as suitable data infrastructures.

Competence development and transfer

The development of AI competencies is a key factor for the digital sovereignty and the competitiveness of Germany and Europe. In particular, this involves the competencies in companies, public administration and skilled workers for the evaluation, verification and application of AI technologies. The starting point is the identification of **competence requirements** of organizations and companies as well as the identification of qualification needs for employees. On this basis, competencies can then be strategically implemented in companies and qualification measures in schools, universities and companies can be implemented.

In addition to basic digitalization skills, specific AI knowledge or AI application knowledge (domain knowledge) is required – depending on the role in the company – as well as knowledge of how to handle and use data (data literacy; Keim & Sattler 2020). For this purpose, further **development of education and training** is expedient. AI opens new options for qualification and lifelong learning – also and especially in combination with classic methods. AI can also – within the framework of legal requirements – provide strategic competence and knowledge management in companies. AI competence is becoming a decisive element for the competitiveness of companies. At the same time, knowledge about AI is a factor in gaining acceptance, participation and the confident handling of the technology by everyone. Competence development also includes empowering people in dealing with AI systems in order to be able to assume responsibility.

> „Artificial Intelligence is one of the most important success factors for mastering the digital transformation. We see the development, promotion and expansion of AI competencies within the company as a strategic task. Continental defines the promotion of „AI talents" as a corporate initiative. Via a digital learning platform, our talents learn the latest technology and science, and their application permeates almost all areas of our company. Our offering consists of various training formats based on internal and external vendors, online offerings, hackathons, and first-hand practical experience. Collaboration programs with leading universities and research institutions world-wide are a very important component. Central to this is that employees and management must grow together with the technology."

Dr. Dirk Abendroth, Continental AG

In addition, **strengthening transfer** through various strategies and instruments is central – especially for SMEs. This involves creating and communicating AI knowledge in research and teaching, translating AI knowledge through networking and cooperation, and implementing AI knowledge in companies. In addition, issues of retaining or attracting AI talent are also important. Moreover, the existing support programs and institutions – such as competence centers or AI trainers – must be made even more aware of AI-affine, but also AI-remote companies via multipliers.

More transfer is also taking place around **centers of excellence for AI research**. Their establishment promotes the development of strong regional ecosystems that attract talented software, hardware and systems engineers as well as founders. Strengthening Europe's top locations, creating a network for training the best young talents, and improving the structural framework conditions are essential for the success of this strategy.

The AI competence centers can, for example, be networked with industry-related transfer hubs: AI laboratories for qualification in the field of Artificial Intelligence can enable transfer between research institutions and industrial users.

Outlook: Continuation of the societal AI discourse

Overall, the Corona crisis is both an **opportunity and a mandate** to further advance the research, application and implementation of AI systems in various areas of life, as well as to make the economy and society more resilient to (external) shocks. The approaches presented are intended to provide impetus for the targeted, strategic and future-oriented development and implementation of AI in Germany and Europe. For example, the Enquete Commission „Artificial Intelligence – Social Responsibility and Economic, Social and Ecological Potentials" also accentuated, among other things, the benefits of AI technologies in healthcare as well as the opportunities and risks of the possible economic upheavals using AI technologies.

Shaping Artificial Intelligence for the benefit of society – this is the claim with which Plattform Lernende Systeme will continue to provide **impetus for the AI discourse** in the future. It will continue to highlight the personal, societal and economic benefits of self-learning systems as well as the challenges that still exist and identify options for shaping AI.

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About this position paper

The position paper was created by members of the Steering Committee of Plattform Lernende Systeme. The Steering Committee of Plattform Lernende Systeme controls on the management level the content and strategic orientation of the platform and provides new impulses for its work. Its members from science and industry represent important topics, disciplines, industries and companies of different sizes in the field of self-learning systems. All members of the Steering Committees were appointed by the Federal Ministry of Education and Research.

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About Plattform Lernende Systeme

To design self-learning systems in the interest of society – this was the aim of Plattform Lernende Systeme, which was initiated in 2017 by the Federal Ministry of Education and Research (BMBF) at the suggestion of the Autonomous Systems Forum of the High-Tech Forum and acatech – National Academy of Science and Engineering. The platform bundles the existing expertise in the field of Artificial Intelligence and supports Germany's further path to becoming an internationally leading technology provider. The approximately 200 members of the platform are organized in working groups and a steering committee. They demonstrate the personal, social and economic benefits of learning systems and identify challenges and design options.

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