Karlsruhe Institute of Technology

AI STRATEGY AT KIT

AI STRATEGY AT KIT:

ADVANCING AI AND APPLYING IT STRATEGICALLY, RESPONSIBLY, AND SUSTAINABLY

The AI strategy defines fundamental, specific goals regarding the use and role of artificial intelligence (AI)[1] in KIT's various activities and identifies related challenges for the institution. AI strategies of relevant superior authorities are integrated into KIT's own strategy development (EU[2], Federal Government[3,4], State of Baden-Württemberg[5]).

Prior to drafting this AI strategy, KIT implemented guidelines on the use of generative AI at KIT in the spring of 2025[6] and introduced the first comprehensive technical solutions for the widespread use of generative AI at KIT[7]. Based on this AI strategy and the guidelines, and in line with KIT's vision, overall strategy, and governance, the next steps will involve developing, prioritizing, allocating resources to, and implementing concrete measures, target-group-specific implementation plans with assigned responsibilities, and key performance indicators (KPIs) for evaluating success. This is not part of this document.

This AI strategy will be continuously reviewed by KIT's digitalization governance bodies and updated (e.g., in two years) to keep pace with the rapidly evolving developments in this field.

GUIDING PRINCIPLES AND STRATEGIC OBJECTIVES

Focusing on KIT's Mission and Responsibilities: Artificial intelligence fundamentally influences and **transforms everyday life, the workplace, and research environments.** The specific opportunities and impacts are often not yet foreseeable, as the development of AI and its potential applications is dynamic. Therefore, it is important for KIT, as a research institution that is intensively dedicated to the field of AI in academia, to consciously help shape AI, to seize opportunities decisively and responsibly, to evaluate its practical impacts as experience grows, and to optimize its application.

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1 Definition of Artificial Intelligence (AI): In formulating its AI strategy, KIT uses a broader definition of artificial intelligence that encompasses both established approaches (such as machine learning) and newer ones (such as generative AI, LLMs, and AI assistants/agents). Furthermore, KIT follows the definition of AI systems as set forth in the European AI Regulation: *"'AI system' means a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments."*

2 https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence

3 https://www.ki-strategie-deutschland.de (German only)

4 https://www.bmftr.bund.de/EN/Technology/HightechAgenda/HightechAgenda_node.html

5 https://digital-laend.de/wp-content/uploads/2023/01/Positionspapier-KI-November-2018.pdf (German only) or https://www.wirtschaft-digital-bw.de/en/ai-made-in-bw/ai-made-in-bw, respectively.

6 https://www.kit.edu/downloads/KI-Leitlinien-de.pdf (German only)

7 KIT's KI-Toolbox, https://www.zml.kit.edu/english/ki-toolbox-en.php or https://ki-toolbox.scc.kit.edu/ (for KIT users only)

- As a **scientific institution with its own expertise in AI**, KIT benefits directly from the insights and competencies gained through research, transfer, and academic teaching when evaluating and applying AI. This enables it to **better achieve its scientific goals** and **optimize administration** as well as **research support services through AI**. **KIT conducts both basic and application-oriented research in AI** and actively helps shape the framework for its successful use.

- The goals here are to enable **breakthroughs in research** and translate them into practice, to offer **forward-looking teaching** that is personalized and accessible to all, and to help shape the development and deployment of AI that serves the common good and is sustainable. In this way, KIT also contributes to making **work at KIT more creative, inclusive, and goal-oriented**.

- KIT considers digital transformation in conjunction with the transition to sustainability and **contributes to sustainable AI solutions**.

- Based on these principles and in accordance with applicable regulations, **KIT shapes and evaluates the use of AI** in order to systematically identify its potential and limitations and to make optimal use of AI in fulfilling its tasks.

- **KIT shapes the responsible evolution of AI use through participatory approaches** and with careful consideration of its broader societal impact, both within the institution and across its scientific activities.

- **KIT supports cooperative approaches to AI**, particularly in collaboration with other institutions in the scientific community, in order, for example, to accelerate the acquisition of knowledge regarding the use of AI or to conserve and share resources.

The Human Perspective: In order to optimize the fulfillment of its tasks and the processes required to achieve them, KIT pursues a task-specific balance between **human collaboration, the use of AI, and hybrid solutions, while placing the human perspective at the center**. This strengthens KIT's position as an attractive and competitive employer and a leading place of learning. In addition to providing its students with foundational and specialized AI skills through its curriculum, KIT also serves as a hub for lifelong learning in the field of AI.

This includes **continuous professional development for employees** as well as **programs for external audiences and KIT alumni**.

KIT promotes a **transparent and human-centered AI culture** that strengthens scientific judgment,

- integrity, and ethical responsibility in order to significantly enhance the benefits while minimizing risks. To support this goal, KIT provides **appropriate platforms and opportunities for dialogue, exchange, and collaboration** that encourage **innovation through the effective integration of AI**.

- KIT encourages and supports all individuals, in their various roles, to engage thoughtfully with the **opportunities and risks of using AI for their individual tasks** and to apply AI in a targeted manner.

CREATING THE CONDITIONS FOR AN AMBITIOUS AND RESPONSIBLE USE OF AI

- AI requires **significant resources** at various levels, which entail **costs that must be covered** (investments in deployment and operation, AI expertise). These investments serve to provide employees and students with **effective, efficient, and legally compliant access to AI tools and infrastructure**. At the same time, this supports the **responsible use of data** as well as the **safe and secure deployment of AI**.

- KIT attaches great importance to **ensuring transparency in the use of resources** in order to promote a responsible, user-centered, and benefit-oriented approach to AI. While the costs associated with expanded AI deployment are expected to increase initially, KIT aims to realize **efficiency gains and cost savings** over the medium term through the strategic application of AI.

- Building and continuously expanding a technically robust and fit-for-purpose AI ecosystem at KIT, together with the necessary expertise, requires more than one-time investments. It calls for a **sustainable, adaptable, and long-term investment and funding strategy**, to be developed on the basis of this AI Strategy. Adequate financial resources must be made available. To this end, a targeted discussion must take place regarding the acquisition of additional funds, the prioritization of financial and human resources, and the allocation of resources. Ongoing, structured **dialogue with policymakers** is essential to align public policy objectives with KIT's strategic goals.

- **Structural dependencies** on a small number of hardware and software providers worldwide present significant challenges (e.g., systematic bias in AI output due to non-transparent training data or the operating principles of large language models, monopolistic pricing). To mitigate these risks, KIT considers the development and availability of **sovereign AI infrastructures** to be essential. In collaboration with partners in the scientific community, the goal is to minimize existing and future dependencies and to provide scalable and interoperable solutions that can be reliably used by various communities within KIT and beyond. This helps to strengthen **German and European competitiveness and sovereignty**.

- The resource consumption associated with AI and its use, which has already been addressed, as well as ongoing issues related to circularity and problematic raw materials or sources, raise **questions of environmental sustainability** that require convincing answers. Within the scope of its own activities and through collaborations with partners, KIT sees significant **opportunities for innovation** in **AI infrastructure and applications**, as well as for **joint qualification and advisory services**.

CORE TASK: RESEARCH

AI as a Research Topic: AI is part of KIT's research strategy and is therefore considered here only as an example. This includes, for example, topics such as **embedded and embodied AI** (e.g., in the fields of robotics, energy systems, and mobility solutions), **IT systems/AI development** (e.g., chip design, low-power AI), cybersecurity (including trustworthy AI/explainable AI), and topics related to the **Twin Transformation** (i.e., the integration of digital and sustainability transformations through, on the one hand, AI that is sustainable from the outset and, on the other hand, AI solutions for sustainability challenges; AI technology impact assessment), as well as **research infrastructures** and **method development** (e.g., Self-driving Labs for materials development, AI for science/engineering).

- KIT will discuss the **AI research priorities and the associated scientific challenges** and, in alignment with the **research strategy**, anchor them in the relevant strategic planning processes. An additional goal is to develop a suitable **recruitment strategy for highly qualified scientific staff** in order to create an attractive environment (e.g., interdisciplinary AI bridge professorships with a focus on computer science and methods development).

AI as a Method or Tool for Research: The use of AI is fundamentally changing **scientific work** and has the potential to bring about further disruptive changes.

- KIT views the methodologically sound use of AI as essential for future research activities and supports researchers accordingly through **central services and support programs**.

- KIT strategically leverages its strengths to reflect on such transformational processes in research and to shape them in an **ethically responsible** manner.

New Pathways for Interdisciplinary Research and Responsible AI Development: KIT builds on the combination of broad scientific expertise with outstanding capabilities in the **scientific application of artificial intelligence**.

- Through innovative approaches, KIT promotes **interdisciplinary AI research** and **responsible AI development** with the goal of strengthening its role as a **pioneer in sustainable and ethical AI research** and thereby increasing its appeal. To this end, KIT leverages its diverse **collaborations with academia, industry, associations, and civil society**.

- Given the high energy and other resource consumption of AI technologies, KIT will prioritize **sustainability aspects in the further development of, and investments in, research and research data infrastructures** in line with the Twin Transformation. AI technology should be deployed strategically where significant added value can be achieved.

- Researchers will be empowered to use AI in a **reflective, ethical, and socially responsible manner, guided by theory**.

Digital Infrastructures: KIT possesses **extensive expertise in digital infrastructures** such as High-performance Computing and Data-intensive Computing (HPC/DIC) or Research Data Management (RDM). The **reusability and accessibility** of research data generated at KIT and the **continued digitalization of research infrastructures** are just as important prerequisites for the broader application of AI methods in research as the reliable provision of transparent, robust, and verified information systems.

- The many years of experience gained from support services in the HPC/DIC environment provide an ideal foundation for **broadly integrating AI methods into scientific applications**.

- Research data infrastructures and support structures will be further strengthened to increase the r**eusability of data, including for AI-based methods**.

Good Research Practice: The use of generative AI in the **production or evaluation of research outputs** (grant proposals, reports, articles, software, data) in particular raises fundamental questions. A **lack of transparency, limited reproducibility, and unclear authorship** challenge the scientific community, as the use of generative AI could, in the long term, lead to the **devaluation of scientific knowledge and methods** and to a **loss of trust in science itself**. This raises further questions currently under dis-

cussion regarding the future **viability of research evaluation**. Systematic biases resulting from inaccessible training data or non-transparent inner workings of the applied large language models may lead to **distorted or discriminatory outcomes**. The principles of good research practice require that research output (publications, data, software, etc.) be **scientifically sound, transparent, and reproducible**.

- The goal is therefore to ensure **research integrity and independence** in the long term and to enable researchers to **handle their own sensitive data securely**.
- Accordingly, the role of **risk assessment** for AI use in the research process, as well as the role of scientific quality assurance, must be strengthened.
- The use of **adaptable, open large-language models** on in-house hardware – including in collaboration with other academic institutions – is being expanded, as it offers certain advantages over closed systems.
- KIT is actively contributing, as an institution, to shaping **changes in research assessment** and in the scientific incentive and recognition system.

CORE TASK: TRANSFER

Successful Technology Transfer: In response to the projected effects of AI on **productivity and demand growth**, KIT's Transfer and Innovation Management teams are implementing a tailored strategy to make the most of the opportunities this presents for KIT. AI-related topics are being integrated into already well-established activities.

- KIT builds on its excellent technology transfer structures and its collaborations for **mutual exchange between research and industry**, and works as a partner with civil society and the business community to **shape the digital transformation, including Twin Transformation**, with the goal of leveraging AI as an accelerator for the development of collaborative, effective, and sustainable solutions.

Increasing KIT's Impact on Society: Through **transdisciplinary research, dialogue, and transparency**, the opportunities – as well as the risks and challenges – of AI are addressed, and solutions are developed collaboratively with various stakeholders. This strengthens trust in AI based on facts and supports its responsible use.

- KIT is **using and developing AI to forge new paths for science communication** and **knowledge transfer in civil society, politics/public administration, and the business sector** (KIT as a methods laboratory); in doing so, it increases its visibility as a **research institution with societal relevance and impact**.

CORE TASK: STUDYING AND TEACHING

AI as a Key Component of a Modern Learning Culture: Artificial intelligence is fundamentally transforming teaching and learning, serving as a **tool**, **a subject of study**, and an **integral part of an increasingly digital academic culture**. At KIT, this development creates and expands opportunities to shape the future of Studying and Teaching and to prepare both students and teaching staff as effectively as possible for a world shaped by science and technology (including AI). When used correctly, AI can **make learning processes more personalized, inclusive, and flexible**, and **open up new pathways to knowledge**. At the same time, its use must remain grounded in a commitment to **academic quality**, **ethical responsibility**, and the core values of higher education: Dialogue, understanding, and shared reflection. As AI becomes more deeply integrated into education, competency requirements are evolving. Alongside strong disciplinary expertise and other established competencies such as analytical thinking, knowledge transfer, systems thinking, and creativity, the **critical evaluation of algorithmically generated outputs** is becoming increasingly important. This supports the ability to design and evaluate AI output, identify biases, and understand the limitations of generative systems.

- The goal is to establish **AI literacy** as a core curricular competency, thereby empowering all students and teaching staff (both in their respective disciplines and in educational practice) to **evaluate and use AI responsibly, critically, and in a manner appropriate to their field** (through offerings from KIT departments as well as cross-departmental programs).

- Building on extensive preliminary work, KIT is significantly expanding **digital teaching and learning formats, media-based instructional support, AI-powered tools, and innovative pilot projects**. In doing so, KIT benefits from **teaching-specific networks** at national and international levels and actively contributes its expertise[8].

Strengthening Individual Learning Processes, Collaboratively Shaping Learning Cultures, and Promoting Curricular Adaptability: AI enables **more adaptive and highly differentiated learning paths**. Personalized assistance, adaptive learning paths, and low-threshold access to learning content can reduce barriers and accommodate diverse learning needs. This creates new opportunities for students to engage with content at their own pace and with guidance tailored to their needs. However, one thing should be clear: **AI merely complements human interaction**; it does not replace it. Guidance, support, and collaborative learning processes remain essential to a high-quality academic experience. At the same time, asymmetrical conditions arise when dealing with AI. Technological and competency-related differences exist both between students and educators and within these groups. To avoid disparities in skill levels, we need **training programs, further development of media didactics, and collaborative efforts to develop appropriate use cases**.

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[8] International networks in the context of digital higher education and AI include, among others, EUNIS, EPICUR, AGORA initiatives, EUA, and ELLIS. At the national level, for example, there is the Hochschulforum für Digitalisierung (HfD), and at the state level, the Hochschulnetzwerk Digitalisierung der Lehre Baden-Württemberg (HND-BW) https://www.hnd-bw.de/ (German only).

- Increasing the use and development of **AI-supported learning and assistance systems**: Adaptive tests, automated feedback systems, learning analytics, and simulated learning environments are used as complementary elements – grounded in media didactics, transparent, and clearly distinguished from assessment. **The integration of AI into learning, content, and student information systems** aims to enable continuous support throughout the entire student lifecycle while simultaneously streamlining processes, using data responsibly, and improving services for both students and teaching staff.

- Getting students involved as co-creators: The introduction of AI in teaching should be shaped in collaboration with students to implement **participatory teaching formats, clear rules for AI use, and the incorporation of student perspectives into the further development of digital and AI-supported learning environments**.

- **Strengthening curricular adaptability**: Since technological innovation proceeds faster than the regulatory cycles of academic and examination regulations, agile processes are used to enable more flexible yet quality-assured curricular adjustments.

- **Further developing examination formats**: Digital and online examination formats, including those that can be taken from any location and for large cohorts, are being further developed where they make sense from an educational perspective and are legally and technically sound. Exams should assess comprehension, the ability to apply knowledge, problem-solving, and creativity. AI is meant to assist in providing feedback or support services, but must not take over the assessment itself.

Lifelong learning: AI-supported environments enable continuous further education and open up flexible forms of knowledge acquisition without diminishing the importance of basic skills or subject-specific depth.

- KIT is leveraging this development to support students and alumni through **lifelong learning** and to systematically expand educational offerings.

RESEARCH SUPPORT AND ADMINISTRATION

As a cross-cutting technology, AI influences all processes at KIT, including those in management as well as in central and decentralized administration. AI technology supports the digitalization of administrative processes and streamlines routine tasks. KIT leverages the flexibility afforded by its in-house AI expertise and corresponding infrastructure to **advance and optimize the use of AI in research support and administration**.

Through the project "Innovation Hub for Generative AI at KIT – GenAI@KIT" basic AI training has already been introduced for all employees. In-depth workshops on creating custom chatbots were conducted with the goal of targeted AI utilization. Furthermore, through the project and via KIT's AI toolbox[9], access to both commercial and open-source AI models has been provided, hosted both in the cloud and on KIT's own hardware, thereby enabling a special focus on data security. KIT also collaborates with other institutions[10] at various levels on digitalization and AI-related topics in administration. Within these **net-**

[9] KIT's AI Toolbox, https://www.zml.kit.edu/english/ki-toolbox-en.php or https://ki-toolbox.scc.kit.edu/ (for KIT users only)

[10] These include, for example, the formats offered by https://www.bwuni.digital/ (German only) at the state level, as well as those within the Helmholtz Association at the federal level.

works, qualified solutions are developed either collaboratively or independently and, wherever possible, implemented.

Strengthening a Service-oriented Approach: AI tools can facilitate more effective solutions and enhance user-friendliness.

- Digitalized and, wherever possible, automated **routine administrative processes are made more user-friendly through the use of AI tools**, thereby **increasing operational efficiency**. The use of AI in administrative processes is transparent, traceable, and responsible, in order to minimize, among other things, the risk of errors and discrimination caused by AI.
- **Decision-making authority** and the **selection** of appropriate quality control procedures **remain with humans**.
- **Employees experience a reduced workload** and gain the **freedom to focus on the conceptual development** of processes.
- Users receive **fast and tailored support** for their needs **through AI-based methods**.

Leveraging Institutional Synergies: AI offers a wide range of solutions that can also be used across departments; these synergies must be harnessed.

- A **structured needs assessment**, **opportunity and risk analyses**, and **prioritization of AI applications** are conducted across the entire institution.
- Solutions are tested in **pilot implementations**. Throughout this process, scaling and transfer remain a focus, both within KIT and, in the long term, to other universities and research institutions.
- KIT also creates the flexibility needed to quickly develop and test **solutions specific to individual disciplines**.
- Through the AI Toolbox, KIT offers its employees access to suitable AI solutions and platforms that can be used with **confidential data**, thereby enabling the **legally compliant** implementation of relevant applications in administration and management.

Continuously Promoting and Developing AI Competence: **KIT employees** must have the greatest possible **autonomy in using AI tools** in order to make decisions regarding the beneficial and effective use of AI and to develop such applications. The development, quality assessment of results, and final approval of AI solutions require a combination of **technical expertise** in administrative processes and a deep **understanding of the opportunities** offered by AI technology.

- To this end, professional development toward **transdisciplinary expertise** is promoted.

GLOSSARY

Technical Terms from the AI Strategy

A

Adaptive Learning Paths: Individually tailored learning paths that adapt to learners' progress and needs.

Adaptive Tests: Testing methods that automatically adjust to the test-taker's performance level.

AI Agents: Autonomous AI systems capable of independently planning and executing tasks.

AI Assistants: AI systems that support humans in specific tasks.

AI Bridge Professorships: Professorships with a mandate for computer science and method development across various disciplines.

AI Literacy: Basic competence in the responsible, critical, and technically appropriate use of AI systems.

AI System: A machine-based system that operates autonomously and derives predictions or decisions from inputs (see EU AI Regulation).

Artificial Intelligence (AI): Computational systems with human-like intellectual capabilities (machine learning, generative AI, LLM).

C

Circularity: A circular economy based on the reuse of resources rather than linear consumption.

Cyber Security: Protection of IT systems, networks, and data against digital attacks.

D

Data Intensive Computing (DIC): Computer-assisted processing and analysis of very large amounts of data.

Digital Transformation: Fundamental change in society and organizations driven by digital technologies.

E

Embedded AI: AI models embedded in specific technical devices to perform specialized tasks (e.g., control, optimization, data analysis).

Embodied AI: AI that is integrated into physical systems, enabling them to interact with the physical world (e.g., in robotics).

Explainable AI: AI systems with decision-making processes that are transparent and traceable.

F

Federated Base: Networked collaboration among several independent institutions with shared standards.

G

Generative AI: AI systems capable of creating new content (text, images, code).

Good Research Practice: A set of guidelines for ethically sound, transparent, and reproducible scientific work.

H

High-performance Computing (HPC): High-performance computing using supercomputers for complex scientific calculations.

Hybrid Approaches: Combined approaches that integrate human work and AI support.

I

Interdisciplinary Research: Collaboration among different disciplines to solve complex scientific problems.

L

Large Language Model (LLM): Very large neural language models trained on vast amounts of text.

Learning Analytics: Collection and analysis of learning data to optimize learning processes.

M

Machine Learning: A branch of AI in which systems learn from data without being explicitly programmed.

Media Didactics: The science and practice of teaching and learning in digital environments.

N

Sustainability Transformation: Fundamental societal change toward ecologically, socially, and economically sustainable systems.

O

Open Source: Software with publicly accessible source code that is free to use.

P

Participatory: Developed with the active participation of all affected groups.

R

Reproducibility: The quality of scientific results that allows them to be replicated under the same conditions.

Research Data (RD): Data generated in research projects that is documented and made available for reuse.

Research Data Infrastructures: Technical and organizational systems for storing research data and making it available.

Research Data Management (RDM): The systematic organization, storage, and provision of research data.

S

Self-driving Labs: Automated laboratories for materials development that use AI to conduct experiments independently.

Simulated Learning Environments: Virtual environments for risk-free practice and experimentation.

Sovereign AI Infrastructures: Independent IT infrastructures designed to reduce dependence on individual providers.

Student Lifecycle: The entire course of study, from application to alumni status.

Systematic Biases: Structural errors in AI systems resulting from unverifiable training data or the operational mechanisms of large language models (LLMs).

T

Technology Transfer: The transfer of research findings into practical applications and commercial use.

Transdisciplinary Research: Research that involves both academic and non-academic stakeholders (civil society, industry).

Training Data: Datasets used to train AI models.

Twin Transformation: The combination of digital transformation and sustainability transformation as an integrated approach.

Contact

Karlsruhe Institute of Technology (KIT)

Professor Dr. Kora Kristof
Vice President Digitalization and Sustainability

Dr. Alexander Haas
Head of Digital Office

Email: kora.kristof@kit.edu
https://www.kit.edu/eb/vp-digitalization.php

Issued by

Karlsruhe Institute of Technology (KIT)

President Prof. Dr. Jan S. Hesthaven
Kaiserstraße 12
76131 Karlsruhe, Germany
www.kit.edu

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