



AI – Made in Germany

GERMAN STANDARDIZATION
ROADMAP ON ARTIFICIAL
INTELLIGENCE (2ND EDITION)

RECOMMENDATIONS FOR ACTION
FOR AI STANDARDIZATION

A summary

Supported by:



on the basis of a decision
by the German Bundestag

Standardization Roadmap on Artificial Intelligence



GERMANY AS A STRONG AI LOCATION

Standards and specifications strengthen trust in AI in industry and society – the now published second edition of the Roadmap on AI contributes to this by identifying further needs for standards and specifications. As part of the German government’s AI Strategy, the Roadmap develops the strategic timetable for AI standardization further on behalf of the Federal Ministry for Economic Affairs and Climate Action and provides concrete recommendations for action.

The Roadmap supports the AI Act

Accompanied by a high-level coordination group for AI standardization and conformity, more than 570 experts from industry, science, the public sector and civil society have further developed the strategic Roadmap for AI standardization. Among other things, the Standardization Roadmap on AI deals with the draft Artificial Intelligence Act (AI Act) published by the European Commission and identifies concrete needs for standards that need to be developed for the implementation of the planned AI Act.

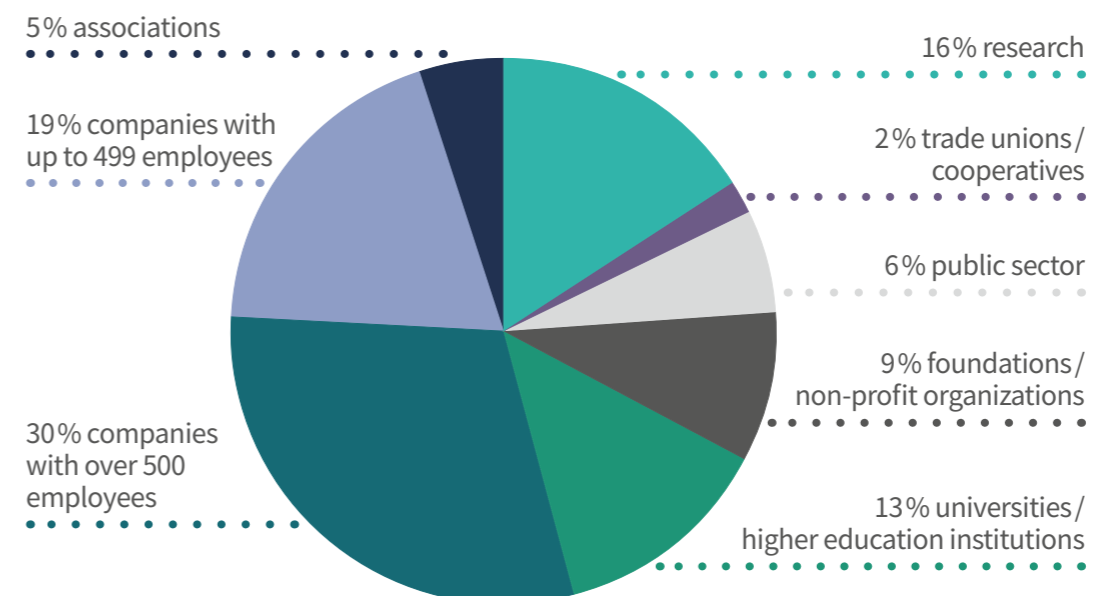
Driving innovation

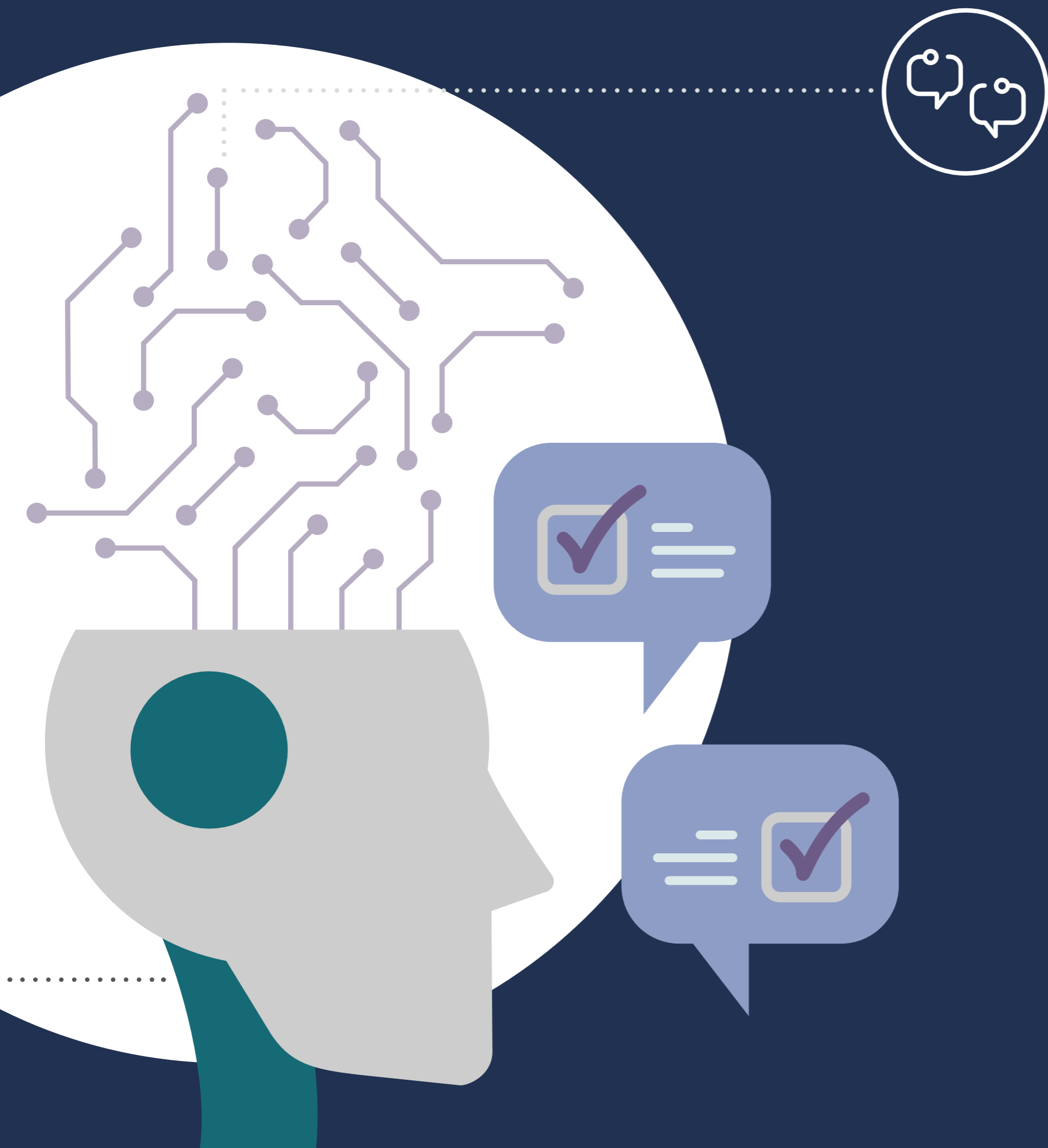
In all, the document covers 116 standardization needs on nine key topics and provides six key recommendations for action. The Roadmap forms the starting point for initiating standardization activities. The resulting standards and specifications create innovation-friendly

conditions for the technology of the future. This calls for experts getting involved in standardization committees. The second edition of the Standardization Roadmap on AI is divided into nine key topics:

- Fundamentals
- Security/safety
- Testing and certification
- Sociotechnical systems
- Industrial automation
- Mobility
- Medicine
- Financial services
- Energy and environment

The number of contributors in percent





Fundamentals

A UNIFORM UNDERSTANDING

As a cross-sectional technology, artificial intelligence offers great potential in many industries and areas. The basis for this is reliable, functional and, above all, safe and secure AI. The Standardization Roadmap covers terminologies and significant areas of application, such as language technologies, imaging sensor technology, quantum AI and describes AI methods and capabilities. Moreover, ethical principles, data quality and other criteria are also addressed. All of these topics are the basis for a common understanding of artificial intelligence and can be reflected in standards and specifications. This promotes interoperability and the interaction of different systems.

Security / safety

IDEALLY PROTECTED

AI systems must be safe / secure in several different ways: People who interact with an AI system must be protected (safety). Moreover, the data used must not be misused (security). Only a deeper consideration of the security/safety of AI-based technologies and applications can enable their comprehensive use in industry and society.

Currently, autonomous AI systems still face the challenge of being able to prove they do not pose a risk to life and limb. The Standardization Roadmap describes an approach towards exploiting the market potential of corresponding applications and achieving the necessary risk reduction. It also helps to tap the market potential of corresponding applications and, in particular, to design the interfaces between ethics, law and technology as regards safety.

AI also needs trust and confidence in cybersecurity and privacy. Testing and certification can help to instil trust, and they are in turn based on standards and specifications: The focus here is on the life cycle of the data or algorithms used for AI systems.





Testing and certification

PUT TO THE TEST

AI systems differ from conventional software in a number of ways in that data and algorithms take on a much more central role. This is why, for instance, the planned AI Act provides for audits of AI applications that could pose a high risk to health, safety or users' rights to privacy. In particular, the quality requirement, for example, for technical reliability as well as the explainability and traceability of AI applications is absolutely central here.

In order to strengthen trust in AI applications, quality criteria and test procedures are necessary that describe AI systems technically and make them measurable. Standards and specifications describe requirements for criteria and procedures (with regard to quality, security/safety and transparency) and form the basis for the certification of AI applications. Certification can also contribute to the creation of a trustworthy "AI Made in Europe" brand and so strengthen Europe's international competitiveness in the field of AI. To this aim, the Standardization Roadmap recommends developing a horizontal AI quality standard, which can be the basis for further industry-specific tests and certifications.

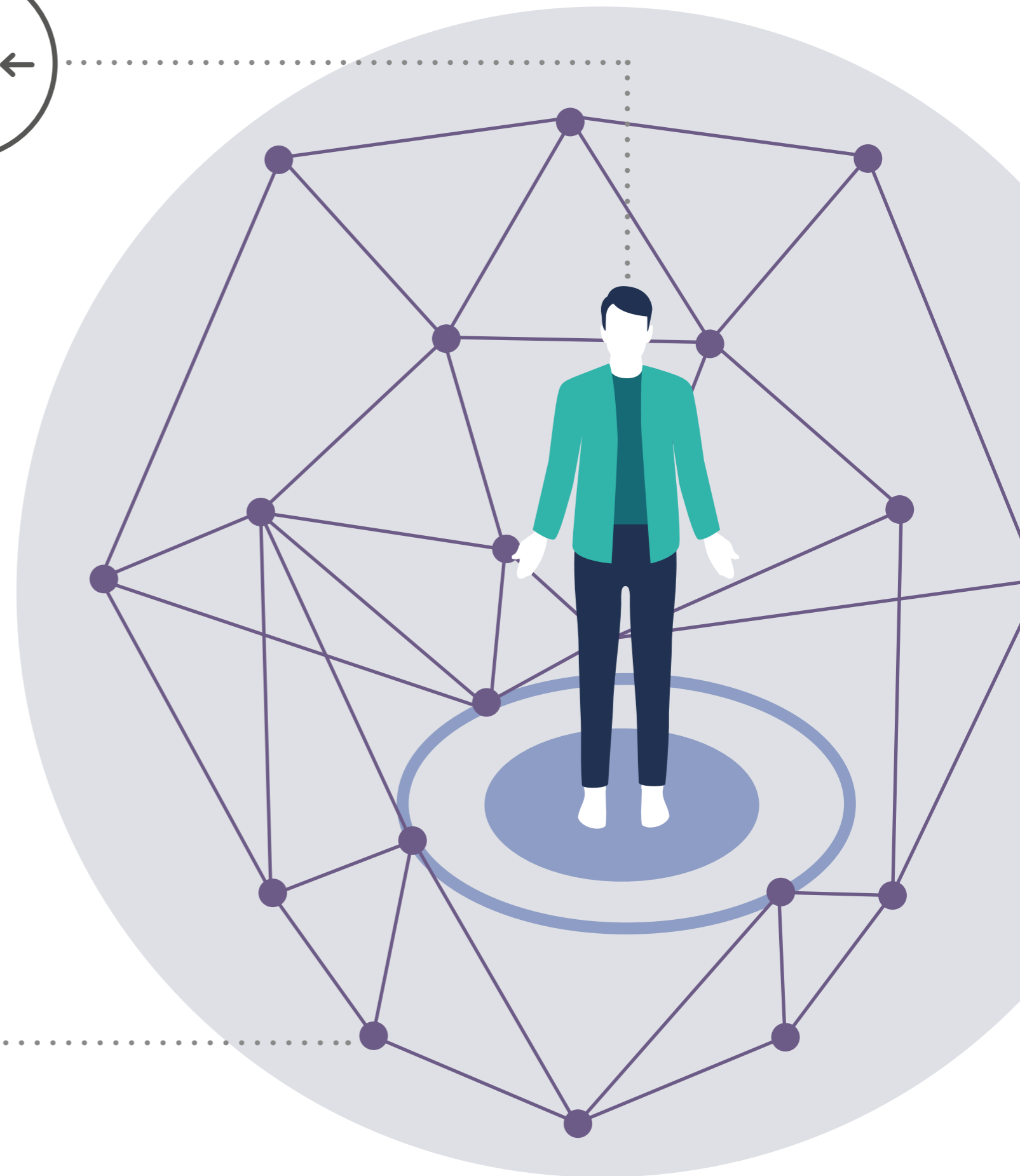
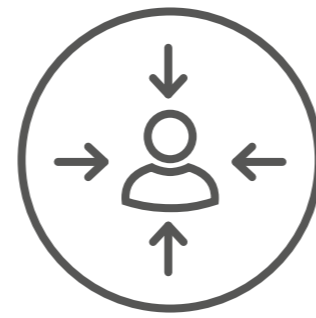


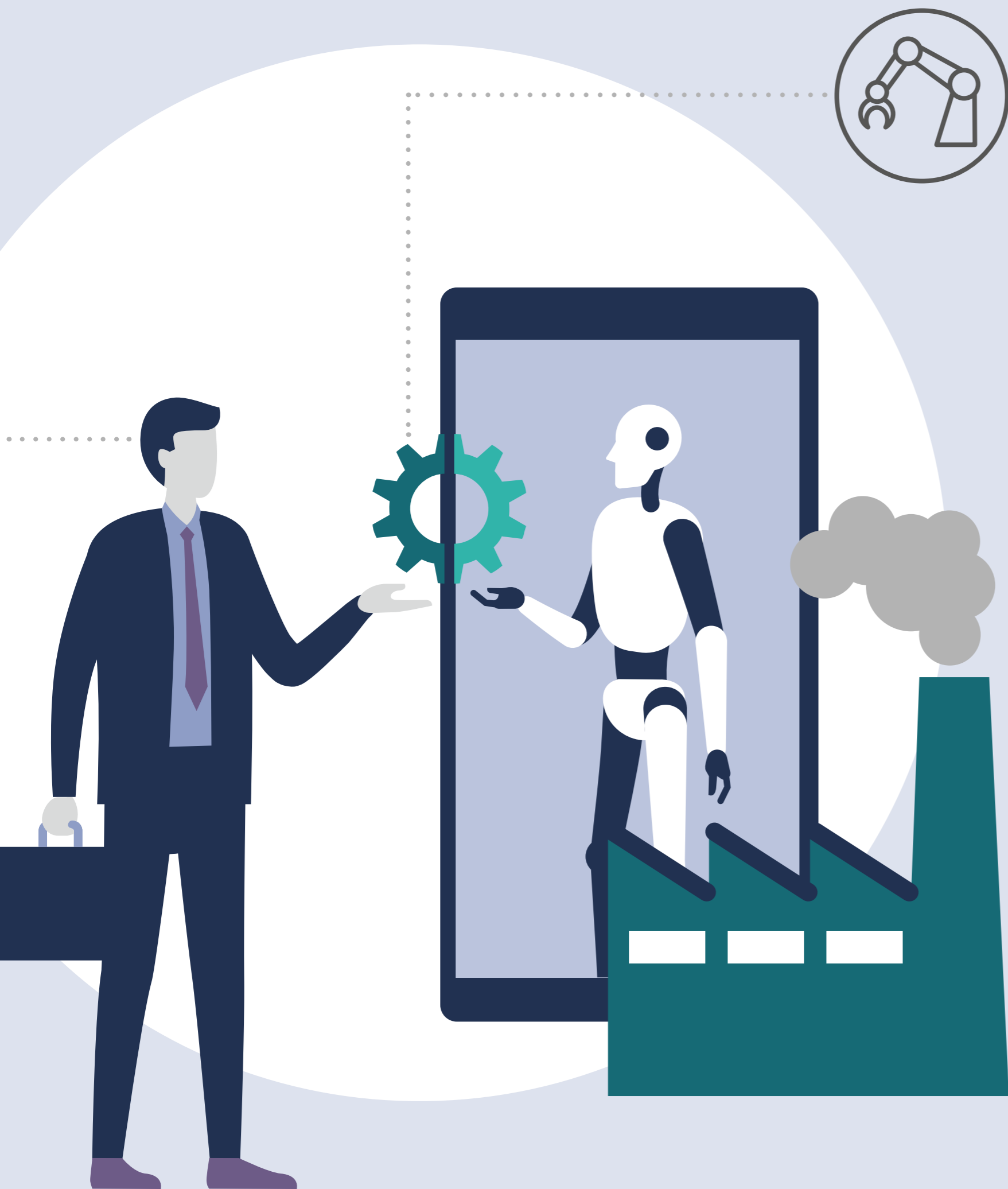
Sociotechnical systems

HUMANS TAKE CENTRE STAGE

AI technology is always within the context of humans and the organizational environment. For successful AI solutions, therefore, it is not enough to look only at the technology. Instead, the sociotechnical system in which artificial intelligence is used and interacts with humans should also be considered. The goal is to identify users' needs and to design AI in such a way that it supports them in their tasks in the best possible way. In particular, small- and medium-sized enterprises and start-ups should be enabled to integrate AI technologies into their business models. Standardization's task is to include all relevant groups of people and perspectives, taking sociotechnical aspects into account.

In the draft regulation of the AI Act, human oversight and the possibility of intervention as well as transparency play significant roles in AI systems, for example. Technical and social components must therefore be thought of from the human perspective and aligned with this in mind during the development process.





Industrial automation

INTEGRATION AND INTERACTION

Artificial intelligence is a key technology when it comes to the digital transformation of the manufacturing sector. An important function is ascribed to the digital mapping of physical reality, the “digital twin”. The Standardization Roadmap outlines current challenges related to data models for the use of AI in industrial automation. The Roadmap also addresses how humans and machines interact and how AI systems can be integrated.

Standards and specifications are essential in industrial automation; they promote cross-company interoperability and help in the implementation of regulatory frameworks.

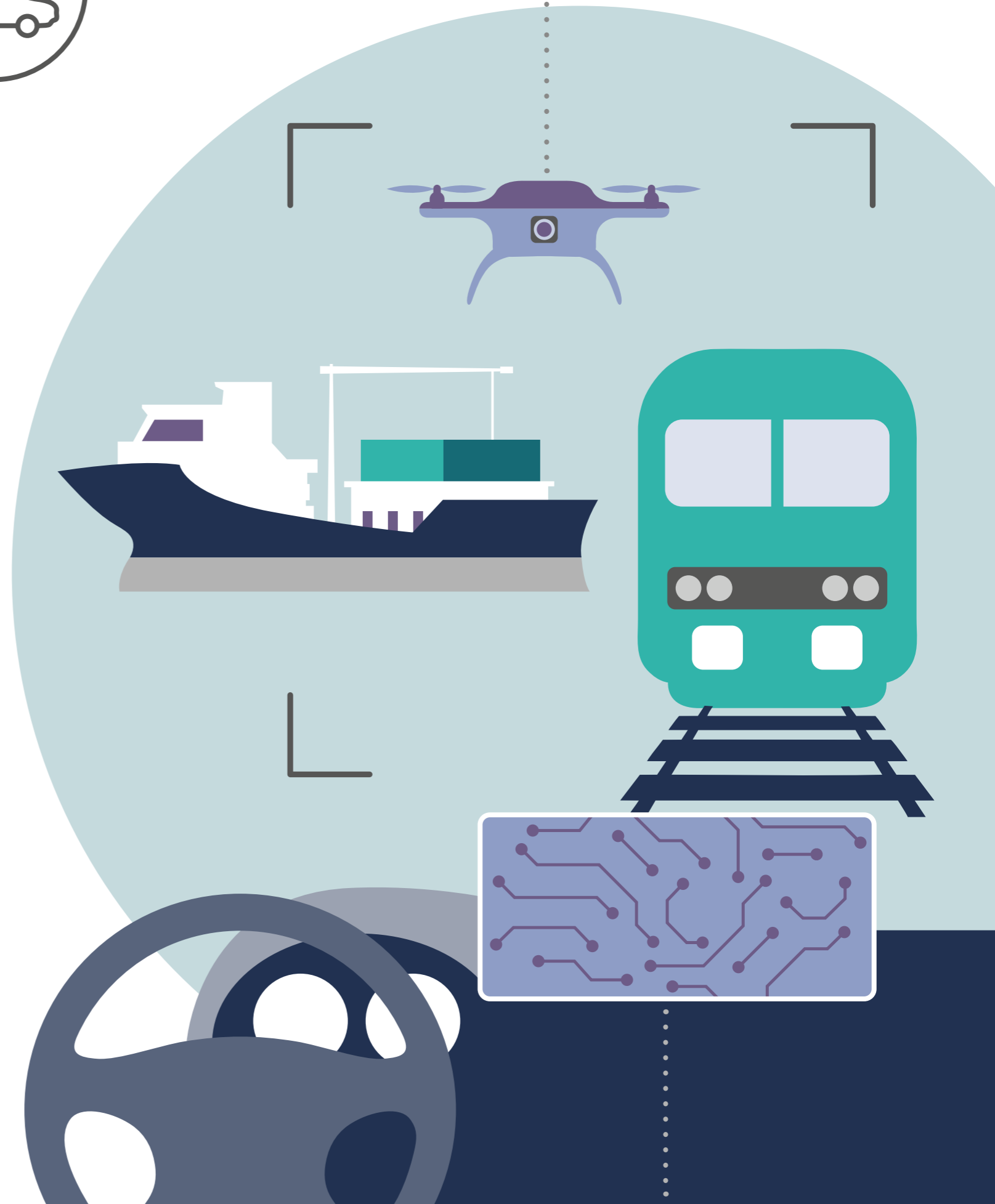
Mobility

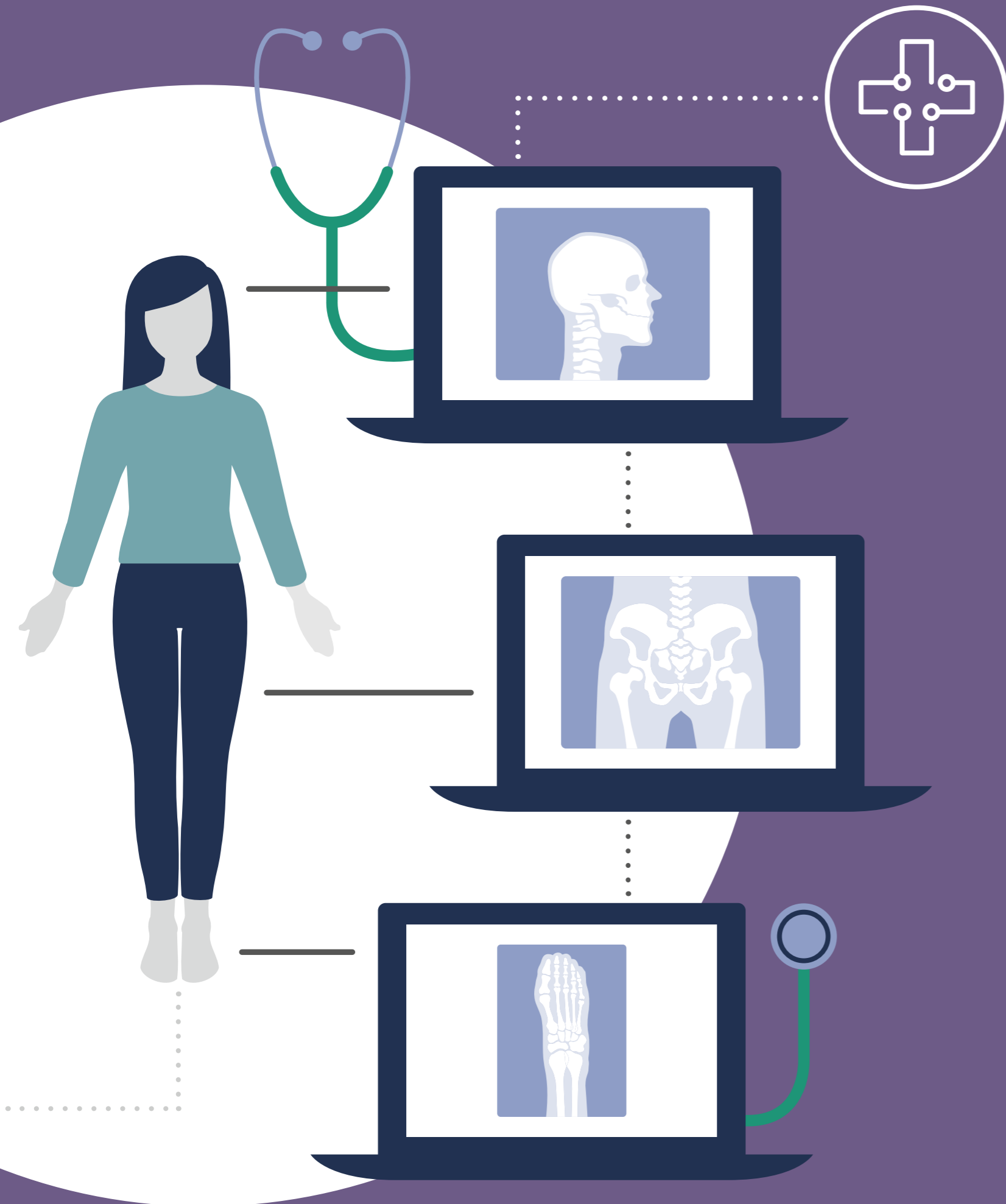
SMART CONTROL

The use of artificial intelligence offers many advantages in the mobility sector, for example, when self-learning systems take over complex automated control functions and optimize traffic flows or mobility chains.

Standards and specifications for the mobility sector can:

- form a basis for operationalization of the planned AI Act by enabling objective methods for testable development according to trustworthiness-by-design
- support dynamic, continuous (re)certification or type approval in the sense of continuous system development
- define interfaces and minimum requirements for interoperability, data exchange, trustworthiness and safety for automated mobility systems





Medicine

HEALTHY CONFIDENCE

Medicine of the future will be unthinkable without AI – whether in diagnostics, therapy, early detection or in everyday care. At the same time, the use of technology in this area is challenging: It's not only about health and personal data, but also about letting people benefit from medical progress quickly and safely.

Standards and specifications can help:

- increase the usability of data for AI-based systems in medicine
- check the performance and safety of AI-based medical devices
- create trust and acceptance among users and patients
- efficiently implement the quality infrastructure of regulatory framework conditions for AI in medical devices

Financial services

SAFE AND FAIR

Money makes the world go round: Financial services ensure social participation for everyone and are also demanding and highly sensitive products – particularly in a digitized world. Seemingly perfect for the use of artificial intelligence, cash has long been replaced by pure data streams.

How can these new opportunities be used responsibly without overlooking the risks? Can customer behaviour models become data leaks? What data should be allowed to be used for decision models and how is it determined when enough information is available to make fair decisions? How are AI models present in conventional bank risk management? Standards and specifications make answering this question much easier.





Energy and environment

SUSTAINABLE SUPPLY

Energy is part of the critical infrastructure, and in particular the energy transition is an important political issue. Economic efficiency, security of supply, climate protection and the switch to renewable energies are on the agenda at the same time. In the future, smart grids will become increasingly important. They combine energy technology with information and communication technologies. Artificial intelligence must be integrated into this system of data models and system architectures.

AI is also a significant tool for achieving the 17 Sustainable Development Goals defined by the United Nations. AI offers use potentials in the context of the European Green Deal. For example, AI can be used to develop cross-sectoral behavioural recommendations for market players and consumers to minimize the ecological footprint. In the environmental sector, AI can also be a tool for greater resource efficiency in industry and for processing large volumes of data in various sectors of the economy. In this context, standardization contributes to Germany's transformation into a climate-neutral industrialized country.



Recommendations for action of the Standardization Roadmap on AI

DRIVING “AI MADE IN GERMANY”

Standards and specifications can contribute to secure, high-quality, reliable and explainable AI: They create the basis for technical sovereignty, promote transparency and provide orientation. In order to exploit this potential, the second edition of the Standardization Roadmap on AI provides six overarching, central recommendations for action.

1.

Develop a horizontal conformity assessment and certification programme for trusted AI

How can the requirements of industry, public authorities and civil society placed on AI be made objectively verifiable? For economic growth and the successful use of AI systems, taking European values into account, a conformity assessment and certification programme is needed. Based on reliable and reproducible tests, sound statements on AI trustworthiness can be made.

2.

Establish data infrastructures and data quality standards for the development and validation of AI systems

The quality of an AI system often depends on the quality of the data used. The extent to which the German AI industry and start-ups in particular can access corresponding datasets is thus a strategic competitive factor. Suitable infrastructures are therefore required to collect, describe and provide datasets. Standards and specifications ensure interoperability and define quality requirements.



3.

**Understand humans as part of the system
in all phases of the AI life cycle**

Which transparency is sufficient in which context for which target group? How can human oversight be implemented in AI systems? And what information must be available as a basis for human intervention in the system? These are all questions that must be thought of from the human perspective and according to which the technical and social components must be developed and aligned. For “lighthouse projects”, concrete tests must be carried out to determine how stakeholders can be integrated into all phases of the AI lifecycle. In addition, standards for the sociotechnical aspects of the planned AI Act must be developed – here it is particularly important that all relevant target groups are involved in a balanced manner. In addition, the sociotechnical perspective, previously underrepresented in standardization, should be developed by experts.



4.

**Develop specifications for the conformity
assessment of continual learning systems
in the medical field**

Learning AI systems in medicine can be continuously improved, for example, via new training data, information on faulty behaviour and corrections obtained. At the same time, the correspondingly high safety requirements must be met. This requires a (re-)conformity assessment with suitable test methods. In order to pave the way for market access for such test methods, the Roadmap calls for the specification of boundary conditions that permit the automated release of continual learning systems.

For this purpose, the initiation of medicine-specific subprojects in cooperation with the relevant stakeholders is recommended in order to implement project results in standards, specifications and generally practicable test methods.



5.

Develop safe and trusted AI applications in mobility through best practices

The use of AI technologies in the context of mobility is characterized by complex boundary conditions: Interaction with a constantly changing environment and many other actors. Malfunctions can have high risks for humans and the environment. Trustworthy AI systems are important for the following reasons: The planned AI Act specifies various aspects of trustworthiness. These are to be concretized on the basis of standards and specifications across the entire life cycle of an AI system. A best practice catalogue should support the efficient development and safeguarding of systems in operation. The Roadmap also recommends the development of standards and specifications that define minimum requirements, especially for safety and essential trust aspects.



6.

Develop overarching data standards and dynamic modelling techniques

Standards and specifications are needed to overcome data system boundaries and to develop reference procedures. The Standardization Roadmap recommends the following pilot projects:

- Establishing a common terminology, semantics, taxonomy, and data mappings and schemas based on them in the domains of materials science/construction to determine energy efficiency and environmental impacts
- Developing an industry-independent communication format for determining the energy and resource consumption of goods and services
- Developing a methodology to assess the runtime, accuracy, and sustainability performance of AI systems



DKE

Contact us

Do you have questions or suggestions or would you like to take part in AI standardization yourself?

Please contact:
Kuenstliche.Intelligenz@din.de

The complete recommendations for action can be found in the Standardization Roadmap on AI (2nd edition): www.din.de/go/roadmap-ai