Annual report 2023

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As we write these words, we wonder whether we can really look back fondly on 2023. While acatech itself was busier than ever, the year was marked by escalating wars, simmering global disputes and serious policy conflicts in our own country. More than ever before, Germany needs clear priorities to guide how it goes about delivering climate action, achieving sustainability and strengthening competitiveness while at the same time bolstering resilience and security. The key lies in actively shaping change, in the power of innovation – and this is where acatech comes in.

In 2023, difficult questions that Germany had been putting off for years could no longer be ignored. This was also true for research institutions, as illustrated by the debate about relaxing "civilian clauses" so that research is no longer confined to civilian purposes. The importance of being able to change, especially in uncertain times, was summed up by German President Frank-Walter Steinmeier at our Annual Meeting: "Clinging to the past, ignoring change, refusing to adapt is not an option – especially in an open society like ours. However, it is up to us in government, science and industry to steer the course of change!".

In 2023, we provided advice on pressing concerns and systemic questions in the field of energy and resources. With fear of blackouts still widespread in Germany during the winter months, our Energy Systems of the Future (ESYS) project formulated an objective, science-based response. A detailed position paper discussed current knowledge regarding the key question of how Germany can achieve net zero. Several of our initiatives looked at how we can move towards a hydrogen economy, examining every aspect of this complex transformation, from production and supply networks to the end consumer. We also developed proposals for a more resilient resource supply.

Another of our priorities is mobility and logistics, where we advocated a more holistic approach that integrates mobility and space under the motto "Ankommen statt unterwegs sein". This German phrase encapsulates the principle of people having to travel as little as possible to get to where they need to be. People's needs were also the focus of the representative Mobility Monitor survey. The results clearly indicated that Germans want more sustainable mobility, but also need better connected urban and rural mobility services. The survey's findings provide science, industry and policymakers

with valuable input for the next steps in the transformation of the mobility system.

We are currently undergoing an economic transformation prompted by the need to meet economic, environmental and social sustainability objectives and driven by technological innovations. In a circular economy, circular value chains are key. To help enable them, we shared knowledge and practical guidelines with businesses and put forward proposals for a digital battery passport. As well as facilitating circularity in the battery sector, the battery passport can provide a blueprint for other digital product passports. Economic transformation also brings about and necessitates change in the world of work. Our HR Working Group provides a forum for discussing these changes.

The digital transformation is a priority theme for us, since it affects every industry and all aspects of our lives. The AI platform "Plattform Lernende Systeme" examined the applications of artificial intelligence (AI) and its governance through mechanisms such as the EU Artificial Intelligence Act. First and foremost, however, the platform supports active public engagement and participation in shaping the future of AI. Our Research Council Industrie 4.0 and our Smart Services Maturity Index – which was updated in 2023 – both help to drive digital connectivity in industry. In the year gone by, we investigated the sustainability dimensions of the digital transformation and highlighted the potential of RISC-V open-source chip technology. It has become clear that the digital transformation calls for new approaches in the technological sciences. To address this, acatech and its partners developed the Model of Advanced Systems Engineering.

Data and novel techniques are opening up a world of new opportunities in the life sciences and healthcare sectors. Yet progress is slow. As the interdisciplinary working group on data in medicine succinctly put it, the benefits of using digital health data in medicine are now so clear that failure to use this data would be positively irresponsible. However, a complex healthcare system and reservations among some medical professionals and members of the public are conspiring to hold things back. We trialled and evaluated a gamified web app that provides impartial information to help people make their mind up about electronic patient records.

One thing that all areas of our work have in common is the desire to strengthen innovation in Germany. To do this, we need the right innovation framework. Convened by Federal Chancellor Olaf Scholz and organised by acatech, the Future Council focuses on new developments, discoveries and trends. Meanwhile, the studies published in our "Germany's Innovation System" series explore the strengths and weaknesses of our innovation system. Last year, we investigated ways of addressing the acute skills shortage. The Barometer of Young Talents in the STEM Subjects found that significant improvements will need to be made in mathematics, science and technology education if Germany is to tackle this shortage. An acatech project on "Shaping Technological Change" outlined and trialled ways of giving the public a more active role in determining technological developments.

Our transfer projects go beyond the provision of science-based advice by helping to put this advice into practice. They do this by building synergy networks where businesses, institutions and researchers develop joint solutions. One highly successful example is the Mobility Data Space which has now been spun off from acatech. Several other data spaces are in the pipeline. acatech coordinates the German hub of the Gaia-X initiative, which connects data spaces like this to form an ecosystem. In May last year, the launch of Mission KI generated a lot of excitement about the future of Germany's AI sector. Mission KI is a national flagship initiative charged with developing artificial intelligence testing methods and establishing AI centres in Berlin and Kaiserslautern.

Attentive readers will have noticed that we have restructured our priority themes. Our science-based advice to policymakers and the public is now focused in the six programmes outlined above. In addition, we engage in transfer projects designed to put this advice into practice. We also promote and facilitate public dialogue across all of our priority themes. Our 2023 TechnikRadar survey explored the public's views and wishes with particular regard to sustainable building and living. Meanwhile, our "acatech am Dienstag" (acatech on Tuesday) series is open to all interested members of the public. Well over 5,000 people engaged in discussions with us at 33 public events last year.

Germany's President described our role as steering the course of change. We personally and acatech as a whole will do everything in our power to fulfil this role, drawing on the extensive expertise of our acatech Members and Senate and the other experts who contribute to our work. And if we succeed in this endeavour, then even though 2023 was a difficult year, we will at least be able to look back on it as a year when we set the course for the future.

The acatech Management Board

Prof. Dr.-Ing. Thomas Weber

Manfred Rauhmeier

Prof. Dr.-Ing. Jan Wörner

Energy and Resources

Delivering the energy transition and a resilient and sustainable resource supply poses huge political, social, economic and technological challenges for Germany. But the opportunities are equally great – Germany has the chance to achieve net zero by 2045 while strengthening the security, resilience and sustainability of its energy system. Rather than considering individual sectors such as electricity, mobility, buildings and industry in isolation, it is becoming increasingly clear that an integrated approach is required. Given the right policy and economic conditions, resource conservation measures can go a long way towards ensuring a secure supply of raw materials. acatech supports systemic approaches and innovations in all these areas, bringing together experts from science, government, industry and civil society.

How can Germany transform its energy system?

Some 200 energy sector experts contribute their scientific and industry expertise to the Academies' Project Energy Systems of the Future (ESYS). ESYS is a joint initiative of the German academies of science acatech (lead institution), Leopoldina and the Union of the German Academies of Sciences and Humanities. Its aim is to promote a sustainable, secure and affordable energy supply. ESYS brings this expertise together in interdisciplinary working groups, distilling energy research findings and policy options so that they are accessible for the policy and public debate. There was a particular focus on three themes in 2023. How can Germany achieve net zero? How likely are blackouts? And should fracking in Germany be re-evaluated in the light of recent geopolitical developments?

How can Germany achieve net zero?

Germany can achieve net zero by 2045, but doing so will require a huge transformation and expansion of the relevant technologies and infrastructure. 100 percent of Germany's electricity will need to be generated from renewable sources, and we will also need more heat pumps, more electric vehicles and a rapid expansion of the necessary infrastructure such as the electricity grid and hydrogen network.

While the production of energy from renewable sources is key, more efficient energy use is equally important. Improving energy efficiency and reducing demand for energy services are thus vital to achieving the goal of net zero. But even if we transition to 100 percent renewable energy and increase efficiency across all sectors, some industries such as concrete production will continue to emit CO_2 in the short to medium term. Carbon management will therefore also have an important part to play in getting to net zero. Carbon management involves the capture, storage and utilisation of CO_2, for instance in conjunction with hydrogen. ESYS experts summarised our current knowledge about all these aspects and proposed potential transformation pathways in the position paper Wie wird Deutschland klimaneutral? Handlungsoptionen für Technologieumbau, Verbrauchsreduktion und Kohlenstoffmanagement (German only – How Can Germany Achieve Net Zero? Policy Options for the Technology Transition, Reducing Consumption and Carbon Management).

Should Germany be worried about blackouts?

According to the experts, Germany currently has one of the most secure electricity supplies in the world. However, Russia's war of aggression against Ukraine and the associated sanctions resulted in a gas shortage and pushed up energy prices. This has led people to ask whether Germany should be worried about blackouts. The debate has more often than not been characterised by unrealistic assessments of the cur-

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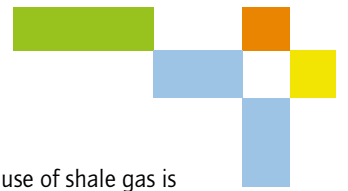
rent situation. The ESYS project team wasted no time in responding with the publication of the discussion paper Are Blackouts in Germany Likely?.

They found that major power outages and blackouts are unlikely in Germany. There is currently no need to fear blackouts due to an energy shortage. The energy transition is creating a decentralised energy system characterised by many small energy producers instead of a few large power plants. This actually strengthens the security and resilience of the energy supply. However, the discussion paper also highlights new potential threats and discusses how they can be mitigated.

Strong cybersecurity standards and more overall resilience are becoming increasingly important, for example. The latter should be addressed through a national resilience strategy.

Fracking: an option for Germany?

Can fracking make a significant contribution to security of supply in Germany? (© Energy Systems of the Future (ESYS); Illustration by Ellery Studios)

Germany banned fracking in unconventional reservoirs in 2016. But Russia's war of aggression against Ukraine and the temporary gas shortage that followed reignited the debate about fracking in Germany. In response, ESYS published the discussion paper Fracking: an option for Germany? in June 2023.

The ESYS experts conclude that, in the medium to long term, limited fracking in Germany could contribute to security of supply and reduce reliance on imports. They believe that the environmental impacts of fracking are manageable if the best available technology is used and clear environmental standards are established.

However, they argue that the long-term use of shale gas is incompatible with the goal of achieving net zero, and that it should therefore only be a stopgap measure. Moreover, there may be less demand for German shale gas now that the global markets have settled down again. Finally, it is important to bear in mind that stepping up natural gas production could further delay the necessary climate action by creating an incentive to keep using gas.

> **The strong public opposition, limited timescale and cost and price uncertainty make it extremely hard to say how much fracking in Germany can help to strengthen security of supply.**
> Karen Pittel, Director of the ifo Center for Energy, Climate and Resources and Vice-Chair of the ESYS Board of Directors

The reasons for hydrogen's growing importance

There is a broad consensus among researchers, policymakers and industry that hydrogen will play a key role in a low-carbon economy. Hydrogen produced by electrolysis using renewable electricity is both an easily transportable long-term energy storage medium and a valuable chemical feedstock. However, there are still many unanswered questions. Between autumn 2021 and autumn 2022, acatech and DECHEMA ran a stakeholder dialogue as part of their H2-Kompass initiative. The aim was to gather the views, knowledge and know-how of different groups with regard to the hydrogen ramp-up in Germany.

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The experts argued that hydrogen can help to reduce critical dependencies. However, its use should go hand in hand with other developments including faster expansion of renewables, greater integration of the European electricity system, building electrolysis capacity and a highly developed import and transport infrastructure. There was also a consensus around the need for a stable regulatory framework that provides a reliable basis for planning and investment.

Presentation of the H2-Kompass on 8 September, (left to right): Maximilian Fleischer (Siemens Energy/DECHEMA), Michaela Löffler (DECHEMA), Stefan Wenzel (BMWK), Till Mansmann (BMBF), Andrea Lübcke and Jan Wörner (both acatech) (© Sandra Kühnapfel)

These conclusions, together with other findings from the stakeholder dialogue and numerous reports and studies provided the input for the H2-Kompass presented by acatech and DECHEMA in September 2023.

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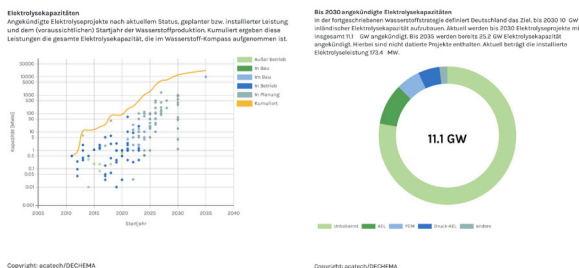
Is importing hydrogen from Australia far-fetched?

(© Shutterstock.com/Studio concept)

The recognition that imported green hydrogen will play an important role in years to come gave rise to HySupply, a joint project of acatech and the Federation of German Industries (BDI). Since 2020, experts have been systematically studying whether it is feasible and appropriate to build a hydrogen bridge between Australia and Germany. The partners deliberately chose a promising but distant exporting country that could serve to test the feasibility of this approach, reflecting the fact that the progressive transition from oil and gas to hydrogen and renewables provides a clear opportunity to reimagine and broaden international energy partnerships.

The final study on options for hydrogen distribution (German only) was presented at the dbb forum in Berlin in January 2024. The study provides a detailed analysis of the European locations that could receive hydrogen imports and exactly how this valuable commodity could be distributed from these locations to the end consumer. The presentation of the study's findings also included an overview of the initiative's many milestones and research outputs. The conclusion is that an Australian-German hydrogen bridge is not only possible, but eminently feasible.

Speaking about the project's findings, acatech President Jan Wörner said that

> **An Australian-German hydrogen bridge promises a stable, mutually beneficial trade relationship between two democratic countries. The work of our joint HySupply project confirms its feasibility and identifies the necessary conditions.**

Project leader, President of the Alexander von Humboldt Foundation and acatech Member Robert Schlögl added that:

> **The completion of the core hydrogen network must be vigorously pursued. At the same time, we must also implement other projects such as expanding the rail network and building a CO2 infrastructure. Close cooperation between government, science and industry is key to a successful ramp-up of the hydrogen market.**

What is needed to improve mineral resource recycling?

German industry relies on a secure and sustainable supply of raw materials. In the future, recycling will play an increasingly important role alongside domestic extraction and imports. So which measures are needed to strengthen recycling? The Federal Ministry for Economic Affairs and Climate Action (BMWK) tasked the German Mineral Resources Agency (DERA) with establishing the Platform for Dialogue on Secondary Raw Materials (German only) in order to investigate this question with experts in the field. Jointly coordinated with acatech, the platform focused on metals and industrial minerals such as aluminium and gypsum.

Published in October 2023, the final report of the Platform for Dialogue on Secondary Raw Materials presents concrete options for eight specific material flows. In total, acatech and DERA developed 94 policy options.

The study partners also stress that recycling can and must be strengthened through an appropriate instrument mix that includes aspects relating to regulation, incentives, technology, digitalisation, infrastructure and logistics.
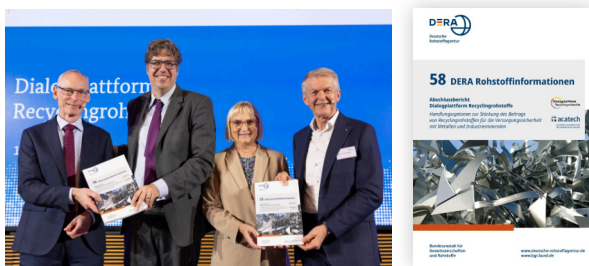
Peter Buchholz, Head of the German Mineral Resources Agency (DERA) at the Federal Institute for Geosciences and Natural Resources (BGR) and acatech President Thomas Weber present the final report to Parliamentary State SEcretary Bettina Hoffmann (BMUV) and Michael Kellner (BMWK). (© acatech)

Reducing nitrogen use in agriculture

Plants cannot grow without nitrogen – but the vast nitrogen emissions from agriculture are damaging ecosystems and exacerbating climate change. Germany has repeatedly exceeded the EU concentration limits for nitrates in groundwater. The POSITION PAPER Sustainable Nitrogen Use in Agriculture (January 2023) proposes five packages of measures for reducing nitrogen emissions across the entire agricultural value chain.
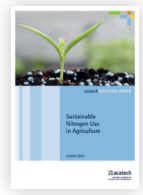
Expand organic farming, make conventional farming more sustainable

Sustainable management structures in predominantly closed cycles reduce nitrogen surpluses, especially in conventional agriculture. Various different approaches should be combined to achieve this. For instance, farmers can opt to use diversified crop rotation including legumes and catch crops while at the same time reducing mineral fertiliser use. Wider use should also be made of organic farming practices that do not employ chemical-synthetic nitrogen fertilisers. However, because organic farming methods achieve lower cereal crop yields than conventional farming methods, more land is required to produce a given amount of cereal. It is thus important to research ways of increasing organic farming yields.

Reduce regional overconcentration of livestock farming

Some parts of Germany have very high livestock populations. The correspondingly high quantities of farm manure lead to high nitrogen surpluses in these regions. Policymakers must create the conditions to ensure that animal welfare goes hand in hand with lower nitrogen surpluses in livestock farming. One way of achieving this is to create closer links between livestock and cash crop farms.

Introduce nitrogen pricing, tighten the fertiliser regulations

Farmers should be compensated for using less nitrogen. Area-based direct payments should therefore largely be replaced in the EU's Common Agricultural Policy (CAP) by payments rewarding environmental and climate protection measures. Nitrogen surplus pricing similar to the carbon pricing in the emissions trading system should also be introduced. To ensure that this does not create too great a burden for farms, the money raised from nitrogen pricing should be distributed back to farmers, for example to promote sustaina-

ble, low-nitrogen farming practices. The Fertiliser Ordinance already bans the broadcasting of farm manure on tilled farmland, and the ban will be extended to pasture from 2025. But this still doesn't go far enough – there should also be a ban on the broadcasting of farm manure on untilled farmland.

Use precision farming and precision feeding

In conjunction with data management systems, AI and computer modelling, modern agriculture and sensor technology is able to adjust fertiliser application to local differences, even within individual fields. Precision farming enables tailoring of fertiliser application to specific subplots. Precision feeding follows a similar approach by enabling low-nitrogen, needs-based livestock feeding.

Eat less meat, throw away less food

If we throw away less food, we have to produce less food, which in turn reduces the environmental impacts. Within the industry, this can be driven by measures such as revised trading standards. In addition, consumers should be encouraged to eat a healthy and environmentally-friendly diet; for instance, to eat less meat and be more mindful of sustainable production and sourcing. The government could set a good example by revising government agencies' procurement guidelines for food and catering so that more organic food and fewer animal products end up on canteen menus.

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Projects

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Economic Transformation

Digitalisation, artificial intelligence (AI), climate action, resource conservation, demographic change and geopolitical shifts are all driving a major economic transformation. Linear value chains are being connected to form complex yet resilient value networks. And the linear economic model (extract, produce, consume, dispose) is being replaced by a circular economy model characterised by material and energy cycles instead of utilisation chains. While this is good for the environment and reduces reliance on raw material imports, it necessitates changes across every aspect of value creation. Moreover, this transformation of value creation will also be accompanied by fundamental changes in the workplace. acatech investigates future trends and provides a forum for debating the economic transformation.

How can we ensure a more resilient raw material supply?

The reliable availability of critical raw materials is vital to Germany's efforts to reach net zero, to its digital transformation and to German industry. How can Germany's primary raw material supply become more resilient and sustainable? How can secondary raw materials and recyclable material systems minimise critical dependencies? And how can we make better use of the potential for recycling? Experts from science, industry and civil society discussed these questions in early November 2023 at the acatech conference Werkstoffe – Wertstoffe – Rohstoffe (materials – reusable materials – raw materials) in Munich's Amerikahaus.

> We can overcome critical dependencies by creating alternatives and – in addition to primary raw materials – making greater use of secondary raw materials as a future material source, while also implementing reduction strategies. We must replace linear value chains with flexible value networks offering multiple alternative connections and routes.

acatech President Jan Wörner

"Make it circular!" – playing your cards right

With support from Johannes Kepler University Linz, acatech and WWF Deutschland have developed a strategy game that provides a simple and effective introduction to the circular economy. Make it circular! comprises a card deck and detailed supplementary materials aimed at medium-sized enterprises. Companies can use the game to develop strategies and align their own business models with the circular economy. The free strategy game includes 22 examples of typical circular business models and a workshop facilitation guide. A German-language version was brought out in 2023.

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The digital battery passport – a blueprint for other industries?

(© systemiq / Battery Pass)

Electric mobility is a key enabler of climate-friendly mobility. But the transition to electric vehicles also means increased demand for lithium-ion batteries. As well as being expensive, the production of these batteries consumes a lot of energy and valuable resources. Batteries should remain in use for as long as possible, and as many as possible of the materials they contain should be reused at end-of-life. Implementation of this circular model relies on the availability of detailed information about a battery's entire life cycle. acatech is therefore working with several other partner organisations to develop a digital battery passport.

In April 2023, a consortium of eleven leading international industry, technology, science and civil society organisations published the publicly available Battery Passport Content Guidance. The guidance explains how to implement the battery passport mandated by the new EU Battery Regulation in a practical, affordable and sustainable manner. It is aimed at organisations responsible for implementing the battery passport and other actors in the value chain.

The project was co-funded by the Federal Ministry for Economic Affairs and Climate Action (BMWK). The concept is transferable to products and components in other sectors, providing a blueprint for digital product passports that contain key information for enabling circular value chains.

Presentation of the Battery Passport Content Guidance by acatech President Thomas Weber and Sophie Herrmann (systemiq) to Michael Kellner (Parliamentary State Secretary at the BMWK) (© BatteryPass/Achim Teuber)

Panel discussion on the Battery Passport Content Guidance at the Hannover Messe. Left to right: Johannes Simboeck, Stephanie Schenk, Ilka van Dalwigk, Franz Geyer, Uwe Seidel, Torsten Freund (© acatech)

How can AI optimise reuse and recycling?

acatech's EIBA project investigated the factors determining the successful introduction of AI in a company. (© Bosch/C-ECO)

The transition from a linear to a circular economy calls for the efficient collection and identification of used products. Since every product has a unique history, accurately identifying and evaluating the condition of used parts involves a lot of manual labour and is prone to high error rates.

Artificial intelligence (AI) can help to significantly optimise and expedite these processes. In the project EIBA: Sensory acquisition, automated identification and evaluation of old parts on the basis of product data as well as information about previous deliveries (German only), researchers at the Fraunhofer Institute for Production Systems and Design Technology IPK developed a machine designed to reduce product

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identification error rates through the use of AI.

But it is not just the technical feasibility of AI-based systems that determines whether they will be accepted and used. acatech investigated the other factors that come into play and looked at how change management can be successfully deployed in companies. The study findings were presented by project staff at the wrap-up workshop held at the Fraunhofer IPK in Berlin in April 2023.

HR Working Group: Achieving a successful digital transformation in the workplace

inform interested parties about the dates of upcoming debates. It also shares details about the views of the Chief Human Resources Officers of leading service providers and technology companies and distinguished ergonomists participating in the debates.

acatech President Jan Wörner (centre), acatech Executive Board member Frank Riemensperger (right) and Caroline Adam (left) welcome participants to the HR Working Group's annual conference in Berlin. (© acatech/David Ausserhofer)

The #FutureWorkDebatte debate series was launched in 2022 by the HR Working Group, which is coordinated by acatech. The series continued with a further eight events in 2023. The topics addressed included the critical influence of new technologies like generative AI, the technology quotient (TQ) and the role of co-determination in tomorrow's workplace. The key findings of the debate series were fed into the HR Working Group Annual Report (German only), published in December 2023. The report contains twelve perspectives for shaping the digital transformation in the workplace.

In October 2023, the HR Working Group held its first annual conference in Berlin. The title of the event was "Digital Transformation: Human Resources and Organisation as Success Factors". HR Working Group host and acatech Executive Board member Frank Riemensperger and his fellow panellists discussed the interaction between technology, organisation and people in the context of the digital transformation in the workplace. The consensus was that organisational change must precede technological change. Companies must review their current management practices as well as their corporate mission, continuing professional development models and employee participation arrangements. The HR Working Group established a LinkedIn presence in 2023 to

Projects

Battery Pass – Implementation of a new generation of digital product handling
https://thebatterypass.eu/

EIBA – Sensorische Erfassung, automatisierte Identifikation und Bewertung von Altteilen anhand von Produktdaten sowie Informationen über bisherige Lieferungen*

acatech's Human Resources Working Group – the forum for Chief Human Resources Officers (CHROs) on the future of work

Publications

Make it Circular! A Gamified Introduction to Circular Business Models in a Corporate Setting

Battery Pass Content Guidance – achieving compliance with the EU Battery Regulation and increasing sustainability and circularity

The Battery Pass Technical Standard Stack – a recommendation for standardisation of the European Digital Product Passport System (DPP-System) with particular specifics for the battery passport

Position Paper on content requirements of the EU Battery Passport – recommendations to the European Commission by the Battery Pass consortium

Impetus for Shaping Digital Transformation (interim report, English version)

Die neue Arbeitswelt: Thesen zur Gestaltung der digitalen Transformation (Jahresbericht)*

News items

Experts discuss acatech's Human Resources Working Group perspective paper

SENAT digital: hybrid working – challenges and opportunities of the new norm

#FutureWorkDebatte: How will AI affect HR?

#FutureWorkDebatte: data-driven decisions in the organisation

#FutureWorkDebatte: IQ? EQ? TQ!

#FutureWorkDebatte: the role of co-determination in the success of the digital transformation

#FutureWorkDebatte: getting the green light in HR

Annual conference of acatech's Human Resources Working Group: The three pillars of technology, organisation and human resources

Digital transformation of work: "We have to 'engineer' employees' enthusiasm"

#FutureWorkDebatte: Strategic human resource planning – the new "supreme discipline of HR"?

GenAI and New Work: Combining domain knowledge, AI and cooperation as a competitive advantage

Battery Pass Consortium Publishes First Content Guidance on the EU Battery Passport (acatech)

Battery Pass Konsortium veröffentlicht Content Guidance für den EU-Batteriepass (CEI)*

* Content only available in German

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Digital Transformation

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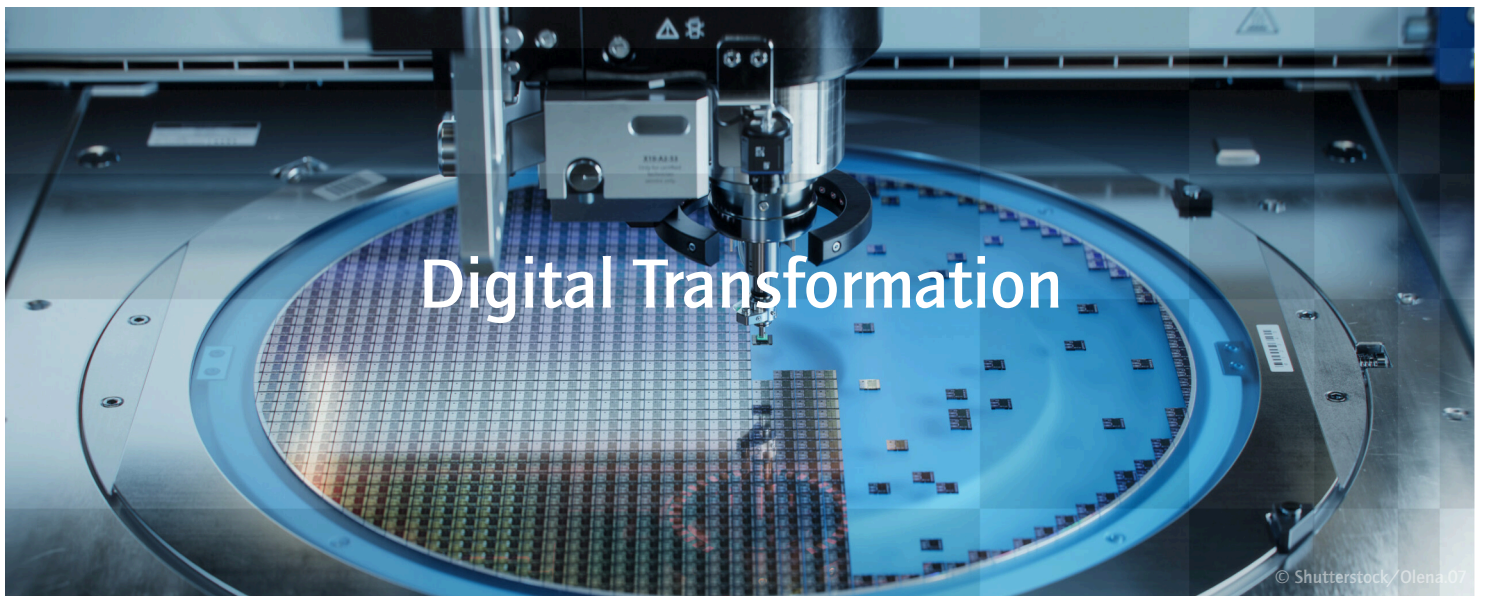
The digital transformation and the step changes in the development of artificial intelligence (AI) are bringing about rapid changes in our everyday lives and the world of work. How can Germany take advantage of the opportunities and emerge stronger from the transformation? How can we ensure safe and transparent artificial intelligence and a level playing field for competition? The profound and wide-ranging changes call for the development of interdisciplinary, cross-sectoral strategies. acatech is contributing through numerous projects, platforms and discussion forums. In this annual report, we highlight our activities in 2023.

Where will the artificial intelligence journey take us?

Established by the Federal Ministry of Education and Research, the Plattform Lernende Systeme (PLS) brings together leading learning systems and artificial intelligence experts from science, industry, government and civil society organisations. Working groups on specific themes discuss the opportunities, challenges and necessary conditions for the development and responsible use of learning systems. The outputs are used to formulate scenarios, recommendations, policy options and roadmaps.

We need the public to actively engage and participate in shaping the future of AI. We will only be able to meet future challenges if we are also prepared to implement innovations. We must not allow sheer fear to prevent us from leveraging the potential of AI..

Jan Wörner, co-chair of the Plattform Lernende Systeme and acatech President

How do robots learn? Participation in the 2023 Digital Summit

"Digital transformation at a turning point" was the title of November's Digital Summit in Jena, where Federal Chancellor Olaf Scholz and several ministers and prominent political figures met with representatives of the research community, industry and the start-up scene. The Plattform Lernende Systeme's involvement in the event included contributions to debates and content provision. In an interview, Federal Minister of Education and Research Bettina Stark-Watzinger stressed that a key goal is to strengthen not only AI research, but also its application. The Minister co-chairs the Plattform Lernende Systeme Steering Committee alongside acatech President Jan Wörner.

Robot co-workers

From nurses and emergency service personnel to retirement home employees and factory workers, in the future working with learning robots (German only) will be the norm for people in all manner of different professions. In Jena, experts from the Plattform Lernende Systeme discussed the latest advances in robotics research with guests of the Digital Summit. A variety of themed displays gave participants the opportunity to fill in gaps in their knowledge, fact-check what people are saying about AI and talk to the experts. Fur-

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ther information is available here (German only).

AI clinic

The 2023 Digital Summit introduced a new event format for members of the public. The "Market of Digital Opportunities" at the University of Jena campus offered local people the chance to learn about digital technology. At the Plattform Lernende Systeme's "AI clinic", over forty guests spoke to PLS experts about the opportunities and threats of ChatGPT and other AI tools in healthcare and the workplace.

(© BMWK)

Plattform Lernende Systeme member and junior research group leader at the Technical University of Darmstadt, Dorothea Koert, explains how robots learn at the PLS World Café during the 2023 Digital Summit. (© Thilo Schoch)

Federal Minister of Education and Research Bettina Stark-Watzinger visits the PLS stand at the 2023 Digital Summit's Market of Digital Opportunities. (© BMBF Hans-Joachim Rickel)

Experts from the Plattform Lernende Systeme discussed learning robots with guests of the Digital Summit (left to right Oskar von Stryk, Barbara Deml, Dorothea Koert, Sven Behnke). (© Plattform Lernende Systeme/Thilo Schoch)

Norbert Huchler and Frank Dittmann discussed the social dimensions of artificial intelligence use with participants in the Kunstareal-Fest (top). At an event in the inner courtyard of the acatech Office in Munich, Volker Tresp and Rudolph Triebel answered questions about potential uses of robots and how they can be combined with AI (bottom). © Kunstareal München

Over 200 participants attended the AI conference "Pioneering: Fit for the Future with Artificial Intelligence" on 14 June in Berlin (© PLS)

Annual conference: using AI responsibly

The current technological advances in large language models and robotics raise a number of questions. What do we want to use AI for? How can AI be used responsibly? And how can Germany and the rest of Europe catch up with their global competitors? Experts from the Plattform Lernende Systeme discussed these questions with over 200 participants at the PLS conference "Pioneering: Fit for the Future with Artificial Intelligence" in Berlin in June 2023.

Co-chair of the Plattform Lernende Systeme and acatech President, Jan Wörner, advocated certification of AI applications to control their potential risks. Quality seals guaranteeing the quality of AI systems would help to build trust. (© PLS)

Over 200 experts and members of the public attended the Plattform Lernende Systeme's 2023 annual conference at Berlin's Humboldt Carré. (© Thilo Schoch)

Why the hype around ChatGPT?
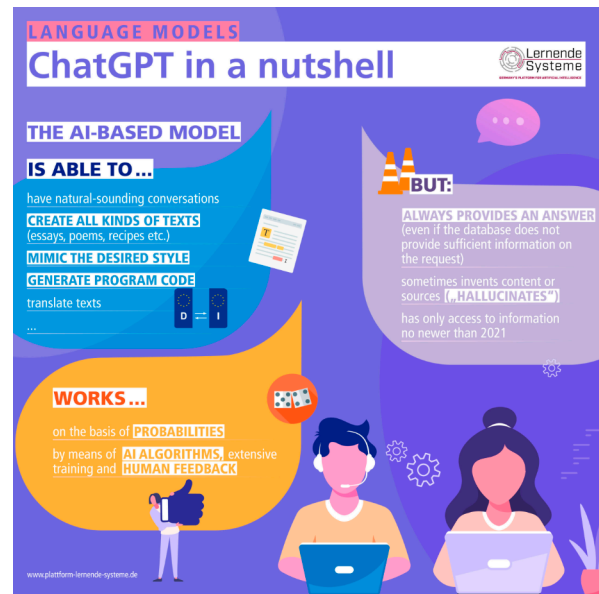
How ChatGPT learns: Plattform Lernende Systeme infographics show how this AI technology works. (© PLS)

In 2023, the ChatGPT language model put artificial intelligence (AI) firmly in the public spotlight – and it continues to inspire huge numbers of people to give AI a try. This textbot is part of a new generation of AI systems that can write text and generate images, videos and code. With all these tools, the human user enters a prompt in the dialogue box. The prompt describes a task and the desired outcome, which the AI then generates. Can this be called intelligence, or even creativity? Are the results really as good and reliable as they seem? Where can systems like this help us, and where could they perhaps also be harmful? The Plattform Lernende Systeme is engaging in the debate on generative AI, seeking to promote understanding and bring together experts from different disciplines through various activities, some of which are listed below:

- The regularly updated web page Generative AI: ChatGPT & Co (German only) provides an overview of how generative AI works and its areas of application.

- On the Perspectives on AI page, PLS experts from different disciplines comment on the latest developments in the field of AI.

- Does ChatGPT mean we no longer need to think (for ourselves)? In March 2023, experts from the PLS discussed this question with the participants in an "acatech am Dienstag" (acatech on Tuesday) event (German only).

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- How does generative AI work and learn? What are the limits and challenges? A film (German only) brought out in July 2023 provides simple and clear explanations.

- The two white papers Large Language Models and Developing and Applying Large Language Models address AI's scientific and economic dimensions.

- In a white paper on AI in journalism (German only) published in January 2023, experts describe how AI tools can be used responsibly by journalists.

How should artificial intelligence be regulated at EU level?

Although AI applications hold great promise for society and industry, they also pose major challenges. Consequently, while both Germany and the European Union promote AI, they also regulate it in order to prevent any undesirable developments. How should AI be regulated to ensure that its development is in everyone's interest? The Plattform Lernende Systeme regularly brings together experts to try and answer this question. In 2023, it focused on proposals relating to the EU AI Act and data protection regulations.

At European level, the EU has drafted the AI Act, its first ever binding regulation on artificial intelligence. In Germany, the German Institute for Standardization (DIN) has been working on a groundbreaking AI standardisation roadmap. In addition, there are already several existing guidelines and checklists that can contribute to successful regulation of AI.

For an overview, see the page on artificial intelligence regulations Regeln für Künstliche Intelligenz (German only).

Published in October 2023, the white paper Unlock the wealth of data while protecting privacy with AI discusses technical approaches to ensuring privacy and data protection with AI systems. Among other things, the authors call for legal recognition of the relevant technical approaches in order to strengthen legal certainty for companies using AI.

How can AI support healthcare?

AI can reduce nursing and medical professionals' workload by helping to analyse large clinical datasets and images. But how can the widespread use of AI in the healthcare sector be enabled? Experts from the Plattform Lernende Systeme investigated this question by carrying out a qualitative survey of healthcare professionals. The results were published in AI for Healthcare Professionals in April 2024.

The survey found that medical and nursing professionals are fundamentally open to the use of AI. However, in order to make the most of the technology, they stress the need for technical and organisational changes in their daily inpatient and outpatient work.

In April 2023, experts from the Plattform Lernende Systeme discussed how to make this happen at the DMEA health trade fair (German only) in Berlin.

What are the research needs of Industrie 4.0?

Front row, left to right: Johannes Kalhoff (Phoenix Contact), Prof. Dr. Boris Otto (FhG IML), Christina Raab (Accenture), Prof. Dr. Peter Liggesmeyer (FhG IESE), Henrik Schunk (Plattform Industrie 4.0), MinDir Bernhard Kluttig (BMWK), Prof. Dr. Wolfgang Wahlster (DFKI), Prof. Dr. Henning Kagermann (acatech), Ernst Stöckl-Pukall (BMWK), Nina Stock (BMWK), Dr. Reinhard Heister (VDMA), Prof. Dr. Thomas Weber (aca-

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Prof. Rainer Stark (TU Berlin), Kai Garrels (ABB), Dr. Stefan Aßmann (Bosch), Martin Stümpert (Ericsson), Dr. Jens Gayko (Standardization Council Industrie 4.0), Dr. Angelina Marko (ZVEI), Dr. Jacob L. Gorenflos López (Bitkom), Henning Banthien (Plattform Industrie 4.0), Dr. Sebastian Schneider (DMG Mori)

Industrie 4.0 has become increasingly important in recent years, especially against the backdrop of national and global influences on the economic system. There is a need for guidance concerning the implementation of innovative Industrie 4.0 solutions and in particular with regard to research and development requirements for overcoming present and future challenges. Industrie 4.0 research is increasingly focusing on topics such as sustainability, resilience, interoperability, technological and strategic sovereignty, and above all the central role of humans.

The Research Council Industrie 4.0 identifies developments and trends in the field of Industrie 4.0 and presents them accessibly for members of the public with an informed interest in this area. It also proposes future research topics and – as a strategic, independent group of experts – fosters interdisciplinary dialogue about Industrie 4.0. The Research Council's work is coordinated by acatech through the ReCoRD project, overseen by project administrators Projektträger Karlsruhe (PTKA) and funded by the Federal Ministry of Education and Research (BMBF).

The Research Council regularly contributes to important debates in the field of Industrie 4.0 through publications and events aimed at specific target groups.

The acatech project office employs various publication formats to present and ensure effective public dissemination of the (research and development) topics identified by the Research Council and the results of its work. The project office is constantly striving to ensure that content is tailored to the relevant target groups and exploring new publication options, with a growing focus on digital formats. For example, it has organised webinars on topics such as the establishment, use and monetisation of an industry data pool, which can be accessed by the wider public through the Research Council Industrie 4.0 website. In addition, simple, virtual explanations of key content are provided in the form of animations and videos.

In 2023, work began on two expert reports on "AI and industrial work" and "engineering of Industrie 4.0 systems with adaptive autonomy". Both are being jointly coordinated by the Research Council and the acatech project office. A short publication on new forms of production work was also prepared, focusing on how new technologies and digitalisation enable new work in manufacturing industry. All of these publications are due to come out in 2024.

The Research Council Industrie 4.0 published an updated version of key Industrie 4.0 themes in 2022. Following on from this, in 2023 the Research Council commenced a strategic review of the future outlook for Industrie 4.0. The aim is to identify strategic research topics and development requirements for the next five to ten years that reflect current challenges and emerging potential at both national and international level and to structure them in the context of different perspectives.

The Research Council's members regularly comment on current trends and recent publications in video statements and interviews. In 2023, they shared their views on topics such as the current and potential applications and impacts of the industrial metaverse, the environmental and economic chal-

lenges of future industrial value creation, and the changes to work and industrial relations in the globally connected Industrie 4.0 workplace.

How can digitalisation create a more sustainable economy?

The acatech STUDY Digitainability proposes ideas and concepts for a joined-up, strategic approach to digitalisation and sustainability. A working group led by acatech Vice-President and Member Christoph M. Schmidt assessed various economic sectors and identified the available digital solutions that have a positive impact on environmental sustainability while also adding economic value.

The STUDY investigates eight sectors of the German economy and describes digital solutions with a positive impact on environmental sustainability. It concludes that digital solutions do not only increase environmental sustainability by delivering efficiency gains. They can also enable significant progress towards greater sustainability by promoting more circular user behaviours and business practices.

The STUDY was funded by the Federal Ministry for Economic Affairs and Climate Action. The results were presented by acatech staff at two networking meetings: the Federal Network Agency's 2023 Network Day Datenkompetenz als Schlüsselqualifikation für KMU (German only – Data Skills as a Core Competency for SMEs) in April 2023 and an event on digitalisation and sustainability held by the Chamber of Commerce and Industry for Munich and Upper Bavaria in November 2023.

Open standards for better chips?

The microchip market is characterised by a relatively small number of established players. It is dominated by a handful of suppliers and two basic instruction sets: ARM and x86. The fact that a licence must be obtained for these instruction sets is a barrier for all chip developers, especially SMEs and start-ups. Moreover, it means that trade or technology embargoes can restrict entire industries' ability to develop by revoking licences and preventing imports of certain products.
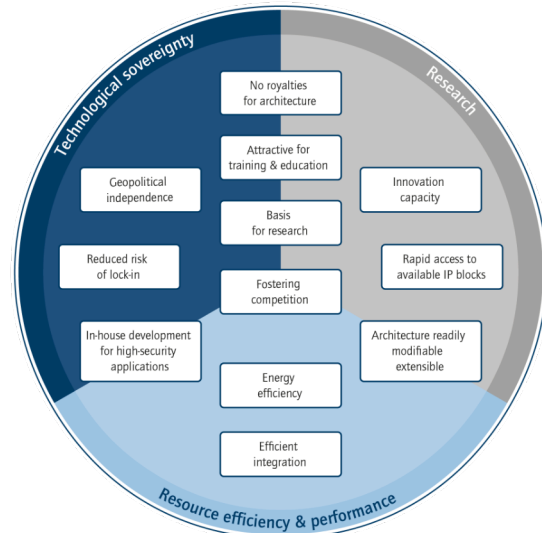
In order to strengthen Europe's competitiveness and resilience in this area, the European Union (EU) passed the European Chips Act in September 2023 with the aim of driving the establishment of chip fabrication facilities in Europe. Training of skilled professionals and the development of standards are key to a successful European chip production capability. There is also widespread agreement among the experts about the importance of an open standard instruction set architecture that facilitates the development of specialised applications and supports education and research in this field.

It is against this backdrop that acatech published the IMPULSE RISC-V – An Open Standard for Chip Development, which describes how RISC-V can act as a catalyst for increasing competition throughout the semiconductor ecosystem. For developers, the advantage of RISC-V is that users do not need a licence in order to extend or modify the instruction set. Moreover, the fact that the RISC-V standard is freely available enables straightforward collaboration on new chip designs between research institutions, start-ups, SMEs and large-scale enterprises in open innovation ecosystems. RISC-V supports greater geopolitical independence and facilitates closer cooperation between science and industry.

> **RISC-V's open standard instruction set architecture offers new opportunities to develop specialised, high-performance microprocessors. As an open standard, RISC-V also opens up new possibilities for research and training and enables new product development ideas.**
>
> Christoph Kutter, RISC-V Project Manager, Fraunhofer Institute for Electronic Microsystems and Solid State Technologies EMFT

How can hidden champions benefit from smart services?

acatech's Maturity Index Smart Services helps companies develop smart services. (© acatech)

The term "smart services" refers to business models comprising a product, service and customer value proposition. Smart services provide manufacturing companies in particular with an excellent opportunity to set themselves apart from their competitors and access new markets.

But much of this potential remains untapped. Only larger companies have the capacity to independently combine the product, service and value proposition elements to create sustainable and competitive smart services, devise successful business models and adapt their organisation to the smart service business. However, it is the hidden champions – small and medium-sized enterprises – that are the lifeblood of German industry.

Published in May 2023, the acatech STUDY acatech Maturity Index Smart Services aims to provide support for these small and medium-sized businesses. It describes a maturity model with six "structural areas" that offers guidance to companies wishing to develop smart services.

In addition, the acatech Maturity Hub Smart Services website was launched at the end of March 2023. This one-stop support shop helps companies approach their smart service transformation in an evidence-based, practical, comprehensive and intuitive manner.

> **Regardless of what level they are at, our maturity model aims to help companies find how to position themselves advantageously in the Smart Service world. It goes on to show how they can attain that position, ultimately facilitating the servitisation of the company's portfolio of offerings.**
>
> Frank Riemensperger, member of the acatech Executive Board

Towards outstanding connected systems engineering

Digitalisation, artificial intelligence, environmental protection and resource conservation, the skills shortage and changing consumption patterns are just some of the reasons why it is necessary to keep reimagining and developing technological systems and services. This can sometimes be a very complex process that calls for collaboration between a wide range of different disciplines. Moreover, in spite of its complexity and the number of different people involved, this elaborate development process must be transparently structured and communicated across all the relevant disciplines in order to prevent errors from creeping in and ensure that every development stage can be fully accounted for.

Advanced Systems Engineering (ASE) is a comprehensive new methodology for facilitating these processes. It includes methods for enabling communication and cooperation between all the participating experts and corporate partners. By helping to manage complexity in engineering, it allows new products and services that are under development to be tested, used and continuously refined as quickly as possible.

How can companies make their value creation future-fit? Was does this mean for their organisation and processes? Are there ways of managing the associated system complexity? Which technologies can enable even more effective system design? More than 150 participants from government, science and industry discussed practical answers to these questions and how ASE can contribute to a climate-friendly, fair and people-centred economy at the system:ability conference in Paderborn in May 2023.

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Impressions from the system:ability conference (© acatech)

In May 2023, acatech published the IMPULSE Rethinking and Reframing Engineering. Challenges, Application Scenarios and the New Advanced Systems Engineering Model. The paper presents a model for this wider understanding of engineering professions and training, discussing both application scenarios and challenges. It also proposes ways for companies to strengthen their strategic competence, policy measures and actions that academia can take to implement ASE in Germany.

Projects

acatech Maturity Index Smart Services (SMART)*

AdWiSE – Creation of a network of stakeholders for the interdisciplinary development of complex networked sociotechnical systems for future value creation (Advanced Systems Engineering)

Digitainability*

Research Council Industrie 4.0 (ReCoRd)

Lernende Systeme – Germany's platform for artificial intelligence

RISC-V – Potenziale eines offenen Standards für Chipentwicklung*

News items

acatech STUDY shows how transformation into a smart service provider works

Pathway to industrial transformation: acatech at Hannover Messe

Survey: How healthcare professionals benefit from AI

Rethinking and shaping engineering with Advanced Systems Engineering

Data protection with AI: Experts call for legal certainty for the use of technical solutions

system:ability Conference: creating sustainable innovations with Advanced Systems Engineering

Digital-Gipfel 2023*

Digital solutions for environmental sustainability: acatech STUDY examines the current situation and potential

Digitalisation and sustainability – where the Twin Transformation is already successful

Martin Krzywdzinski joins Research Council Industrie 4.0

AI pioneer and acatech member Wolfgang Wahlster inducted into the "Hall of Fame of German Research"

Report on the webinar of the Research Council Industrie 4.0 on the expert report "Establishment, use and monetisation of an industry data pool"

Research Council Industrie 4.0 to award contract on artificial intelligence and industrial work

Research Council Industrie 4.0 to award contract related to the engineering of Industrie 4.0 systems with adaptive autonomy

Six new members appointed to the Research Council Industrie 4.0

AI in Journalism: Opportunities and limits for use in media houses

AI-controlled robots: Platform shows potential and limits

Smart Service Summit in Munich: new maturity model launched

From culture to artificial intelligence – AI talk, mobility data

and a touch of romance: acatech's participation in the Digital Summit

How the open-source standard RISC-V can help to avert future chip crises

How does a company make the transformation to a Smart Service provider? acatech gives a preview of a new maturity model

Publications

acatech IMPULSE: Digitainability – Digital Technologies for Environmentally Sustainable Economic Activity: Market Potential and Strategic Implications

acatech IMPULSE: Rethinking and Reframing Engineering. Challenges, Application Scenarios and the New Advanced Systems Engineering Model

acatech IMPULSE: RISC-V: An Open Standard for Chip Development

acatech STUDY: acatech Maturity Index Smart Services: Shaping the Transformation from Company to Smart Service Provider

Unlock the wealth of data while protecting privacy with AI

AI for Health Professionals. Opportunities and Challenges of AI Applications in Health and Care Settings
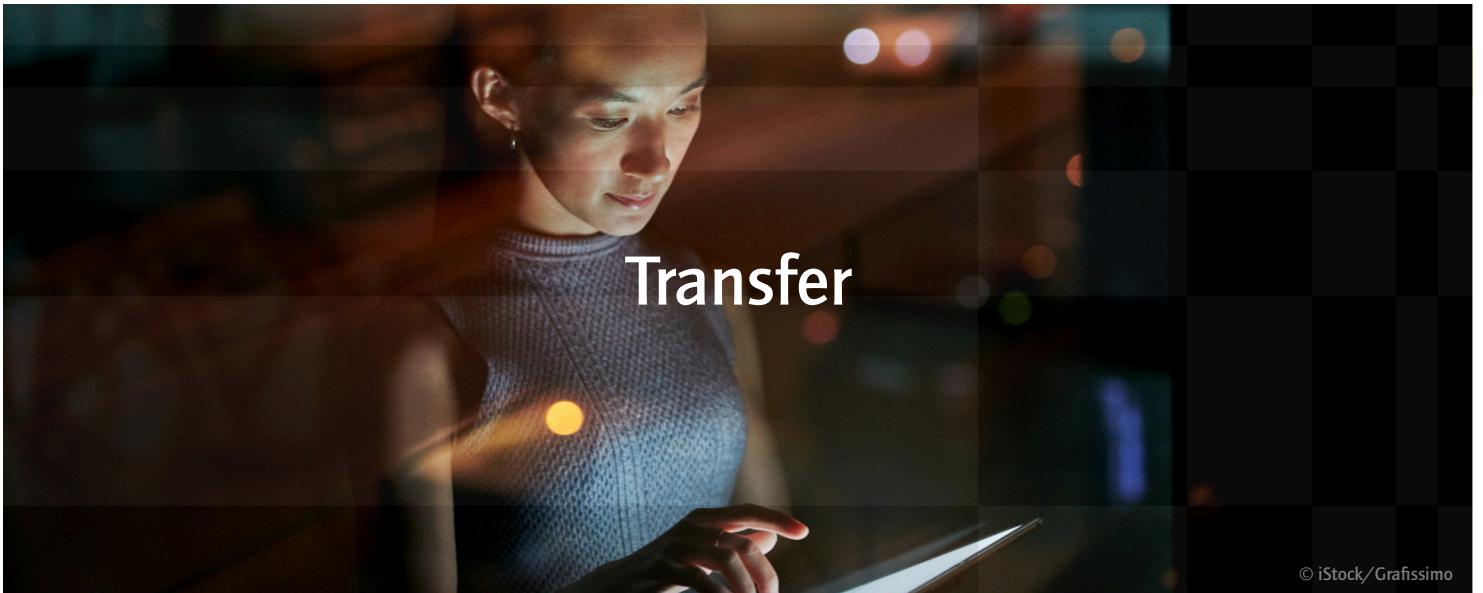
Artificial Intelligence in Journalism

Developing and Applying Large Language Models

Large Language Models

With AI to More Participation in the World of Work

AI At A Glance: Hybrid AI: combined use of knowledge and data

Themenfelder Industrie 4.0 (Key Themes of Industrie 4.0 (Second Revised Edition))*

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Transfer

The emergence of tools like ChatGPT has made artificial intelligence (AI) more tangible for policymakers and the public and has also foregrounded questions about the opportunities, limitations and threats of AI tools. It has made it even clearer that Germany and the EU need good strategies and a shorter path from idea to innovation to enable the sovereign use of data and AI. acatech is supporting this transfer through a range of projects and initiatives. It is also helping to establish institutions that enable collaboration on equal terms between providers and users.

MISSION KI generates excitement about the future of Germany's AI sector

The Federal Government has committed to accelerating the development of "AI made in Germany". To this end, in 2023 it launched MISSION KI, a national initiative charged with developing artificial intelligence (AI) testing methods and establishing two AI centres in Berlin and Kaiserslautern. acatech is helping to get the initiative up and running.

MISSION KI will develop and trial AI quality and testing standards that will form the basis of a voluntary AI quality seal. The initiative brings together the expertise of prestigious standardisation and testing organisations such as AI

Quality & Testing Hub, CertifAI, Fraunhofer IAIS, PwC Deutschland, TÜV AI Lab and the Association for Electrical, Electronic & Information Technologies (VDE).

The AI quality seal aims to support the secure and transparent use of AI applications among both private and professional users. This will strengthen the competitiveness of German businesses by making these applications a more attractive commercial proposition.

> 'AI made in Germany' can become a global competitive advantage if we make it easier for our domestic AI companies to bring to market high-quality, secure and high-performing AI applications.
>
> Volker Wissing, Federal Minister for Digital and Transport

The Mobility Data Space: a data marketplace with equal partners comes of age

Funded by the Federal Ministry for Digital and Transport (BMDV) and conceived by acatech, the Mobility Data Space (MDS) is an online marketplace for mobility-related data that aims to enable seamless, sustainable and accessible trans-

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port in both urban and rural areas.

In the second year after its launch, the focus was on three main goals: fine-tuning the technical platform, lowering the entry barriers for participants and recruiting additional members to the Mobility Data Space from across the whole of industry.

The efforts paid off:

- In 2023, the number of participants rose from 65 to 160. This was accompanied by a corresponding increase in the amount of data on offer and the number of use cases.

- By the end of 2023, the number of available data sets had risen to around 220.

- An overview page on the website provides a detailed insight into what the data space has to offer.

- The Connector-as-a-Service (CaaS) enables easier technical access to the data space.

The Mobility Data Space isn't just about exchanging data. It is also about ideas, know-how transfer and dialogue between equal partners. The organisation's growth in 2023 was supported by intensive networking and the cultivation of close links with other national and international data spaces.

The Mobility Data Space enables new business models for better mobility.
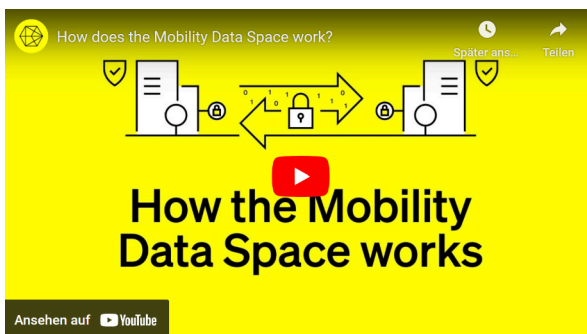
© Mobility Data Space

Coming soon: a European Mobility Data Space

As well as offering a blueprint for other data spaces, the Mobility Data Space also provides a starting point for Euro-

pean cooperation. How can mobility data be shared and securely used throughout Europe in order to facilitate better, more sustainable mobility? What initiatives already exist in Europe and how can they be integrated?
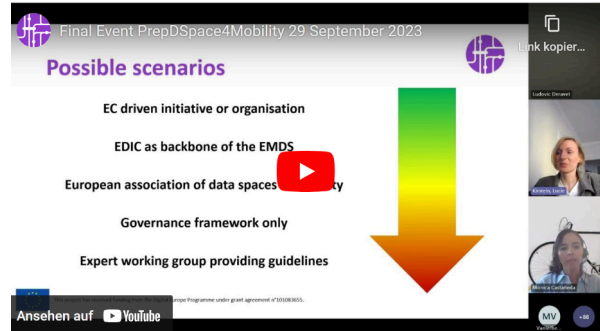
© PrepDSpace4Mobility

In 2023, acatech brought together mobility experts from the private and public sectors to find answers to these questions. Funded through the EU's "Digital Europe" programme, the initiative's name is self-explanatory: Preparatory Action for the European Data Space for Mobility (PrepDSpace4Mobility). The project's findings and recommendations are summarised in the final report Towards a common European mobility data space.
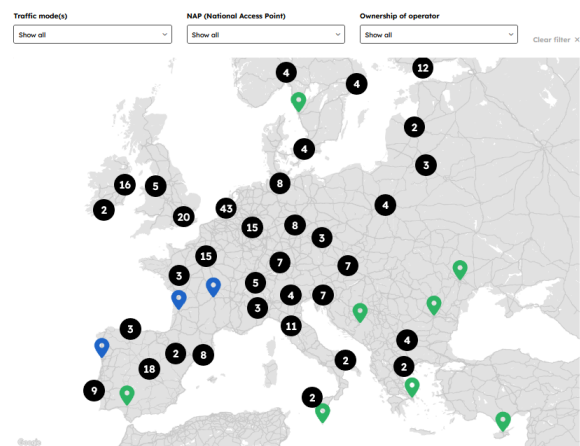
Map with mobility data initiatives © PrepDSpace4Mobility

Technology and governance – making a European data space reality

Building on the groundwork laid by PrepDSpace4Mobility, the deployEMDS initiative is developing an operational data space and common governance mechanisms. Projects will be implemented in nine European cities and regions: Barcelona, Budapest, Île-de-France, Milan, Lisbon, Flanders, Sofia, Stock-

holm and Tampere. The project is co-funded by the EU and led and coordinated by acatech. It was officially launched in November 2023 at the Tomorrow.Mobility World Congress in Barcelona, Spain.

Please welcome on stage the Culture Data Space!

The Covid-19 pandemic highlighted the need for digitalisation in the cultural sector. We can now go to concerts, museums and the theatre in person again. But many people have grown accustomed to the obvious benefits of digital cultural offerings. However, creative artists and culture professionals wishing to offer these benefits are often still forced to use the big digital platforms. This means they are not free to make their own decisions about data sovereignty and value creation.

Launched in July 2022, the Culture Data Space responds to this problem by providing a digital infrastructure for secure data exchange. The Culture Data Space is coordinated by acatech and brings together actors from all areas of culture, the creative industries, the media and research. Its goal is to create fair, interoperable, digital data infrastructures for cities, municipalities, individual cultural institutions and freelancers.

Initial use cases were presented at the Federal Government's Digital Summit (German only) in Jena in November 2023.

Claudia Roth, Federal Government Commissioner for Culture and the Media (fourth from left), with Culture Data Space project partners (© acatech/Christiane Seger)

European Media Data Space supports journalism in the digital age

A data space for audiovisual media in Europe (© created by Midjourney under licence CC BY-NC 4.0)

The proper use of digital tools is becoming increasingly important for journalists. But small editorial teams in particular often lack the necessary resources.

The Trusted European Media Data Space (TEMS) (German only) seeks to address this by creating a data space for audiovisual media in Europe that provides anyone interested with access to essential tools. The consortium charged with implementing the project began work in October 2023.

The TEMS consortium's work has four flagship themes:

- News content and fact-checking

- Audience data recommendations and personalisation

- Collaboration in production chains and digital rights management

- Innovation and new media formats

As a consortium partner, acatech is involved in several subprojects and coordinates the Media Data Ecosystem Adoption & Governance work programme. Held in Frankfurt in March 2024, the first symposium gave over 1,000 participants the opportunity to discuss the available technologies. The initiative's website www.tems-dataspace.eu provides information about its priorities and forthcoming events.

Gaia-X Hub Germany: active community develops applications

acatech coordinates the Gaia-X Hub Germany, helping to create a Gaia-X ecosystem of federated data spaces. Its aim is to use standards and open interfaces to connect formats and data from different sources and share them securely and in compliance with European data protection regulations.

acatech coordinates the Gaia-X Hub Germany, helping to create a Gaia-X ecosystem of federated data spaces. Its aim is to use standards and open interfaces to connect formats and data from different sources and share them securely and in compliance with European data protection regulations.

Since February 2022, the hub has supported eleven projects selected through a funding competition. The projects are

developing blueprints for the creation of data spaces and example applications of data-driven business models in the Gaia-X ecosystem. In June 2023, halfway through the current funding period, Head of Division at the Federal Ministry for Economic Affairs and Climate Action (BMWK), Christina Schmidt-Holtmann, praised the pioneering contribution made by the eleven Gaia-X projects to the digital transformation in their respective sectors.

The initiative's research activities are every bit as important as the development of concrete applications and communities.

In 2023, the hub published three working papers and two position papers:

- **Gaia-X and Business Models: Types and Examples,** February 2023: The advance of digitalisation means that, in the future, all companies will to a greater or lesser extent have to base their value creation on data. In many cases, it will be necessary to exchange data with other companies. Until now, however, the comprehensive and widespread exchange of data has been confronted with multiple technical, organisational and regulatory challenges. Gaia-X helps to overcome these challenges. The paper provides an overview of types and examples of business models that can use Gaia-X.

- **Data trusts, data intermediation services and Gaia-X,** March 2023: The trustworthiness of data infrastructures plays a particularly important role in enabling open and transparent data sharing. Especially with highly sensitive personal data such as financial and medical data, suitable concepts and tools are needed to ensure that data transmission, processing and utilisation is compliant with data protection regulations. As independent, neutral, trusted entities, data trusts and data intermediation services offer promising initial solutions. The white paper Data trusts, data intermediation services and Gaia-X explains various concepts relating to data trusts and data intermediation services, particularly in the context of Gaia-X.

- **AI and Gaia-X,** November 2023: The Gaia-X ecosystem as a whole supports the development and use of artificial intelligence (AI). But there are also several Gaia-X projects that deal with AI to varying degrees. The paper AI and Gaia-X provides a user-friendly overview.

- **Domain Logistics Position Paper,** October 2023: The logistics industry is undergoing a digital transformation. Driven by Industrie 4.0, advances in robotics, autonomous systems, data-driven (smart) services and the Internet of Things (IoT) are changing logistics from the ground up. This paper contextualises the importance of data spaces for the logistics sector. The position paper focuses on the vision, value proposition and technological deliverables of Gaia-X. The Gaia-X ecosystem as a whole supports the development and use of artificial intelligence (AI).

- **Energy Domain Position Paper,** November 2023: Energy providers face huge challenges due to the ongoing decentralisation of the energy supply at all voltage levels and the transition that the system as a whole is undergoing. This position paper (German only) presents an overview of how Gaia-X can add value for the sector and support implementation of the energy transition.
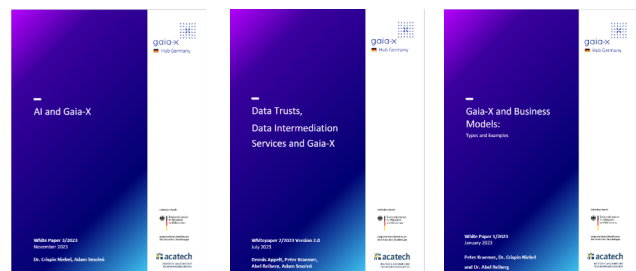
At the Hannover Messe (German only) in April 2023, the Gaia-X Hub Germany presented the growing community's current projects to visitors including Federal Minister for Economic Affairs, Robert Habeck.

Hannover Messe 2023: Bundesminister Robert Habeck besucht den Gaia-X-Messestand; v. l. n. r. Christina Schmidt-Holtmann (BMWK), Jan Wendt (Marispace-X), Bundesminister Robert Habeck (BMWK), Peter Kraemer (Gaia-X Hub Deutschland) (© acatech)

Projects

Culture Data Space
deployEMDS (project)
European mobility data space deployment (deployEMDS)
Gaia-X
Gaia-X Hub
Mobility Data Space

Publications

Data trusts, data intermediation services and Gaia-X
Domäne Energie Positionspapier*
Domain Logistics Position Paper
Gaia-X and Business Models: Types and Examples
Inventory of existing data platforms and ecosystems in the mobility and logistics sectors
Artificial Intelligence (AI) and Gaia-X
Preparatory Action for the European Data Space for Mobility (PrepDSpace4Mobility)
Mobility Data Space: Use Cases
Towards a common European mobility data space – Perspectives, recommendations and building blocks

News items

Auf dem Weg zur Nutzung europäischer Mobilitätsdaten*
Much of the body of work of Romantic painter Caspar David Friedrich can now be viewed on the web portal "cdfriedrich.de"
Der Datenraum Kultur auf dem Digitalgipfel – Sicher, selbstbestimmt und souverän in die digitale Transformation*
Der Datenraum Kultur ebnet den Weg für den digitalen Wandel im Kultursektor*
The Culture Data Space is growing: more than 90 institutions in Munich deliberate over the next steps
Förderprojekte leisten Pionierarbeit*
Hannover Messe 2023: Das kann Gaia-X*
Mission KI – National Initiative develops AI testing approaches and two AI centres

 *Content only available in German

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Life Sciences and Healthcare

As life expectancy rises in Germany and other countries, so too does the risk of multiple illnesses and chronic conditions. At the same time, however, scientific and technological advances are enabling a new paradigm in medicine as targeted, individually tailored treatments with fewer side effects become available. Tomorrow's medicine will be precisely tailored to each patient's genetic make-up, lifestyle and individual symptoms. Germany is a leading global innovator in the fields of medicine and medical devices. Through its projects, events and contributions to debates, acatech aims to shed light on the complex technological, economic and ethical questions arising in connection with these new solutions.

How can health data drive progress in medicine?

© istockphoto.com/Natali_Mis

Printers are still clattering, fax machines are still beeping and patient files are still piled up high in practices and hospitals the length and breadth of Germany. Paper-based data sharing takes time that would be better spent on patient care.

Fundamental changes in the healthcare system are required so that data can be used more effectively. Published in June 2023, the acatech IMPULSE Secure, Controlled Use of Health Data discusses the potential and policy options in this area. It proposes national rules, common strategies for improving data quality and a frank public debate. The paper concludes that, given the obvious benefits, failure to make use of health data entails serious risks.
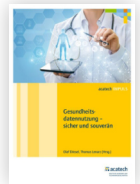
> " The advantages of using digital health data in medicine are now so obvious that it would be negligent not to use them.
>
> Thomas Lenarz, Department Chairman at Hannover Medical School and co-chair of the acatech Healthcare Technologies topic network

Accurate and balanced communication of the facts about electronic patient records

People with statutory health insurance have been able to create an electronic patient record (ePA) since 2021. ePAs store medical results and information from all practices and hospitals in one place. This can significantly improve individual medical care by allowing medical professionals to devote more time to actually treating patients and by preventing duplicate examinations. The patient decides whether and how widely they wish to use the ePA, which data should be stored or deleted in their patient record and who can access their data.

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While almost 1.2 million people in Germany currently use electronic patient records, many others have never even heard of them. How can we make it as easy as possible for more people to form an opinion about whether they would like to create their own electronic patient record? One option investigated by acatech is the ePA Check-up web app (German only) which it developed, tested and evaluated in conjunction with the Körber Foundation.
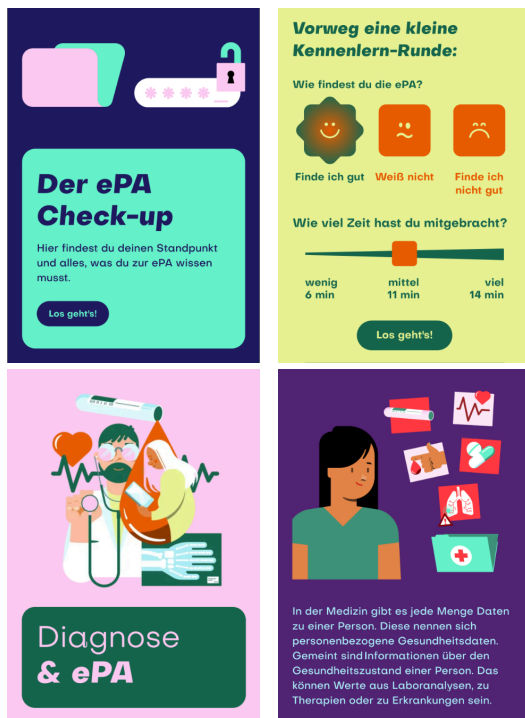
Sample pages from the ePA Check-up app (German only), mobile device view. Left to right: the app's home page, the initial survey page, the diagnosis home page and one of the pages about data (Source: www.epa-checkup.de).

Full details of the campaign are provided in the November 2023 publication Kampagne zur Website ePA Check-up (German only). A range of digital marketing methods were used to reach a large audience. Almost twelve million people viewed information about the website on their social media feeds and the Internet, while some 70,000 actually visited the ePA Check-up site during the campaign. The working group concluded that large numbers of people can be reached through digital solutions like this. Those who visited the site also spent a lot of time there. In short, this approach can help people to obtain information and form an opinion.

The impact assessment revealed that the ePA Check-up can help people who are still undecided about the ePA to make up their minds. However, very few people who already had an opinion about electronic patient records changed their fundamental stance after visiting the ePA Check-up site. This was to be expected given the deliberately neutral presentation of the information and yes/no questions about the ePA.

Projects

Future of Medicine
Shaping technological change: transparency, dialogue and participation to bring about social consensus

Publications

Secure, Controlled Use of Health Data
Kampagne zur Website ePA Check-up. Dokumentation und Analyse*
Unterstützung von Meinungsbildung im digitalen Wandel. Wirkungsanalyse exemplarischer Kommunikations- und Dialogangebote*

News items

The risks of non-use must be considered: acatech IMPULSE identifies need for action in the use of digital health data
Electronic patient record: acatech and Körber-Stiftung launch digital guide

* Content only available in German

Mobility and Logistics

Mobility supports quality of life, social inclusion, security of supply and prosperity. The need for the mobility system to adapt to a changing world and become more resilient is greater than ever. At the same time, it also needs to be made compatible with environmental and climate goals. Innovation and technology neutrality are key to the development of appropriate technological solutions. It is vital to take the public's mobility requirements into account in order to ensure needs-based implementation of solutions that are suitable for everyday use. The findings of the project "Integrated Urban Development and Mobility Planning" are encapsulated in the motto "Ankommen statt unterwegs sein". This German phrase expresses the principle of people having to travel as little as possible to get to where they need to be. The idea is that urban spaces and mobility should be planned and implemented in a way that enables resource-efficient mobility by minimising the length of people's everyday journeys. Meanwhile, 2023's representative Mobility Monitor survey investigated the everyday travel behaviours of people in Germany and what they think about the transition to sustainable mobility.

Integrating urban development and mobility planning

© iStock/funky-data

Environmentally, economically and socially sustainable everyday mobility requires a joined-up approach to space and mobility, and its implementation calls for integrated urban and regional development. A project (German only) begun in 2020 and led by acatech Members Klaus J. Beckmann and Helmut Holzapfel has developed a series of recommendations based on an analysis of existing approaches in Germany and Europe.

The project's publications discuss how to create "liveable urban regions" that offer people a pleasant and accessible environment. The acatech STUDY "Ankommen statt unterwegs sein" (German only) features cities that have already reimagined and redesigned space and mobility. Paris, for example, is pioneering the 15-minute city, where all people's everyday needs can be accessed within a 15-minute walk or bus, rail or bike ride.

An acatech POSITION PAPER (German only) concludes that in order to follow this or other examples, local authorities in Germany need more leeway to make their own decisions, together with a supportive overall framework and legal certainty. A guide for local authorities (German only) provides a concise explanation of the contexts and effects of integrated planning. It also presents 16 action modules that describe the principles and tools needed for successful implementation. acatech presented the project's findings at a

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museum in early 2024.

acatech President Thomas Weber presents the project's findings to Daniela Kluckert, Parliamentary State Secretary to the Federal Minister for Digital and Transport (© acatech/David Ausserhofer)

The extension of experimentation clauses could be a useful tool for giving local authorities more leeway. These clauses offer them a limited exemption from the relevant regulations, during which time they can trial certain projects and evaluate their impacts.

> " *Sendlinger Straße in Munich is a good example. When the street was initially pedestrianised on a trial basis, people started going for a stroll there and enjoying this newly accessible space. Retailers also benefited from the increased footfall. After just one year, it was clear that it should stay that way.*
>
> acatech Member and project leader Klaus J. Beckmann

One of the project's main aims was to engage in a dialogue with the public. An event held on Munich's Marienplatz during IAA Mobility (German only) provided an opportunity to discuss how to create streets, cycle paths and access routes where people feel safe. Organised in conjunction with the Philipp Lahm-Stiftung, a workshop with the SV 67 Weinberg women's football team in west Bavaria discussed the everyday mobility challenges faced by sportspeople. For a

small club like Weinberg, playing in the second tier of German women's football is not just challenging on the pitch. To get to their away games, they sometimes have to travel hundreds of kilometres. And as none of the talented women's squad actually lives in Weinberg itself, many of them also face a long car journey to get to their four weekly training sessions. The suggested improvements and solutions that the workshop participants came up with were subsequently fed into the project.

Workshop with the west Bavarian women's football team SV 67 Weinberg (© acatech)

Mobility behaviours in Germany

The representative Mobility Monitor survey (German only) investigates the mobility behaviours of people in Germany and reveals what they think about the transition to sustainable mobility. The 2023 edition found that even in a year marked by multiple crises, climate action was not relegated to the back of people's minds. The respondents thought that the transport sector has a key role to play in tackling climate change. Accordingly, they want to see an expansion of public transport, an increase in the percentage of freight transported by rail and waterways, and low-emission drive systems.

Hebel für mehr Klimaschutz 2/2

Frage: „Was meinen Sie, wie könnte es vor allem gelingen, die Klimabelastung wesentlich zu reduzieren, was ist da Ihrer Meinung nach am wichtigsten?"

die Menschen weniger Auto fahren	48 %
die Geschwindigkeit auf Autobahnen durch ein allgemeines Tempolimit begrenzt wird	46
der Verkehrsfluss durch intelligente Verkehrsleitsysteme und vernetzte Autos verbessert wird	41
die Laufzeit von Kernkraftwerken verlängert wird	41
die Menschen ihre Ernährung umstellen	38
schon bald keine neuen Autos mit Benzin- oder Dieselantrieb mehr zugelassen werden	23

© IfD-Allensbach
Basis: Bundesrepublik Deutschland, Bevölkerung ab 16 Jahre
Quelle: Allensbacher Archiv, IfD-Umfrage 12064

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Stagnierendes Interesse

Frage: „Käme es für Sie in Frage, in den nächsten Jahren ein Elektroauto zu kaufen, oder käme das für Sie (eher) nicht in Frage, oder haben Sie bereits ein Elektroauto?"

%

28 26 24 21 24 24 23

E-Auto käme in Frage

2011 2013 2016 2019 2020 2021 2022

3 Prozent der Bevölkerung nutzen mittlerweile (auch) ein Elektroauto

© IfD-Allensbach
Basis: Bundesrepublik Deutschland, Bevölkerung ab 16 Jahre
Quelle: Allensbacher Archiv, IfD-Umfragen, zuletzt 12064

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Christian Lindner ✔
@c_lindner

Der neue #Mobilitätsmonitor zeigt: Das #Auto ist unverändert das Verkehrsmittel Nummer eins. Damit bleibt auch die Straße weiterhin ein zentraler Verkehrsträger. Eine Politik gegen das Auto kann ganz offensichtlich nicht im Interesse der Menschen sein. CL

Mobilität: Deutsche bleiben beim Elektroauto skeptisch – aus gleich vier Gründen - WELT

Von welt.de

Many people said that switching to an eco-friendlier electric car isn't an option. The figure for people who would consider buying an electric car remained more or less the same at 23 percent – since 2019, it has fluctuated between 21 and 24 percent. People's main reservations are the high purchase price (71 percent), the feeling that there aren't enough charging stations (64 percent) and the high cost of electricity (62 percent).

.
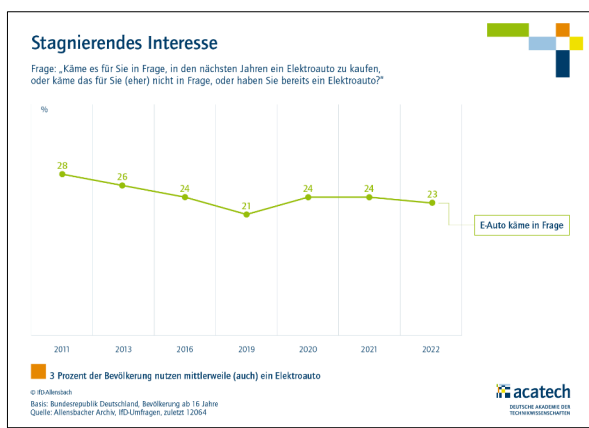
The results of the Mobility Monitor survey yield valuable insights for science, industry and policymakers in relation to the future transformation of the mobility system. In the near future, people and goods will need to be able to get from A to B in a safe, affordable and environmentally-friendly manner if the transport sector is to meet its own challenging climate targets. This will call for alternative drives, more attractive private and public transport options and better coordination of all modes of transport. Moreover, given the daily volumes of commuter traffic and congestion, Germany must take a joined-up approach to mobility and space and must implement integrated planning. acatech is currently developing concepts to meet this need for integrated urban development and mobility planning.

acatech President Thomas Weber

Following their publication in February 2023, the results of the Mobility Monitor survey sparked widespread debate about the car's importance to everyday mobility in Germany.

Nevertheless, the car was once again by far the most widely used means of transport in 2023. 47 percent of those surveyed said they use their car every day, and a further 23 percent drive several times a week. 72 percent of the population regard their car as indispensable, whereas the figures for bicycles and public transport are 51 percent and 42 percent respectively. It is important to note that there were pronounced differences in the responses for urban and rural areas.

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Projects

Integrierte Stadtentwicklung und Mobilitätsplanung
Mobilitätsmonitor: Alle Ergebnisse

Publications

acatech POSITION: Raum und Mobilität gemeinsam denken.
Handlungsempfehlungen für eine integrierte Stadtentwick-
lung und Mobilitätsplanung
acatech KOOPERATION: Lebenswerte Städte und Regionen.
Kommunaler Leitfaden für eine integrierte Stadtentwicklung
und Mobilitätsplanung
acatech STUDIE: Ankommen statt unterwegs sein. Projekt
Integrierte Stadtentwicklung und Mobilitätsplanung

News items

Thinking space and mobility together: acatech recommends
greater freedom for local authorities
Travelling 9000 kilometres within a season: acatech and the
Philipp Lahm-Stiftung host a workshop on mobility in foot-
ball
Mobility Monitor survey: Germans take climate protection in
transport seriously and want changes to be made

* Content only available in German

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Innovation Framework

Prosperity, growth and competitiveness can be compatible with environmental and climate action, however the development and use of new technologies – i.e. innovations – is key to making this possible. Innovations come about as a result of research and development. They are turned into applications by innovative companies and start-ups and require an innovation-friendly public and policy environment. This means government regulations and efficient administrative structures that provide targeted support for the commercialisation and public use of innovations. First and foremost, however, innovation requires people to develop and shape it – and it is to these skilled professionals that acatech devoted the first issue of its "Germany's Innovation System" series.

Future Council of the Federal Chancellor

The Future Council convened by Federal Chancellor Olaf Scholz focuses on new developments, discoveries and trends in the innovation cycle. The Council comprises high-level representatives of science and industry who formulate proposals for strengthening resilience and technological sovereignty in key enabling technologies and in the field of digitalisation.

The organisational side of the Future Council is managed by an acatech project office which provides background documentation on the different topics, ensuring a common factual and discussion basis for the advice provided to the Federal Government.

On 6 June 2023, the members of the Future Council met for the third time since its establishment. At the invitation of Federal Chancellor Olaf Scholz, the participants discussed biotechnology as a key technology of the 21st century. The meeting was also attended by Federal Minister for Economic Affairs, Robert Habeck, Federal Minister of Education and Research, Bettina Stark-Watzinger, Federal Minister of Health, Karl Lauterbach, and Head of the Federal Chancellery, Wolfgang Schmidt. The discussion focused on the economic potential of biotechnology for German industry. The Council's members stressed the need to build on the successes of biotechnology during the Covid-19 pandemic and identified the conditions and actions required to make this happen. In addition to an excellent research landscape, Germany has successful pharmaceutical and chemical companies and partners in medical and industrial biotechnology. The participants agreed that these conditions should be fostered in order to translate research results into applications and enable the development of internationally important biotechnology hubs. The opportunities arising from the use of artificial intelligence and data in biotechnology were also highlighted. In addition, the discussions touched on how Germany can position itself resiliently in international value networks and how it can benefit as soon as possible from new applications aligned with European values. The Council stressed the importance of this for securing technological sovereignty and long-term prosperity.

AI-based robotics is also a key technology for the transformative, Industrie 4.0-based modernisation of manufacturing industry and for tackling major social challenges like demographic change. In the IMPULSE Innovation Potential of AI-based Robotics, published in November 2023, the Future Council discusses how robotics can help to secure value-added in the face of growing global competition and also contribute to maintaining technological sovereignty.

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The postponed fourth meeting of the Future Council took place on 26 January 2024, when participants discussed the use of generative AI to strengthen competitiveness and technological sovereignty. The main question addressed at this meeting was "What conditions must be in place to step up the development and use of generative AI in Germany?".

The foundations are in place for Germany to quickly close the gap on the current global leaders. Germany has outstanding research and talents and strong domain knowledge and data resources in both large industrial enterprises and SMEs. The Future Council stressed that science and industry need appropriate computing capacity in order to implement ideas for innovative AI applications. It concluded that the challenges should be tackled jointly at European level and through partnerships between government and industry at national level. The whole generative AI value chain should be addressed and skills and technological ecosystems should be developed locally with the aim of ending unilateral dependencies and anchoring European values in AI models.

Federal Chancellor Olaf Scholz met with members of the Future Council in Berlin to discuss the use of generative AI. (© Federal Government/ Steffen Kugler)

Innovationssystem Deutschland: Wie können Fachkräfte gesichert werden?
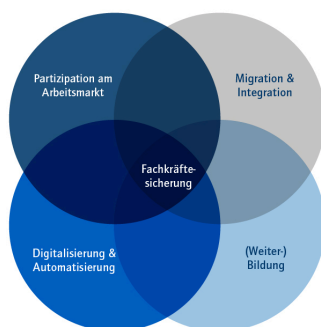
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A vibrant innovation system is key to prosperity, competitiveness and sustainability. But what is the current state of Germany's innovation system? What are the main challenges and how might they be addressed? These are the questions investigated by the acatech project Germany's Innovation System.

Published in 2023, the project's first study focused on securing Germany's skills base. The potential workforce is likely to decline as a result of demographic change. This will further exacerbate the current skills shortages, to the detriment of Germany's innovation system.

In order to address the skills shortage, the project team led by acatech Executive Board members Christoph M. Schmidt and Ann-Kristin Achleitner proposes measures to access the potential workforce in Germany more effectively (e.g. work-friendly childcare). However, they also regard an increase in skilled immigrant workers as indispensable. To facilitate this, Germany will first need to become a more attractive destination for immigrants by making it easier for them to come and stay there. It will be especially important to streamline, digitalise and centralise visa applications and the process for recognising professional qualifications. This will require well-resourced, digitalised government agencies. The state must also promote further efforts to digitalise the workplace and reform the education and training system.

> A societal and political commitment to economic migration is needed, as is a bureaucratic culture that is service-oriented and enabling.
> acatech Vice-President Christoph M. Schmidt

Following their publication in summer 2023, the acatech project group's recommendations attracted widespread attention in the media and among policymakers (both German only). In the autumn, Christoph M. Schmidt discussed the study's findings at an online "acatech am Dienstag" event.

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Event marking the publication of the acatech STUDY "Securing and Strengthening Germany's Skills Base" on 20 June 2023 in Berlin; left to right: Christoph M. Schmidt (RWI – Leibniz Institute for Economic Research/acatech Vice-President), Gunilla Fincke (Federal Ministry of Labour and Social Affairs (BMAS)), Thomas Weber (acatech President), Anja Piel (member of the National Executive Board of the German Trade Union Confederation (DGB)), Steffen Kampeter (Confederation of German Employers' Associations (BDA)) (© acatech)

What is the reason for the STEM gender gap?

According to the <u>Barometer of Young Talents in the STEM Subjects 2023</u> (German only), ten-year-old boys' performance in mathematics is around 15 school weeks ahead of their female classmates. Moreover, women are vastly underrepresented in occupations requiring apprenticeships or other formal training in the fields of science, technology, engineering and mathematics (STEM).

The annual Barometer of Young Talents in the STEM Subjects is produced by the Leibniz Institute for Science and Mathematics Education (IPN) on behalf of acatech and the Joachim Herz Foundation. It summarises the main studies in the field of STEM education and makes appropriate recommendations. Referencing the gender gap, IPN Managing Director and acatech Member Olaf Köller said:

Not least because of the skills shortage, we cannot tolerate a situation where many girls are opting out of STEM education at an early age. The STEM subjects are seen by many, often subconsciously and unintentionally, as more of a male domain. This view is widespread among girls, which is why female pupils often feel less drawn to STEM subjects than other subjects. Efforts should be made to overcome these powerful gender stereotypes. We need far more positive female role models.
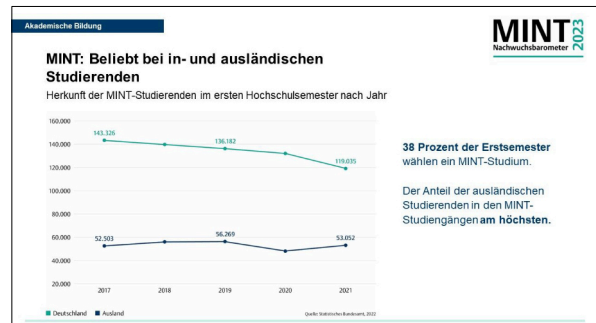
Olaf Köller, Managing Director of the Leibniz Institute for Science and Mathematics Education (IPN)

On a positive note, STEM courses at German universities are very popular with foreign students. According to the Barometer of Young Talents in the STEM Subjects 2023, the number of foreign STEM students enrolling rose by around ten percent compared with the previous year.

Germany is still known for its engineering prowess and this reputation attracts students to the country. The fact that so many people from all over the world come here to study STEM subjects should motivate us to further strengthen STEM education. Ultimately, this is what lays the groundwork for Germany as an innovation hub. STEM knowledge helps Germany develop ideas and technologies to tackle the major challenges of our time – climate change, the energy supply and resource scarcity.

acatech President Jan Wörner

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Dringend gesucht: MINT-Lehrkräfte
Einstellungsbedarf und Neuangebot von MINT-Lehrkräften in NRW

In den kommenden Jahren werden **bundesweit zwischen 40.000 und über 100.000 Lehrkräfte fehlen.**

In NRW kann bis 2030/2031 nur ein Drittel des Einstellungsbedarfs gedeckt werden.

What are the right communication formats for shaping technological change?

The benefits of new technologies only come to bear if they are at least tolerated by individuals and ideally accepted by society as a whole. This calls for dialogue and opportunities to shape technological change together. Since 2020, an acatech project on shaping technological change has been investigating appropriate communication formats and their impact on the target groups. Its findings were presented in Berlin at the end of 2023.

The project investigated two separate questions:

Focus groups are a research method where small groups engage in focused, moderated discussions. In the first sub-project, research was carried out in two municipalities to assess whether focus groups can, in general, help participants to form opinions. The focus group in the small Brandenburg town of Wittenberge discussed the potential of e-government. In Wuppertal, which is regularly threatened with flooding due to its location in a valley along the River Wupper, the discussions considered how digital tools can support emergency management.

The second sub-project investigated whether a gamified website is a suitable tool for helping people form opinions about a complex digital innovation like electronic patient records (ePAs). From 2025, an ePA will automatically be created for all German citizens unless they actively opt out. The "ePA Check-up" (German only) developed by the project team guides website visitors through various topics, using illustrative examples, expert opinions and quiz elements to show the benefits and risks associated with the ePA. At the end of the "check-up", users receive an evaluation of their current opinion. The website will remain online until at least the end of 2024..

> *We keep hearing that we need to 'take the public with us' when it comes to technological change. But that's a misleading image: it sounds as if people are sitting in the back of the car and don't know their destination. Car pools are a much better image that reflects the active role of citizens in shaping technological change. This was the approach taken by the project: we wanted to develop and test communication formats that make participants feel like they are being taken seriously and allow them to form an opinion based on impartial facts.*

acatech President and project manager Jan Wörner

Projects

Germany's Innovation System
Barometer of Young Talents in the STEM Subjects
National STEM Forum
Shaping technological change: transparency, dialogue and participation to bring about social consensus
Future Council of the Federal Chancellor

Publications

acatech IMPULSE: Innovation Potential of AI-based Robotics
Bürgerdialoge zur Digitalisierung kommunaler Aufgaben.*
acatech STUDY: Germany's Innovation System: Securing and Strengthening Germany's Skills Base
Kampagne zur Website ePA Check-up. Dokumentation und Analyse*
MINT Nachwuchsbarometer 2023*
Technischer Wandel – wirksam kommunizieren und beteiligen. 12 Denkanstöße aus der Wissenschaft *
Unterstützung von Meinungsbildung im digitalen Wandel. Wirkungsanalyse exemplarischer Kommunikations- und Dialogangebote*

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News items

acatech STUDY: Germany will only overcome the skills shortage with a cultural change and more migration

acatech study shows how opinion-forming on technology topics can work

Biotechnology a key technology for Germany

Digital transformation of work: "We have to 'engineer' employees' enthusiasm"

Electronic patient record: acatech and Körber-Stiftung launch digital guide

Skills shortage: how can Germany increase its appeal to skilled workers from abroad?

Sustainable development and use of generative AI in Germany

Lost in Translation: How Germany can unleash the potential of biotechnology

STEM education: girls are falling further behind

80 per cent of home owners plan energy upgrades

SENAT digital: hybrid working – challenges and opportunities of the new norm

What start-ups need to grow into successful companies

How can we shape digital change together? Project group presents findings in Berlin

* Content only available in German

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Dialogue with the public

Using different formats ranging from traditional panel discussions to science slams – and in collaboration with various partners – acatech seeks to promote a dialogue with the public by making expert knowledge publicly accessible and stimulating debate about the future of science and engineering. In-depth projects and initiatives analyse socio-technical transformation processes and public discourses.

What do people in Germany think about technology?

The TechnikRadar survey published by acatech, the Körber Foundation and ZIRIUS has been investigating what people in Germany think about technology since 2018. This year, the representative survey focused on energy. How do people aim to reduce their energy consumption? What energy upgrades are they planning? And how can smart home technology help?

One important finding of the 2023 TechnikRadar survey was that photovoltaics and solar thermal have become more popular as a result of rising energy prices. These are the technologies most favoured by homeowners: of the 79 percent planning to carry out energy upgrades in the near future, 45.9 percent intend to install solar panels, while almost a third (31.7 percent) want to install a solar thermal system in their home.

Smart home technology is experiencing a similar boom to solar power. Compared to TechnikRadar 2018, the use of smart home technology has more than doubled among respondents in Germany. While 8.1 percent reported using it in 2018, the figure in the latest survey had risen to 21 percent.

People in Germany regard climate warming as one of the most pressing issues for the future, alongside safeguarding jobs, protecting national security and online data protection.

Germany's most important tasks for the future

Task	Value
Protecting jobs	8.9
Preserving national security	8.7
Ensuring internet data protection	8.7
Limiting climate warming	8.5
Reducing shortages of skilled workers	8.1
Reducing dependence on energy imports	8.1
Reducing energy consumption	8.0
Limiting further rises in housing prices	7.8
Reducing dependence on raw material imports	7.7
Reducing income/wealth disparities	7.4

TechnikRadar 2023   Average values on a scale from 0 (not at all important) to 10 (very important)

Following the TechnikRadar survey's publication, acatech used its findings to engage in a dialogue with experts, policymakers and the public:

- Project leader Cordula Kropp presented and discussed the results at the Sustainability Day of the German Sustainable Building Council (DGNB).

- acatech President Jan Wörner used the study as a basis for discussing a sustainable transformation of the building sector with parliamentarians at an "acatech am Morgen" breakfast event in the German Bundestag.

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> **The results of our 2023 TechnikRadar survey show that the majority of Germans support more sustainable ways of constructing and using buildings. For example, they are favourably disposed towards renewable energy, energy efficiency upgrades and sustainable building materials.**
>
> acatech President Jan Wörner

fracking and health in the era of big data. As well as some of the key innovation questions of our time, the programme also covers new topics that are not yet part of acatech's work. "acatech am Dienstag" also provides a space for new, experimental and fun formats like the science slams at the "Münchner Wissenschaftstage" science festival and the Münchner Volkshochschule (German only).

The TechnikRadar survey's findings were explained to German parliamentarians at an event in the Bundestag. (© acatech)

Science slam on animals and humans at the Münchner Volkshochschule. Moderator Lydia Weinberger (MVHS, pictured right) announces the evening's best slammer as voted for by the guests. (© RCC)

Salvation or threat? Discussing controversial key technologies

Participants discussed geoengineering at an "acatech am Dienstag" event in Munich's Amerikahaus (Photo top left: © Shutterstock/WorldStockStudio; other photos: ©acatech)

acatech provides advice to the public through a dialogue with various social groups. To enable this dialogue, the Academy established a series or regular "acatech am Dienstag" (acatech on Tuesday) events where representatives of science, industry, government, the media and other organisations engage in discussion with interested members of the public. Experts give talks about and discuss a wide range of topics, from artificial intelligence and the skills shortage to geoengineering,

Panellists in the "acatech am Dienstag" event on health in the era of big data at the Evangelische Stadtakademie München. Left to right: moderator Barbara Hepp (Evangelische Stadtakademie München), Tobias Heimann (Siemens Healthineers), Karen v. Mücke (internist and diabetologist, Bündnis für Datenschutz und Schweigepflicht) and Peter Dabrock (Friedrich-Alexander-Universität Erlangen-Nürnberg). (© acatech)

acatech am Dienstag: AI on trial – will the backlog of cases finally be cleared? Can AI applications effectively take the pressure off the justice system? This topic was discussed by Frauke Rostalski (centre), Jan-Frederik Arnold (top right), Stefan Schifferdecker (bottom right), acatech President Jan Wörner (top left) and moderator Linda Treugut (bottom left). (© Background photo: Shutterstock/ImagingL; © Screenshots: acatech)

Once again, many of the "acatech am Dienstag" discussion events in 2023 were held online. However, some face-to-face events did take place, including one at the Deutsches Museum in Munich which asked "What does the energy transition mean for Germany as a place to do business?" and further events at the acatech Forum in Karolinenplatz.

More than 5,100 people took part in the 33 public dialogue events in 2023. acatech organises events with a wide range of partners. One example is the collaboration between "acatech am Dienstag" and the further education colleges platform "vhs.wissen live" (German only). Other public dialogue events were held in conjunction with the Deutsches Museum, the "Münchner Wissenschaftstage" science festival, the Munich Re Foundation and the Catholic Academy in Bavaria.

In 2023, acatech also continued the series of dialogue events on "Innovation and Responsibility" in partnership with the Evangelische Akademie Tutzing and LMU Munich's Technology-Theology-Natural Sciences Institute. Following an in-depth analysis and discussion of this topic in the Academy's Working Group on Fundamental Questions in Science and Engineering, the public dialogue event in Tutzing focused on the question "What military technology does Europe need?" (German only). In view of recent changes in Europe's security policy landscape, participants discussed the conflicting priorities of university research and the economic utilisation of military technology, considering perspectives from the fields of technology, industry, research and ethics.

acatech continues to devise innovative science communication formats to pass on experience and knowledge to young scientists, engineers and communication professionals. Organised by acatech in conjunction with Wissenschaft im Dialog, the "Lernwerkstatt Technikkommunikation" (technology communication workshop) plays a key role in enabling this knowledge sharing. The twenty participants showed a lively interest in topics such as how to identify and address different target groups, managing the digital media revolution and the rise in disinformation. Disinformation was also discussed with experts from science, industry, journalism and non-profit organisations at a special end-of-year internal acatech conference organised by the Technology and Society

Working Group and the Safety and Security Topic Network.

Group work during the technology communication workshop (© acatech)

Outstanding and engaged: the rising female stars of 2023

Entrenched traditional stereotypes make it harder for girls and young women to enter professions in the fields of science, technology, engineering and mathematics (STEM). As a result, they are less likely to choose degrees and careers in the STEM subjects. Moreover, the percentage of women steadily declines the higher up the academic ladder you go, reaching its lowest level among professors.

acatech established the "Schnieder-Preis JUNGE MACHERIN" to support female talents in the technological sciences and encourage them to advance their careers. acatech's Members nominate female science and engineering graduates for the €3,000 prize, which is awarded annually and forms part of the Academy's efforts to promote gender equality in the technological sciences.
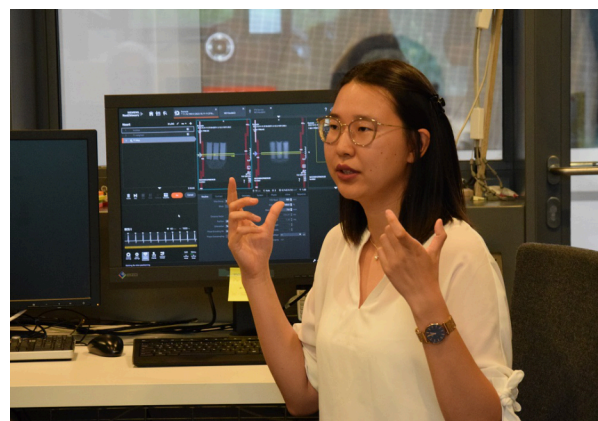
Jana Zhang, winner of the Schnieder-Preis JUNGE MACHERIN 2023. (© acatech)

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acatech awarded the "Schnieder-Preis JUNGE MACHERIN" to Jana Zhang at a prizegiving ceremony in the Institute Berlin of the National Metrology Institute of Germany (PTB) on 11 October 2023. The judges were impressed by her excellent Master's thesis on new quantitative magnetic resonance imaging (qMRI) techniques to improve the determination of the spatial distribution of abdominal T1 relaxation times, as well as her various extracurricular activities and voluntary work. The jury felt that she met all three of the prize's criteria to an exceptional degree. In his prizegiving speech, Tobias Schäffter, Head of the Institute Berlin of the PTB, Professor of Biomedical Imaging at TU Berlin and supervisor of Jana Zhang's Master's thesis, commended the originality and exceptional scientific quality of the Master's thesis. He reserved special praise for Jana Zhang's attentiveness and enthusiasm, as well as her technical skills and interest in medical issues. He said that the original aspect of Ms Zhang's ambitious Master's thesis is that both motion fields and T1 data are generated from the same measurements.

In addition to winner Jana Zhang, acatech also shortlisted Friederike Butt and Melanie Johanning for the Schnieder-Preis JUNGE MACHERIN. Friederike Butt studied physics at the Institute for Quantum Information at RWTH Aachen University. She completed her Master's thesis on the theoretical development and analysis of new protocols for the fault-tolerant operation of logical qubits. Melanie Johanning completed a Master's in materials science at the Technical University of Darmstadt. Her Master's thesis investigated processes for recycling oxygen transport membranes as part of a major Federal Ministry of Education and Research project on green hydrogen. Given the strong field, the panel decided to award special commendations to both of these outstanding graduates in recognition of the fact that they too are exceptional young female researchers and rising stars who fulfil the prize's criteria.


Award ceremony video (in German): Speech by acatech President Jan Wörner, speech by acatech Member Tobias Schäffter and presentation of certificate and trophy to Jana Zhang by prize founders Katharina and Antonio Schnieder

acatech HORIZONS: explaining complex topics clearly and concisely

acatech's HORIZONS series makes topical, environmentally and socially significant technology issues accessible to the layperson. Each edition is devoted to a technology field that opens up new horizons, is economically important and enables social change. The acatech HORIZONS publications provide a clear, easily understood, evidence-based overview of these topics. They set out the facts and discuss the social, economic and policy issues and the options for addressing them. The edition published in 2023 focused on hydrogen.

The publication shows that hydrogen presents a huge opportunity for the environment and the economy if government, science, industry and the public all pull together. It explains that electrical energy can be temporarily stored and transported from A to B in hydrogen, before subsequently being converted into electricity. Alternatively, hydrogen can be used as a feedstock in industry.
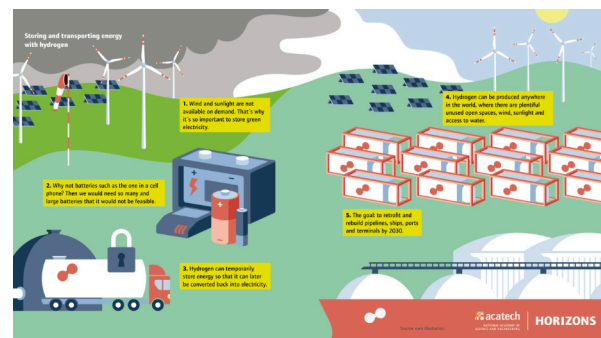
How can hydrogen be used to store and transport energy? The acatech HORIZONS series provides clear and concise explanations of strategic questions. (© acatech HORIZONTE)

Hydrogen can replace the fossil fuels that power aircraft, ships, trucks and industrial plants. The publication also explains the role of hydrogen in green steel production and in the manufacture of fertilisers. In short, this HORIZONS issue shows why a hydrogen economy is key to the future of European industry.

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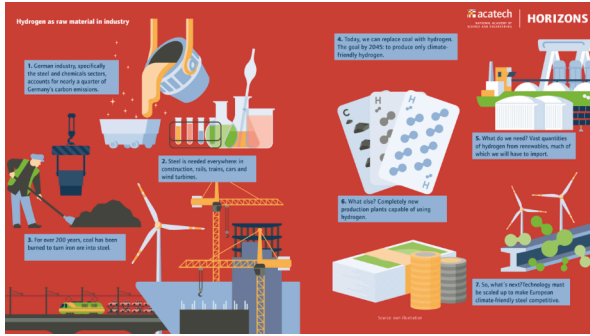
What can hydrogen be used for? An overview of its potential applications. (© acatech HORIZONTE)

It is evident that a climate-friendly hydrogen economy will call for international partnerships with parts of the world that have plenty of sunshine, wind and open spaces. Both sides stand to benefit: Europe gets to import climate-friendly hydrogen, while jobs and environmentally sustainable prosperity are created in the exporting countries.

> **The production of green hydrogen offers countries in the Global South an opportunity for economic development. It is in the interests of industrialised nations to transfer financial resources and technological know-how to them in exchange for their transition away from fossil fuels.**
>
> acatech Vice-President Christoph M. Schmidt

At an online event organised by HORIZONS as part of the Berliner ENERGIETAGE convention, experts Ulrike Hinz, Robert Schlögl and Nikolas Iwan discussed whether hydrogen can be the saviour of the climate and the economy.

The discussion was followed by

353

people

Other platforms for the issues addressed by the HORIZONS series include the HORIZONS logbook (German only), social media and the podcast series, which was relaunched in 2023.

"Late Night Tech" features in-depth conversations with the experts on technology-related topics – but with a personal touch. In one HORIZONS podcast, for example, IT expert and acatech Executive Board member Claudia Eckert talks about cybersecurity and her own career.

What makes good technology journalism?

acatech's PUNKT prize for journalism recognises well-researched, independent science and technology journalism that helps people understand technological developments and enhances the public discourse in science, innovation and technology. Since the 2022 prizes were awarded for written (German only) technology journalism, in 2023 it was once again the turn of entries in the Photo and Digital (formerly multimedia) categories.

acatech again received several outstanding entries this year. In the Digital category, the jury comprising representatives of journalism, science, photography and the media shortlisted entries from BR, ZEIT ONLINE and Tagesspiegel. In the Photo category, they shortlisted three photo series by freelance photographers.

The prizes were awarded at the "WISSENSWERTE" research congress in Freiburg in October 2023. The PUNKT Digital prize went to a BR team led by Rebecca Ciesielski for the research and groundbreaking digital presentation of an article revealing the threat posed by biometric devices to people in Afghanistan. The Photo category was won by Jan Richard Heinicke for his photo series "The Past is the Key to the Future". acatech President Jan Wörner praised the series for its exceptional photographic documentation of paleocli-

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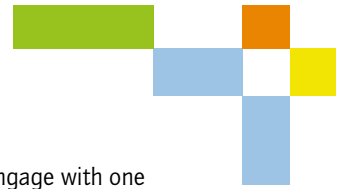
matology, remarking that its unusual, aesthetic perspective on climate change made it a worthy winner of the PUNKT prize.

PUNKT prizegiving at the Markthalle Freiburg. Left to right: Jan Wörner, Gabriele Frey, Rebecca Ciesielski, Steffen Kühne, Sebastian Bayerl, Jan Richard Heinicke, Volker Stollorz and Felix Streiter (© Mediateo)

Bringing art, science and technology together

Art, science and technology all reimagine the future in their own way. Launched in 2020 with the aim of bringing these different disciplines together, the interdisciplinary Driving the Human project received over 1,000 applications. The 7 projects selected from a shortlist of 21 presented their prototypes as room installations, architectural models and video games at the Driving the Human Festival, a three-day project wrap-up event in November 2022.

The book "Seven Prototypes for Eco-social Renewal" documents the project milestones and widens the discussion. It features contributions from experts with creative visions in the fields of science, technology and the arts. Kim Albrecht, Brigitte Baptiste, Jan Boelen, Corine Pelluchon, Peter Weibel and many more help to create new insights for a sustainable future.

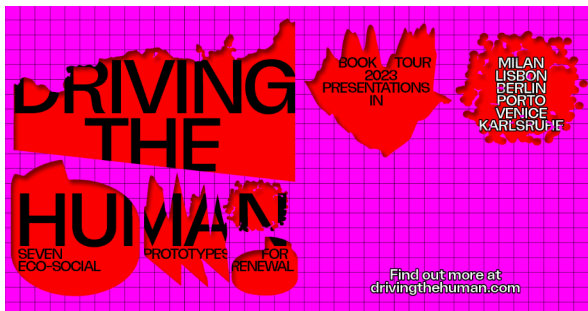At the book's heart are the seven prototypes for eco-social renewal, each proposing new ways to engage with one another and the planet. They include an exploration of how artificial intelligence could help to mitigate climate change, a film that reflects on how humans use animals to carry geo-locators, and an opportunity to experience the Arctic from the perspective of birds or bacteria.

Driving the Human Book Tour 2023 in Berlin (© Driving the Human/ Camille Blake)

The publication of the book, which marks the end of this three-year project, was celebrated on the "Driving the Human Book Tour 2023" with dates in Milan, Lisbon and Berlin. As well as lively discussions, the Berlin event also offered participants the opportunity to get creative themselves. Run by biotechnologist and acatech Member Vera Meyer, the workshop "Interweaving Architectures of the Future with Fungi" mixed biotechnology with art.

"Driving the Human" was a joint project of the four partner institutions acatech, the mentoring platform Forecast, Karlsruhe University of Arts and Design (HfG) and the Karlsruhe Center for Art and Media (ZKM). It was funded by the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection.

Projects

Driving the Human – seven prototypes for eco-social renewal*

acatech HORIZONS: Hydrogen

PUNKT prize for technology journalism and technology photography

The "Schnieder-Preis JUNGE MACHERIN"

TechnikRadar

Publications

acatech HORIZONS: Hydrogen

Late Night Tech – the acatech HORIZONS Podcast

acatech HORIZONTE logbuch*

TechnikRadar 2023: What Germans Think about Technology

News Items

Driving The Human Book Launch in Berlin

Jana Zhang wins the Schnieder-Preis JUNGE MACHERIN

Protect the climate, create prosperity: acatech HORIZONS examines the opportunities and challenges presented by hydrogen

PUNKT 2023 journalism prize: Enter the Digital and Photo categories now!

Digital formats from BR, ZEIT ONLINE and Tagesspiegel shortlisted for PUNKT journalism prize

Ear to the future: acatech launches the podcast "Late Night Tech" with guest Jan Wörner

TechnikRadar 2023: Presentation in Stuttgart

Hydrogen: Germany should take a more international approach

"How is that possible?" BR research about safety gaps in biometric devices wins the PUNKT journalism prize

* Content only available in German

European and global policy advice

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acatech is the voice of the technological sciences, representing them at national, EU and global levels. At European level, the Academy organises the Sounding Board on Innovation, is a member of the umbrella organisation Euro-CASE, and coordinates the EU project SAPEA.

European policy advice

Euro-CASE

acatech is a member of the European umbrella organisation Euro-CASE (European Council of Academies of Applied Sciences, Technologies and Engineering), which brings together 23 academies of science and technology with a total of 6,000 experts. Euro-CASE's President is Tuula Teeri, President of the Royal Swedish Academy of Engineering Sciences, while acatech President Jan Wörner is member of the Board. In 2023, Euro-CASE focused on developing a new communication strategy and addressing raw materials in the geopolitical context.

Video message by EU Commissioner Thierry Breton at the 2023 Euro-CASE Annual Conference in Madrid. (© acatech/Rudolf Hielscher)

To promote transatlantic cooperation, Euro-CASE organises the annual EU-US Frontiers of Engineering Symposium together with the US National Academy of Engineering (NAE). The symposium provides young engineers from Europe and the US an opportunity to discuss ways of optimising the use of innovative technologies for the benefit of society. The 2023 symposium in New Jersey (USA) addressed topics such as "The Quantum Era Challenge", "Computational Era in Life Sciences and Chemistry" and "Future Directions in Additive Manufacturing". In September 2023, the Euro-CASE Annual Conference, hosted by the Royal Academy of Engineering of Spain in Madrid focussed on "Energy Challenges in Europe – The Role of Engineering in Securing Supplies and Technologies". The conference opened with a video message from European Commissioner Thierry Breton.

SAPEA – Science Advice for Policy by European Academies

The five European Academy Networks — Academia Europaea, ALLEA, Euro-CASE, FEAM and YASAS — bring together the expertise of more than 110 academies in over 40 countries across Europe. Through the SAPEA – Science Advice for Policy by European Academies project, they form part of the European Commission's Scientific Advice Mechanism (SAM). The SAPEA project is funded through Horizon Europe and is coordinated by acatech. The aim is to ensure that scientific evidence plays a stronger role from the earliest stages of the European policymaking process.

The European Commissioners request from the Group of Chief Scientific Advisors advice on scientific topics that are directly relevant to policymaking. The academies prepare

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reports that bring together the available evidence and formulate evidence-based policy options, using an independent, interdisciplinary approach based on the best available scientific data. The SAPEA Evidence Review Reports provide the scientific basis for the Scientific Opinions presented to the European Commission by the Group of Chief Scientific Advisors.

In 2023, SAPEA published the Evidence Review Report "Sustainable food consumption" at the request of European Commissioner for Health and Food Safety, Stella Kyriakides. Its findings are informing the review of the EU's Farm to Fork strategy. The working group includes acatech Member Andrea Büttner.

SAPEA has also started to work on the Evidence Review Reports "Solar radiation modification" requested by Vice-President of the European Commission, Frans Timmermans; "Use of AI in science", requested by Vice-President Margrethe Vestager; and "One Health", requested by Commissioner for Health and Food Safety Stella Kyriakides.

SAPEA also expanded its podcast series, which provides information on formats of policy advice. One episode features an interview with acatech Member Ottmar Edenhofer, Chair of the European Scientific Advisory Board on Climate Change and, discussing "Giving climate advice in Europe".

In October 2023, SAPEA co-organised the European Commission's two-day conference "Science for policy in Europe" in Brussels. Guests included Nicole Grobert, Chair of the Group of Chief Scientific Advisors to the European Commission; Antonio Loprieno, Chair of SAPEA; Maria Leptin, President of the European Research Council; Stephen Quest, Director-General of the European Commission's Joint Research Centre; and Barbara Prainsack, acatech Member and Chair of the European Group on Ethics in Science and New Technologies.

European Sounding Board on Innovation

Since November 2022, acatech has been advising and supporting the European Commission on innovation matters. The inaugural high-level Round Table of the European Sounding Board on Innovation took place in April 2023, co-chaired by former European Commissioner for Innovation, Research, Culture, Education, and Youth, Mariya Gabriel, and acatech President Jan Wörner.

The Round Table of the European Sounding Board on Innovation in April 2023 (© acatech/Fredography)

Established by acatech, the European Sounding Board on Innovation serves as a direct policy advisory instrument for all European Commissioners working on innovation under the "European Innovation Agenda". Leading figures from European science and industry offer strategic guidance on contemporary issues to the Commission.

List of participants

Ann-Kristin Achleitner, Technical University München
Kai Beckmann, Merck KGaA
Miguel Belló-Mora, Spanish Space Agency
Dimitris Bountolos, Ferrovial
Alicia Garcia Medina, Atos SE
Patrick Johnson, Dassault Systèmes SE
Veselina Kanatova-Buchkova, Bulgarian Energy Holding EAD
Anke Kaysser-Pyzalla, DLR, German Aerospace Center
Barbara Lenz, Humboldt University of Berlin
Ewa Lojkowska, University Gdansk
Chiara Manfletti, NeuraSpace
Maria Persson Gulda, H2 Green Steel
Carlos Rodriguez Cocina, Telefonica S.A.
Olivier Sala, ENGIE SA
Christoph Schmidt, Leibniz Institute for Economic Research
Monika Stanisheva, Bulgaria Innovation Forum
Daria Tataj, Tataj Innovation, EIT Culture & Creativity, EIT Manufacturing
Bertrand van Ee, Hardt B.V.
Jan Wörner, acatech

The European Sounding Board on Innovation focuses on strategic, structural, and social aspects of innovation to bolster Europe's innovative capacity.

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First ESBI Roundtable with Maryia Gabriel (© acatech/Fredography)

acatech's Brussels Office

In 2023, acatech expanded its European-level activities, with the Brussels office playing a key role. The office facilitated evidence-based policy advice, enhanced the competitiveness of German science and industry, and inspired young people to engage in science and research at the European level. Additionally, the Brussels office networks for acatech's EU-level projects, helps acatech colleagues explore project funding opportunities at EU level, and organizes both the European Sounding Board on Innovation and its own events.

acatech Executive Board member Peter Dabrock visits the Brussels office with a group of students (© acatech)

acatech Executive Board member Peter Dabrock visited the Brussels office with a group of students from Friedrich-Alexander-Universität Erlangen-Nürnberg, gaining insights into the office's work and the vibrant debates surrounding inno-

vation policy developments in Europe as well as Germany's role in them. As part of their trip, the students attended an evening event in Brussels co-organized by acatech, which discussed the ethical perspectives on the limitations of artificial intelligence regulation.

Global cooperation

It is acatech's firm conviction that international thinking and cooperation are key to Germany's future success and competitiveness. Guided by this fundamental principle, acatech has, right from the outset, sought to build bilateral relationships with engineering academies, foundations, think tanks and other organisations. The Academy also engages in the International Council of Academies of Engineering and Technological Sciences (CAETS). This cooperation allows acatech to place the national issues that it addresses in an international context and incorporate ideas from other countries into its own work.

acatech engagement in the academies' association CAETS

acatech has been a member of the International Council of Academies of Engineering and Technological Sciences CAETS since 2005. 31 academies of engineering and technological sciences collaborate under the CAETS umbrella. CAETS develops solutions to global challenges, formulates evidence-based policy options, promotes social dialogue and works to advance the education of engineers at international level.

This year's Annual Meetings and Technical Symposium was attended by acatech Member Ulrich Wagner who took part in an international panel on the "Electrification of Transport in Integrated Fully Decarbonized Societies".

At the CAETS Council Meeting and the CAETS Board Meeting on 10 October 2023, the CAETS presidency was assumed by the Finnish Academy of Technical Sciences. The next CAETS Annual Meetings will take place in Helsinki in July 2024, while acatech will host the 2026 event.
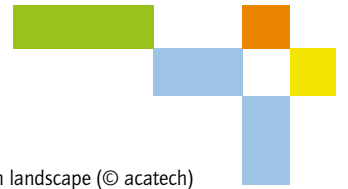
Cooperation with international academies

acatech maintains numerous partnerships with sister academies around the world. In 2023, there was a particular emphasis on strengthening cooperation with the French and Swiss academies of engineering. An initial workshop allowed for more in-depth discussion of the ties between the academies. This led to acatech and the French academy setting out their first cooperation priorities in July 2023 with the announcement that they will be formulating joint positions on energy and mobility. The efforts to promote bilateral cooperation also resulted in the President of the Swiss Academy of Engineering Sciences (SATW) joining the acatech Impulskreis Europe/International in 2023.

Regular, in-depth discussions also took place with colleagues from Switzerland on the subject of foresight. The discussions provided input for developing the process that acatech uses to identify which topics it works on. Other collaborations included a joint video project to raise the academies' profile and a joint "acatech am Dienstag" event.

### Shaping the future together with the Impulskreis Europe/International

The first meeting of the newly established Impulskreis Europe/International in March 2023 was chaired by acatech President Jan Wörner. The purpose of the Impulskreis is to provide strategic guidance for acatech's European and international activities and facilitate their development. One question that quickly arose related to the partners and countries that acatech can and should cooperate with in view of recent geopolitical changes. Following on from the discussion, Jan Wörner formulated the strategy "Positioning acatech in a changing globalisation landscape" to help guide the Academy's choice of global partners and topics.

Positioning acatech in a changing globalisation landscape (© acatech)

Sino-German cooperation

Notwithstanding the above, it remains essential to engage in discussion with other countries around the globe and to compare and study what everyone is doing and learn from each other. It was this mindset that informed the meeting between acatech President Jan Wörner and the Chinese Vice Minister for Science and Technology, Zhang Guangjun on 19 June 2023 in Berlin. Jan Wörner and Zhang Guangjun agreed to strengthen science-based cooperation, building on the partnership with the Chinese Academy of Engineering (CAE) that acatech has maintained since 2012.
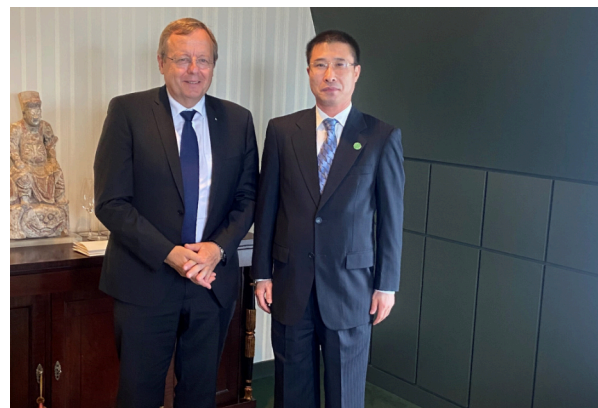
acatech President Jan Wörner and Zhang Guangjun, Vice Minister at the Chinese Ministry for Science and Technology (© acatech/Karen Wagner)

At a meeting on 14 November 2023, acatech President Jan Wörner and British Ambassador Jill Gallard strongly signalled their commitment to a British-German innovation partnership. As well as engaging in dialogue on topics of common interest, they also expressed their intention to carry out projects on specific themes.

Jan Wörner (left) met with British Ambassador Jill Gallard (right) at the British Embassy (© acatech/Karen Wagner)

Science and Technology in Society forum

acatech President Jan Wörner and Michael Dowling, acatech Member and Chairman of the Management Board of Münchner Kreis, took part in the Science and Technology in Society forum (STS forum) in October. In his keynote speech, Jan Wörner explained how space can help to find solutions to many of the problems we encounter here on Earth. In his session, Michael Dowling argued that hyperautomation will have an even more profound influence on the economy and society in years to come.

Confederation of Indian Industry visits acatech

acatech President Jan Wörner welcomed senior representatives of Indian companies in September 2023. The discussion focused on the innovation process – the chains and networks linking research, application and commercialisation. In Germany in particular, it can sometimes be challenging to make the leap from research to application. A new initiative has been launched to accelerate this process in the field of AI. Mission KI is a joint project of acatech and the Federal Ministry for Digital and Transport.

Dialogue on productivity between Japan, Germany and USA

In partnership with acatech, the MÜNCHNER KREIS and the Japanese-German Business Association (DJW), the Japan Productivity Center has established a forum for board members of prominent German, Japanese and American companies to discuss productivity in the digital age.

acatech President Jan Wörner, acatech Member and Chairman of the Management Board of Münchner Kreis, Michael Dowling, and Managing Director of Maschinenfabrik Reinhausen, Wilfried Breuer, attended the dialogue on 4 October in Tokyo (Japan). In view of recent geopolitical shifts, the participants discussed how to strengthen strategic autonomy without holding back foreign trade.

Proposed solutions included strengthening strategic alliances with countries that share European values and priorities. However, it was suggested that increasing the flexibility of traditional value chains, digitalisation and the use of smart systems can also play a major role in growing productivity in years to come.
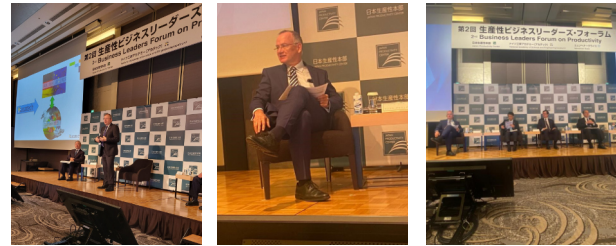
Impressions of the Business Leader Forum in Tokyo (Japan) (© acatech/Michael Dowling)

Assisting with the reconstruction of Ukrainian industry

In November, Jan Wörner welcomed representatives of Ukrainian ministries in Berlin to discuss strategic approaches to the reconstruction of industry in Ukraine. The Ukrainian guests cited the destruction of the Kakhovka Dam on 6 June 2023 as an example of why Ukraine's decision makers urgently need concrete, science-based advice. They explained that Ukraine is now unsure about whether or not to rebuild the dam. The energy, food and water supply aspects must be weighed up against the dam's potential impacts, for example on biodiversity. acatech's approach to policy advice can help to address questions like this. A project outline has already been drawn up and submitted to the Federal Ministry for Economic Cooperation and Development.

acatech President Jan Wörner describes the Academy's policy advice role at a meeting with representatives of Ukrainian ministries in Berlin. (© acatech/Karen Wagner)

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Projects

International Council of Academies of Engineering and Technological Sciences (CAETS)

Impulskreis Europäisches/Internationales

European Council of Academies of Applied Sciences, Technologies and Engineering (Euro-CASE)

Science Advice for Policy by European Academies (SAPEA)

European Sounding Board on Innovation

Publications

Towards sustainable food consumption

News Items

acatech – National Academy of Science and Engineering and NATF – National Academy of Technologies of France step up collaboration

CAETS 2023

Confederation of Indian Industry visits acatech

Dialogue and cooperation – shaping the future together

National Academy of Technologies of France and acatech wish to further strengthen bilateral cooperation

Unleashing entrepreneurial innovation potential as the linchpin of European climate policy

EU Commissioner Mariya Gabriel meets with leaders from industry and academia for the inaugural Innovation Round Table

Identifying, monitoring, understanding and overcoming global challenges together

Dialogue on productivity between leading representatives of science and industry from Japan, Germany and the USA

Collaboration for industrial recovery in the Ukraine

20th Annual Meeting of the Science and Technology in Society forum

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Developments at acatech

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212
Employees

665
Members

112
Senate members

19
Executive Board members

22
Board of Trustees members

Members

acatech's Members are scientists from the fields of engineering, the applied sciences, the humanities, economics and the social sciences who are invited to join the Academy on the basis of their outstanding scientific achievements. The 39 new Members elected by the Academy's annual General Assembly in October 2023 strengthen its interdisciplinary scientific expertise in specific areas. The newly elected scientists bring the total number of acatech Members up to 665.

> " *I extend a warm welcome to acatech's new Members. As the range of future topics grows, interdisciplinary cooperation becomes increasingly important. In this dynamic environment, the proven expertise of acatech's Members will ensure and enhance the quality and relevance of the science-based advice that acatech provides to policy-makers and the public. I would like to thank all our Members for the part they play in this.*
>
> acatech President Jan Wörner

The Members elected to the Academy last year introduced themselves at the General Assembly. (© acatech/Ausserhofer)

At their annual meeting, the Members set the direction of acatech's future development and the themes of the Academy's work. The discussions focused on interdisciplinary collaboration and ways of strengthening strategic sovereignty, while recently elected Members had the opportunity to introduce themselves and their research. Participants also enjoyed a keynote speech in which acatech Executive Board member and renowned expert in the field of medical devices, Katja Schenke-Layland, discussed the contributions made by the technological sciences to advancements in medicine and healthcare.

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New upper limit on the number of ordinary Members

The Members adopted a number of changes to acatech's statutes. In view of the growing number of projects and platforms in the Academy and the need to add to its scientific expertise in these areas, they agreed that the number of ordinary Members should be limited to no more than 500.

New ordinary acatech Members in 2023

Prof. Dr. Elisabeth André
Prof. Dr. Konrad Bergmeister
Prof. Dr. Eric Bodden
Prof. Dr. phil. Dipl.-Ing. Stefan Böschen
Prof. Dr. techn. Dr.-Ing. eh. Dieter W. Fellner
Prof. Dr.-Ing. Johannes Fottner
Prof. Dr. Martin Fussenegger
Prof. Dr.-Ing. Amelie Hagelauer
Prof. Dr.-Ing. Hans Hasse
Prof. Dr.-Ing. Jens Haueisen
Prof. Dr. Christopher Hebling
Prof. Dr. Meike Jipp
Prof. Dr.-Ing. Dr. med. Karsten Hiltawsky
Prof. Dr.-Ing. Gerhard Kahmen
Prof. Dr.-Ing. Katharina Klemt-Albert
Prof. Dr. Dr. med. Birger Kollmeier
Prof. Dr. Cordula Kropp
Prof. Dr.-Ing. Andrés Fabián Lasagni
Prof. Dr. med. Dr.-Ing. Steffen Leonhardt
Prof. Dr. Erica Lilleodden
Prof. Dr.-Ing. Sven Matthiesen
Prof. Dr. Wolfram Münch
Prof. Dr. Kai Nagel
Prof. Dr. Stefan Pickl
Prof. Dr.-Ing. Robert Pitz-Paal
Prof. Dr. Geraldine Rauch
Dr. Heike Riel
Prof. Dr. Jörg Rocholl
Prof. Dr. Bernhard Rumpe
Prof. Dr.-Ing. Ahmad-Reza Sadeghi
Prof. Dr. Piet Oliver Schmidt
Prof. Dr. Sebastian M. Schmidt
Prof. Dr. Christine Silberhorn
Prof. Dr. Roland Ulber
Prof. Dr. Anke Weidenkaff
Prof. Dr.-Ing. Abdelhak Zoubir

New associate acatech Members in 2023

Prof. Dr. Johann Plank
Prof. Dr. Paolo Samorí
Prof. Dr.-Ing. Yi-Ming Wei

acatech Members who passed away

Prof. Dr. Utz-Hellmuth Felcht
Prof. Dr.-Ing. habil. Werner Krause
Prof. Dr. Clemens Zintzen

Senate

acatech's Senate forms the second pillar of the Academy, alongside the Members. The Senate is made up of leading figures from technology companies, industry associations and the major science organisations. The members of the Senate advise the Academy on strategic issues and complement its scientific expertise with practical, business-focused perspectives. Comprising staff members who they designate themselves, the "Senate Network" provides the Senate members with strategic content, communication and policy support.

Once a year, the Senate members come together for their annual meeting in Munich. At the July 2023 meeting hosted by aviation and aerospace company Airbus, they discussed the future of the aerospace industry.

The Senate's annual meeting in Munich was hosted by aviation and aerospace company Airbus. Pictured here, acatech Presidents Thomas Weber (left) and Jan Wörner in conversation with Airbus CTO and host Sabine Klauke. © David Ausserhofer

The virtual events in the "SENAT digital" series provide acatech Senate members with a regular opportunity to discuss specific topics. In 2023, members of the Senate and Senate Network discussed hybrid working and the challenges and

opportunities of the new norm and strengthening the start-up culture in Germany.

The acatech Senate comprised 112 individual and corporate members as of 31 December 2023.

New Senate members in 2023

Dr. Lukas Aschenberg
Andrew Barr
Dr. Thomas Blunck
Prof. Dr. Tanja Brühl
Prof. Dr. Lutz Eckstein
Yasmin Fahimi
Lisa Gradow
Prof. Dr. Holger Hanselka
Matthias Hartmann
Prof. Dr. Angela Ittel
Dr. Adam Henrik
Dr. Stefan Kampmann
Andrea Martin
Dr.-Ing.Hans Heinz Zimmer

Executive Board and Management Board

The Executive Board is responsible for directing the Academy's scientific activities. Together with the Managing Director, its 18 members represent acatech's twin science and industry pillars. 12 of the Executive Board's members are elected from the General Assembly and 6 from the acatech Senate. Jan Wörner has served as the scientific President since 2021.

In March 2023, Thomas Weber was elected to succeed Reinhard Ploss as the President representing the industry side. The two Presidents plus the Managing Director and Vice-Presidents Ann-Kristin Achleitner, Ursula Gather (who succeeded Thomas Weber as Vice-President in March 2023), Stefan Oschmann and Christoph M. Schmidt make up the body that carries out detailed preparations for Executive Board meetings. acatech's Management Board consists of the two Presidents and the Managing Director.

New Executive Board member in 2023

Torsten Jeworrek

Board of Trustees

The acatech Board of Trustees comprises prominent figures from science, industry, government and civil society. Chaired by Henning Kagermann, it helps the Vice-Presidents and in particular the Management Board to determine the Academy's strategic direction. The Board of Trustees meets every six months and had 23 members in 2023.

acatech offices

The acatech Office in Munich is the Academy's headquarters. It is home to the Academy's senior management and the majority of its staff in the support, organisation and administration functions, as well as those responsible for specific priority themes. acatech also has a Berlin office and an office in Brussels that coordinates the Academy's networking activities at EU level. In 2023, a total of 212 people were employed at acatech's offices, approximately 60 percent of whom were women. Over the course of the year, the Academy was also supported by 44 student assistants.

Finances

acatech is a non-profit organisation. Its institutional funding is shared equally between the Federal Government, the 16 German Länder and the State of Bavaria. This is supplemented by public and private project funding.