

# shaping. the future. together.

Final Report of the  
High-Tech Forum 2019–2021

Unofficial translation

**HIGHTECH FORUM**

## About this report

The High-Tech Forum is the official board that advises the Federal Government on implementing the High-Tech Strategy 2025. In this Final Report, the High-Tech Forum presents its most important recommendations for a future research and innovation strategy of the Federal Government. The most important topics and recommendations from the High-Tech Forum's total of nine advisory papers have been reworked, enriched and summarized for this publication. This Final Report by the High-Tech Forum was first issued within the context of the High-Tech Forum's Final Conference on 21 April 2021. All discussion papers and advisory topics of the High-Tech Forum are also available at: [www.hightech-forum.de/en](http://www.hightech-forum.de/en)

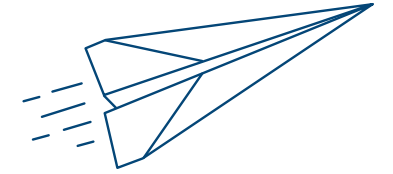
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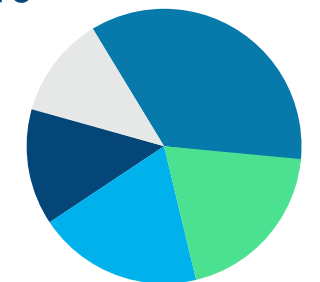
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## Foreword by the Co-Chairs

Dear Reader,

Never before have research and innovation been as topical and, at the same time, as important as they are today. Whether health, climate change or the economy, wherever a society is facing major challenges and is reorientating itself, science and research make influential and innovative contributions to change. It is therefore essential to involve society in this development. This creates trust and forms the vital step towards realigning the economy with value-based value creation, while also bringing about changes to our own behavior.

In its interdepartmental High-Tech Strategy 2025, the Federal Government has formulated key goals, areas of action, and tasks for its research and innovation policy. The 21 experts of the High-Tech Forum are appointed to make recommendations for this and at the same time to bring new perspectives from business, civil society, administration and science into policy-making.

Since 2019, the High-Tech Forum has therefore advised the government on increasing national innovative strength, interweaving it more closely with the Sustainable Development Strategy, and achieving the 3.5% target. The importance of new social and economic developments has also been addressed in discussions on social innovation, qualification and open science. Further deliberations are taking place on innovative capacity and competitiveness, for example in the context of the future of value creation and the merging of “bio” and “IT”.

In a pilot for a participation process focusing on further development of the High-Tech Strategy, the Forum members supported seven regional dialogues, drawing important lessons from them about successful participation and interfaces between the regional innovation systems and that of the Federal Government. In spring 2020, the members also presented

guidelines for innovation policy in the wake of the COVID-19 pandemic, highlighting opportunities for reorientation by means of sustainable innovations and value-driven growth.

This results report pools the High-Tech Forum’s most important recommendations for further development of the Federal Government’s research and innovation strategy in the coming legislative term.

We would like to thank the members of the High-Tech Forum who have developed these recommendations in transparent, open and constructive discussions. We would also like to thank you, our readers, for your interest in the wide variety of perspectives on a future research and innovation policy. We hope that the following pages can provide you with valuable inspiration to think and act innovatively and thereby with important stimuli for the benefit of our joint future.

Berlin, April 2021



Christian Luft

Co-Chair  
State Secretary at the Federal Ministry of  
Education and Research



Prof. Dr. Reimund Neugebauer

Co-Chair  
President of the Fraunhofer-Gesellschaft e.V.

# Final Report

## Executive summary and outlook

These recommendations by the High-Tech Forum are aimed at further development of the future innovation strategy. They are based on the eight discussion papers published by the Forum during the 19th legislative term. They are influenced in turn by experience gained from the COVID-19 pandemic, one of the greatest challenges we have faced in recent years. In “Seven guidelines for new\* growth”, the High-Tech Forum reflected on initial experience during the pandemic in spring 2020 and pointed to ways of using innovation policy to overcome the crisis. The recommendations focused on agile governance, targeted increases in investment in research and development (3.5 percent target), European partnerships, consistent use of research and innovation for the common good, and achievement of the Sustainable Development Goals.

→ See overview of the *High-Tech Forum’s advisory papers 2019–2020* (page 8–10)

As a result of the COVID-19 crisis, the government put together a stimulus package for the future and provided public investment of more than 60 billion euros for education, research and innovation. In Germany, research projects and new developments were initiated at all levels of industry, science, society, and politics, spanning many different areas of life. In particular, there was a strong boost for the cultural change repeatedly called for by the High-Tech Forum towards greater agility as well as the digitalization of initial and continuing vocational education and training, public administration and business models. Many of the necessary modernizations are based on using existing technologies and solutions. The crisis shows that forward-looking public funding of research and innovation, including social innovations, is an essential building block for the resilience of society and the economy to crises. Digitalization and innovative technologies offer entirely new opportunities in this context. The High-Tech Forum advises exploiting these opportunities even more consistently.

The Forum sees a particularly great need for improvement in the German innovation system when it comes to disruptive innovation and technologies with a high degree of novelty. In the global competition with the USA and (Southeast) Asia, Germany is too hesitant with regard to scaling up and commercializing the results of cutting-edge research. Stakeholders in Germany too rarely exploit scientific breakthroughs and develop them on a global scale. In view of Europe’s technological sovereignty and capacity to act, the High-Tech Forum therefore calls for strategies based on binding architectural and support frameworks and proposes an innovation pact between science, industry and society. It calls for the Europe-wide agreement of technology architectures and lead markets for the scaling of disruptive innovations.

→ See central topic: *Resilience and technological sovereignty* (page 20–23)

The members also insist on further boosting the research transfer and start-up culture in Germany. There ought to be encouragement and also reward within the research and innovation system for greater openness, flexibility and willingness to experiment. An initiative for freedom of technology transfer should help to encourage and facilitate more knowledge-intensive start-ups, particularly spin-offs from research establishments and higher education institutions. The political objectives and expectations regarding start-ups and spin-offs play an important role here in the form of legal requirements and framework conditions.

→ See central topic: *Freedom of technology transfer and promotion of knowledge-intensive start-ups* (page 28–33)

In a future innovation strategy, policymakers should set framework conditions and incentives so that research and innovation projects are more closely aligned with societal needs and goals and can be widely used. More focus on innovation, openness to new innovation stakeholders, and agility in public administration and procurement are considered important requirements for this. Basic rights in crisis management are another key aspect for the development of innovations and solutions. During the containment of the COVID-19 pandemic, the opportunities for digitalization and automation, e.g. in testing, tracing and quarantine management, were not fully utilized due to data protection concerns, even though they could have enabled the protection of health and life and more freedom of movement. If, in the long term, more resources are poured into the joint development and prioritization of solutions, into the building up of new systems and skills, and into agile and participatory approaches, this will make an important contribution to more innovation in this country. In general, the High-Tech Forum recommends involving citizens in innovation policy in a more binding and unbureaucratic way, and strengthening social participation in innovation.

→ See central topics: *Agile research and innovation promotion* (page 24–27) and *Participation as a strategic instrument of innovation policy* (page 16–19)

The pandemic is currently overshadowing other global challenges. It is more urgent than ever to combat climate change. Germany has largely missed its 2020 targets for nature conservation and environmental protection. In close consultation with the population, science and research provide new insights and solutions to these challenges. With the twelve missions of the High-Tech Strategy 2025, a first attempt was made to pool innovative forces to achieve ambitious societal goals. The aim now is to further

develop the mission-oriented approach in innovation policy. The High-Tech Forum proposes improvements and ambitious strengthening, particularly with regard to mission targeting, funding and governance.

→ See central topic: *Mission-oriented innovation policy* (page 12–15)

The High-Tech Forum attaches great importance to the joint development of an innovation culture that is open and at the same time proactive and precautionary. Brainstorming and initial proposals for action were defined with representatives from society, industry and science in two stakeholder dialogues and recorded in an ideas paper.

→ See Ideas paper: *Innovation culture* (page 34–37)

With this final report, the High-Tech Forum consolidates its recommendations, which extend beyond the advisory papers already published. Once again, the recommendations focus on societal needs and goals, agile and innovative governance, promoting technological, social and environmental innovations, encouraging skills development and knowledge-intensive start-ups, and the broad participation of society.

## Deliberations

# Key recommendations for further development of the High-Tech Strategy 2025

During its term, the High-Tech Forum has published nine advisory papers that provide important stimuli for the future development of the German research and innovation system. The recommendations in the discussion papers have lost none of their relevance or validity and should be considered in a future innovation strategy.

Five overarching central topics can be derived from the High-Tech Forum's deliberations. They run through the discussion papers like a common thread. This Final Report summarizes the key recommendations for the central topics of Mission-oriented innovation policy, Participation as a strategic instrument of innovation policy, Resilience and technological sovereignty, Agile research and innovation funding, and Initiative for freedom of technology transfer – promotion of entrepreneurship.

## Advisory papers of the High-Tech Forum 2019–2021

# 3,5%

Paths to the 3.5% target

In its High-Tech Strategy 2025, the Federal Government formulated the goal of increasing the share of investment in research and development (R&D) to 3.5 percent of gross domestic product by 2025. In their deliberations, the members of the board provide important policy impulses and describe R&D promotion as the interaction of a multitude of influencing factors. The paper discusses not only financial but also legal, societal, technological and economic aspects. Investments in research and development are the sources of tomorrow's prosperity and must be leveraged specifically for innovations. [Reference → 3,5%](#)



### Guidelines for new\* growth after the coronavirus crisis

Agile governance, social cohesion, and a broad consensus on the need for far-reaching measures helped to indicate initial routes out of the coronavirus crisis in June 2020. In its seven guidelines, the High-Tech Forum highlights the historic opportunity to trigger a transformation toward new and qualitative growth with the help of extensive innovation subsidies and economic stimulus packages. In this respect, the Sustainable Development Goals are more important than ever for Germany and the world, and must be approached with genuine commitment. The High-Tech Forum sees new growth as a positive development toward social, economic and environmental sustainability. New growth is qualitative and based on the central values of society. New growth creates added value for present and future generations. [Reference →](#)



### Innovation and Qualification

Specialist knowledge, professional training and job requirements are changing in ever-shorter cycles. Lifelong learning must become the norm for everyone. The motivational foundations for lifelong learning are already laid in childhood and basic education. Here, early experiences of self-efficacy, a constructive approach to mistakes and experimenting, as well as learning in groups should be integrated more thoroughly into everyday learning. In adult education, skills development and continuing education and training must be more strongly professionalized in the future, geared to specific target groups and, if necessary, financed from tax revenues. The High-Tech Forum recommends an individual training budget, the granting of pension points and expansion of the examination grants already in use. Important signals could also come from an individual right to continuing education. The recommendations also focus on the question of how future competencies can be identified early and taught more broadly. One core recommendation is to put digital literacy on an equal footing with basic literacy and numeracy. [Reference →](#)



### Agility in the innovation system

Germany has some catching up to do in terms of digitalization and the innovative capacity of its public administration. As an educator, promoter of research, investor and user of innovations, the government not only sets the political framework conditions in the innovation system, but is also an important stakeholder. The leadership level is central to strengthening an agile culture and national innovation capacity. Human resources policies in the civil service should be modernized in favor of transparent career paths, more flexible forms of work, and training courses. Organizationally, more “ambidexterity” is required, that is the ability to work efficiently and error-free in the execution of procedures on the one hand, and to drive innovations forward in a goal- and user-oriented manner on the other. Many practical examples show how public administrations implement this “ambidexterity”, particularly in the promotion of research and innovation, and innovative public procurement. [Reference](#) →



### Social innovations

None of the major challenges of our time, such as climate change, digitalization and aging societies, can be met by technology alone. For this we also need new organizational models and changes in behavior, i.e. social innovations. Social innovations frequently emerge from individual needs and solve problems that are closely linked to the reality of people’s lives. The High-Tech Forum therefore recommends that the Federal Government approach the promotion of social innovations more strategically so as to initiate specific interdepartmental action. Social enterprises, i.e. companies, that use entrepreneurial means to pursue purposes aimed at the common good should be strengthened as drivers of social innovation, for example by opening up new sources of financing for them and creating more networking and consulting opportunities. [Reference](#) →



### Open Science and Innovation

For the benefit of society, we must make even better use than before of the wealth of data available within science, companies and public administrations. Research and innovation efforts can also benefit significantly from involving different sources of knowledge in the process – from formulating research questions and assessing needs to developing business models. This requires a cultural change on all sides. In the science system, involving society and sharing data at an early stage must be more strongly promoted and generously rewarded than in the past. The High-Tech Forum also recommends that the state should set an example in its role as a producer of data and knowledge. Not only by making public data available to research and society in a legally compliant manner, as an element of research promotion schemes for example, but also by creating the necessary framework conditions and infrastructures for open science and innovation. This includes further developing agile research funding, establishing data platforms and standards, and legal certainty for the sharing and use of data. [Reference](#) →



### The future of value creation

Digitalization and geopolitical shifts present German industry with a double challenge of adapting its production- and export-oriented business models. The High-Tech Forum advises investing more heavily in intangible production factors, creating digital infrastructures, and taking advantage of innovation opportunities that arise due to openness and cooperation. Sustainable products and services should be at the heart of these new business models. The consistent digitalization of products and production across company boundaries will open up new opportunities in the data economy for German and European industry. To do this in the EU and Germany, there is a need to establish not only technological infrastructures but also suitable framework conditions conducive to innovation. [Reference](#) →



### Sustainability in the innovation system

Innovations can enable more sustainability but at the same time we need to bring more sustainability into the innovation system. Among other things, the High-Tech Forum recommends that policymakers consider sustainability in all its dimensions as a guiding objective of research and innovation policy, and that they dovetail the Sustainable Development Strategy more closely with the High-Tech Strategy. One way to do this is through the twelve missions of the High-Tech Strategy 2025 which need to be implemented more consistently and must be better coordinated across the whole of government. Public procurement should be better positioned for promoting sustainable products and services. In addition, the High-Tech Forum advises pushing for the internalization of external costs at “true prices” and using alternative prosperity indicators to measure sustainability. Stronger incentives for sustainable investment are needed to generate more start-ups with sustainable business models. Key areas for sustainable innovations include the circular economy, the bioeconomy, and low-carbon industrial production. [Reference](#) →



### Bio-IT Innovations

The convergence of biology and information technology is giving rise to the development of disruptive innovations that will lead to entirely new possibilities in medicine, agriculture and the food industry and industrial production. Global players, particularly the big digital companies, are leading the way with far-reaching projects. The High-Tech Forum advises the Federal Government to put the topic on the political agenda, to strengthen transdisciplinary bio-IT research, and to put it into practice together with society and business. The Forum therefore recommends that the Federal Government should implement a bio-IT agenda as a core component of the next High-Tech Strategy. A new bio-IT research center should combine all relevant specialist competencies throughout Germany to promote research and development at an international level. In addition, policymakers should stimulate and promote the early involvement of society, e.g. in product development. This also includes a broad debate in society on the ethical and social challenges of new bio-IT applications. [Reference](#) →



#### To the discussion papers

All discussion papers and recommendations on the advisory topics from 2019 to 2021 are available in German and English on the High-Tech Forum’s website. [www.hightech-forum.de/en/publications](http://www.hightech-forum.de/en/publications)



## Central topic

# Mission-oriented innovation policy



**Beating cancer, achieving a carbon neutral industry, providing clean mobility and preserving biodiversity:** In its High-Tech Strategy 2025, the Federal Government initially formulated twelve missions to leverage research and innovation (R&I) for central societal goals. In general, the High-Tech Forum sees the mission approach as a promising policy instrument, particularly when it comes to uniting many innovative forces from a wide variety of fields behind a societal goal. In future, the Federal Government should concretely and effectively promote missions in order to help achieve the goals of the German Sustainable Development Strategy and the European Green Deal by means of social, environmental and technological innovations.

In Germany, missions are a new instrument of innovation policy and also internationally, the approach is being tested for the first time in practice, e.g. in the European Union's new "Horizon Europe" R&I framework program. The governance, i.e. management and coordination of the missions, is extensive and requires clear responsibilities, appropriate dialogue formats, and sufficient resources. The Federal Government should monitor and consistently drive forward implementation based on specific funding targets, milestones, and impact assessments. To do this, the Federal Government's departments must collaborate even more closely and link up with regional and local initiatives so that efforts cross-fertilize and complement each other, while at the same time identifying and filling gaps.

The High-Tech Forum emphasizes the opportunities and challenges of the mission-oriented innovation policy and, for future development, particularly recommends:

## Anchoring a broad understanding of innovation

Solutions that consist of technological, social and environmental innovations are needed for almost all major challenges, particularly for the missions of the High-Tech Strategy. Funding approaches that are technology-neutral play a significant role in this. It is also important to note that for each problem, the combination of social, environmental and technological innovations must be measured against different success criteria. Accordingly, evaluation standards must also be adjusted for the missions. →

## Promoting the active participation of citizens

Societal use is inherent to innovations and, thus, many different stakeholders will always help shape them. In this respect, citizens should be involved in innovation policy more widely and at an early stage. The High-Tech Forum suggests that the Federal Government formulate and implement the missions jointly with society. For this purpose there should be more (digital) offerings and resources for dialogues with civil society groups. Furthermore, partnerships should emerge in which political leadership levels (e.g. when setting the framework and formulating the mission) complement the relevant implementation levels (e.g. through initiatives from science, business and society). The Federal Government should support such experiments with a variety of participation formats and have them scientifically evaluated and tested to determine how effectively they can contribute to the implementation of a mission. (See central topic: *Participation as a strategic instrument of innovation policy*) →

## Formulating goals clearly, ambitiously and realistically, and assessing them holistically

Future missions should be made tangible with ambitious but also achievable and measurable goals. It is important to pay even greater attention to ensuring that the mission goals resonate with society, preferably by using co-design approaches for formulating the goals. If as many people as possible support the goal of a mission, they are more likely to participate in its implementation. If goals that are too ambitious or too broad are set for a mission, then it becomes harder to get involved or to even to take the goal seriously. The missions should be assessed holistically because achieving a goal has a variety of effects in very different areas. It is thus necessary to consider and monitor possible undesirable developments from the outset. For example, the change to climate-neutral production might impact on the labor market, create conflicts with nature conservation goals or aggravate problems when there is structural change in a region. →

**Missions** are an instrument of innovation policy, designed to achieve ambitious societal goals with combined forces, a package of innovations, and across sector boundaries. Missions engage a variety of stakeholders. They become effective due to clearly defined responsibilities and the coordinated interaction of stakeholders across all levels, as well as goal-oriented use of various policy instruments and appropriate funding. To do this, it is necessary to define a time frame for their implementation which can be verified using goal-oriented, measurable milestones.<sup>1</sup>



**"We are committed to dovetailing the national Sustainable Development Strategy more closely with the High-Tech Strategy."**

Prof. Dr. Antje Boetius

# The 12 Missions of the High-Tech Strategy 2025

For the past 15 years or so, research and innovation policy has increasingly focused on addressing the grand challenges of society, such as the climate crisis, demographic change, and safety and security. The new mission orientation of research and innovation policy, which has recently been taken up by many industrialized countries, aims at system transformation and claims to translate the challenges, which are very extensive in terms of their content, into concrete and solvable problems. In this way, they differ fundamentally from earlier mission-oriented approaches

which focused more strongly on pursuing specific technological goals. The High-Tech Strategy 2025 defines twelve missions which address major and complex societal challenges. During preparation of the strategy, the ministries defined them in fields where it is necessary to focus all relevant stakeholders behind a common goal to achieve further progress. As a new instrument of innovation policy, the missions are intended to strengthen interdepartmental cooperation in the research and innovation policy, and to implement research results in a targeted manner.<sup>2</sup>



Building up battery cell production in Germany



Ensuring good living and working conditions throughout the country



Preserving biological diversity



Putting artificial intelligence into practical application



Creating sustainable circular economies



Combating cancer



Digitally networking research and healthcare – for intelligent medicine



Achieving substantial greenhouse gas neutrality in industry



Substantially reducing plastic discharged into the environment



Developing safe, networked and clean mobility



Shaping technology for the people



New sources for new knowledge

Source: Own illustration based on: Research and innovation that benefit the people. The High-Tech Strategy 2025, available at: [www.bmbf.de/upload\\_filestore/pub/Research\\_and\\_innovation\\_that\\_benefit\\_the\\_people.pdf](http://www.bmbf.de/upload_filestore/pub/Research_and_innovation_that_benefit_the_people.pdf)

## Effectively designing governance and promotion of the missions

The missions are a key element of the High-Tech Strategy. As a result, the Federal Ministry of Education and Research is also primarily responsible for their implementation and management, from formulating the goals and motivating participation to monitoring. The political leadership of the Federal Government must give higher priority to these interdepartmental missions and ensure that they can be effectively coordinated outside of departmental structures and without being formally subject to directives. In future, it would be important to define a (virtual) governance structure that can better integrate and coordinate all interested parties, both on the vertical (e.g. from the EU via federal and state governments to local authorities) and on the horizontal level (e.g. between departments and economic sectors). Management also means assigning clearly defined roles to interested parties and supporting them with resources for implementing the missions. →



**“The potential of new technologies only develops when it is accompanied by changes in behavior and new social practices. Social innovations can make an important contribution here.”**

Prof. Dr. Anke Hassel

## Implementing missions in a goal- and results-oriented manner

What is a mission’s starting point? Which actions contribute towards successful implementation and to what extent? What data can be collected and analyzed and to what extent? Continuous monitoring and reflective assessment of the achievement of a mission’s goals is especially challenging and at the same time particularly crucial to success. It must be possible to measure a mission’s progress and an unbureaucratic monitoring system should be set up for this purpose. When the goals are met, missions are to be terminated. If far-reaching changes occur, missions can also be aborted and/or reformulated. Scientifically, the success and impact of missions can be studied by analyzing the intermediate steps and milestones of their implementation. Participatory elements should also be strengthened during impact measurement. For example, the Federal Government could include public forums in the monitoring process. (See central topic: *Participation as a strategic instrument of innovation policy*) →



**“With bio-IT innovations, we can pursue important missions with new dynamism. Society must be consistently involved from the outset.”**

Prof. Dr. Christiane Woopen

### References

- 1 Based on: OECD. Definition of 'mission-orientation policies'. International Database on STI Policies. Mission-Oriented Innovation Policies. Available at: [stip.oecd.org/stip/moip/the-definition-of-moips](http://stip.oecd.org/stip/moip/the-definition-of-moips)
- 2 Federal Government (2019). The High-Tech Strategy 2025 Progress Report. Berlin, Federal Ministry of Education and Research. Available at: [www.bmbf.de/upload\\_filestore/pub/The\\_High\\_Tech\\_Strategy\\_2025.pdf](http://www.bmbf.de/upload_filestore/pub/The_High_Tech_Strategy_2025.pdf)



Central topic

# Participation as a strategic instrument of innovation policy



Innovation results from mutual exchange and the involvement of as many providers of ideas as possible. The High-Tech Forum advocates developing a culture of participation in innovation policy in which participation is not understood as a one-sided sending or receiving of opinions but rather as a process of mutual understanding to which all stakeholders can actively contribute.<sup>1</sup>

Innovations are successful when they meet societal interest and needs. Policymakers, science and business should therefore merge their research and innovation projects with societal objectives and needs at the earliest stage possible. (see central topic: *Mission-oriented innovation policy*) Participation is a way of facilitating and shaping innovations along the entire value chain from research and development to utilization. For not only is there a need to apply innovations in society, many people would also like to contribute their own questions, perspectives and competencies and thus help shape developments. To dovetail these aspects together, innovation policy needs new competencies, channels and formats for collaboration. Participation should be organized in a lean, efficient and unbureaucratic manner. To achieve this, the High-Tech Forum recommends:

## Ensuring broadly based participation when developing the future innovation strategy

Up to now, Germany has tended to use traditional participation processes which listen to specialist expertise and invite comments. When developing the future innovation strategy, the Federal Government should encourage more participation across the breadth of society. Public consultation procedures, e.g. open survey and co-design for the "Horizon Europe" R&I framework program or open hearings on questions of innovation policy in the USA, can be a model for this. The important thing here is to create binding framework conditions for concrete participation processes and to stick to them. In this respect, the recommendation is to first develop a functioning prototype for a subarea. Policymakers must ensure cooperative action between departments and seek the cooperation of diverse, including critical, stakeholder groups and interested individuals. Participants should be told from the beginning how their contributions will be handled or how they can be discussed further.<sup>1</sup>



## Structurally anchoring civic participation in innovation policy

The Federal Government should involve citizens in the design and implementation of innovation policy on a permanent and binding basis and take up the ideas of different societal target groups. To do this, the High-Tech Forum recommends setting up and funding "citizen's forums" or "future councils" in those areas of research and innovation policy where they are important for shaping the framework conditions of innovation policy and provide added value. In addition to the direct participation of people, there are also new opportunities for indirect participation. For example, the use of AI-based methods, e.g. anonymized analysis of posts or discussions in social media, could provide an additional opportunity to better incorporate the perspectives and ideas of different target groups in innovation policy (e.g. vision development, missions). →

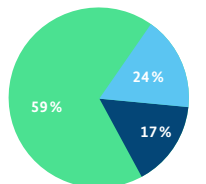


**"The broad participation of society in research is an important requirement for new ideas and innovations which we urgently need for a future worth living."**

Prof. Johannes Vogel Ph.D.

Interest of citizens in science and research

- Keen
- Neutral
- Slight



N=1017 respondents

Source: Science barometer 2019, published by Wissenschaft im Dialog available at: [www.wissenschaft-im-dialog.de/en/our-projects/science-barometer/science-barometer-2019/](http://www.wissenschaft-im-dialog.de/en/our-projects/science-barometer/science-barometer-2019/)



**"The great strength of participation processes lies in the co-creative development of shared visions and solutions."**

Prof. Dr. Patrizia Nanz

## Developing structural change and innovation policy together

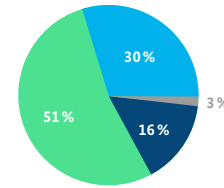
Innovations are inevitably linked to change. In this respect, innovation policy is also always part of regional structural policy. The High-Tech Forum recommends setting up formats, such as participation workshops, to condense ideas and the wishes of local people into blueprints, visions or objectives and to discuss how everyone can get involved in achieving these goals. It is possible through such workshops or forums to dovetail federal and state levels cooperatively. It is also easy to integrate European initiatives into participation formats at regional level via existing EU projects and programs. Participation succeeds with the right expertise and can accelerate innovations and transformation. It requires appropriate resources and clear responsibilities. In particular, it is necessary to clarify what will happen to the results of these workshops and who will take responsibility for implementation and funding (at different levels).<sup>1</sup>

## Aligning research and innovation with societal values, goals and needs

The half-life of knowledge and innovation cycles are becoming shorter and shorter. Technologies are also merging to entirely new applications. This makes it much more difficult to understand and assess new technologies and innovations retrospectively, as ready-made market applications. For publicly funded research to be applied more frequently and also more quickly, society must be involved in R&I projects, from research question to business model development. It is a matter of considering different needs and perspectives from the outset and of learning from each other. Methods such as citizen's dialogues, co-creation, crowd science, participatory or transdisciplinary research, and citizen science help with this. A fixed percentage of government R&I funding should be invested in such participation formats for responsible research and innovation (RRI). → 🧑🏫📊 3,5%

Public should be more heavily involved in decisions about science and research

- Agree
- Neutral
- Disagree
- No indication



N=1017 respondents

Source: Science barometer 2019, published by Wissenschaft im Dialog available at: [www.wissenschaft-im-dialog.de/en/our-projects/science-barometer/science-barometer-2019/](http://www.wissenschaft-im-dialog.de/en/our-projects/science-barometer/science-barometer-2019/)



**“We are only at the beginning of the path towards more openness. Secrecy has long been a virtue, whether in companies or in research – only now are we learning what there is to gain.”**

Prof. Dr. Dr. Andreas Barner



It is about considering different needs and perspectives from the outset and learning from each other.

## Improving societal participation in research and innovation

With a view to innovation capability, it is important that as many people as possible engage with research and innovation or are enabled to deal confidently with innovations (see central topic: *Resilience and technological sovereignty*). Science communication, participation formats and knowledge transfer into society are gaining importance and should be included in the training and job profiles of researchers. The federal and state governments must create appropriate incentive options for researchers, e.g. using success criteria and remuneration, but they must also be considered in career decisions. This will enable scientific institutions to motivate and promote participation as well as knowledge and technology transfer activities among their employees. → 🧑🏫📖📚



**“SMEs are fundamentally important to economic development and innovation capacity in Germany, especially for rural areas. The dovetailing of society, science and business is pivotal here for the change toward more sustainability and the preservation of a healthy environment.”**

Prof. em. Dr. Wolfgang Lücke

## Access to public research results and data

With a view to developing a culture of participation in innovation policy, the government should not only make policy and R&D funding more participatory and agile (see central topic: *Agile research and innovation funding*), but also set a good example and make its knowledge and databases usable for society, business and science in a manner compliant with data protection requirements. (see central topic: *Resilience and technological sovereignty*) Government “data donations”, the establishment of government data custodian models or data cooperatives would be innovative ways toward a new form of participation in publicly funded knowledge including data. → 🧑🏫📊📚

### Regional dialogues

**Pilot for a participation process for the High-Tech Strategy 2025**

In 2020, the Federal Government initiated an initial participation process for the High-Tech Strategy to develop it further with society. Seven regional dialogues formed the key component of this pilot project. In 2020, stakeholder conferences, both digital and local, were held across Germany from Karlsruhe and Lausitz to Bremerhaven. They were accompanied in parallel by online discussions. Thematically, they addressed focal points of innovation, e.g. “sustainable mobility in the city”, “the circular economy” or “artificial intelligence in agriculture”. In the exchange with regional stakeholders and initiatives, the aim was to discuss practical knowledge, uncover blind spots and discover new perspectives as well as to dovetail all areas and levels of innovation in Germany.

Online discussion

Stakeholder conference

Reflection workshop

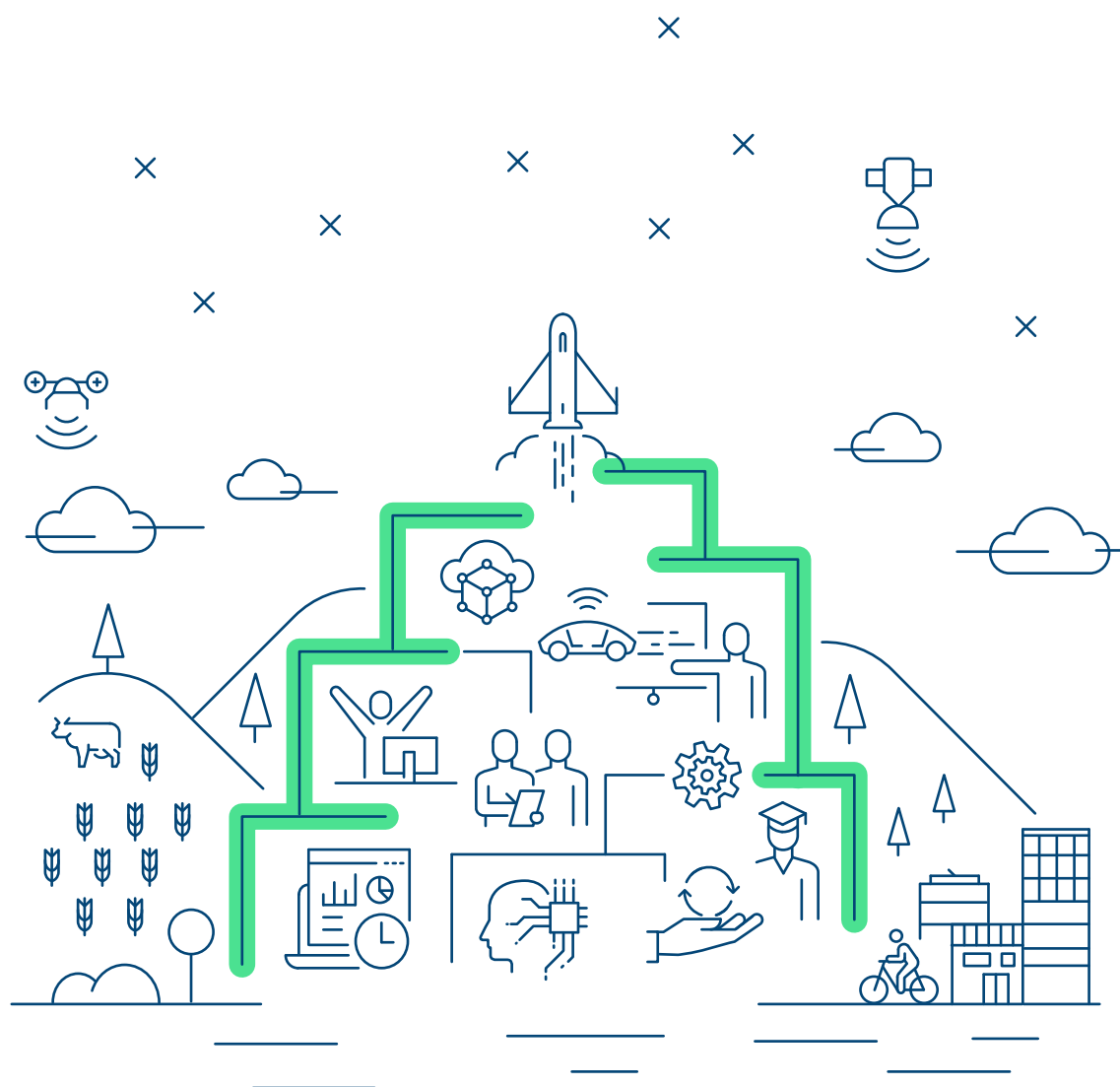
Further information and results of the participation process: [www.mitmachen-hts.de](http://www.mitmachen-hts.de)

### Reference

- 1 Federal Ministry of Education and Research (2020). Key messages from the participation process for further development of the High-Tech Strategy 2025. Available at: [www.mitmachen-hts.de/sites/default/files/downloads/kernbotschaften\\_hightech-strategie\\_beteiligungsprozess.pdf](http://www.mitmachen-hts.de/sites/default/files/downloads/kernbotschaften_hightech-strategie_beteiligungsprozess.pdf)

## Central topic

# Resilience and technological sovereignty



Climate change, pandemics and protectionism are just three acute challenges facing Germany and Europe. They transcend borders and have a profound impact on the way societies and economies function. In principle, the following applies: The more sustainable societies and economies are, the more resilient they are and the better they will be able to cope with such challenges.

Recent experience with the COVID-19 crisis shows that there is a need to improve and modernize the systems for resilience in Germany and Europe. Digitalization and new technologies offer entirely new opportunities in this regard. In the future it will be a matter of using these opportunities more consistently to avert damage, safeguard fundamental rights and supplies, and gain greater freedom of action. Societies that are technologically autonomous can make self-determined decisions about using new solutions. This gives them more options for action and coping when making provisions or in the event of a crisis, for example by developing and producing new tests and drugs and employing digital crisis management. In addition to excellent science, innovative companies and more agility (see central topic: *Agile research and innovation funding*), international R&I collaborations and partnerships also contribute quite significantly to this. For this reason, Germany should act autonomously, in the sense of achieving the greatest possible freedom of choice, but never in a protectionist manner. In view of the future innovation strategy, the High-Tech Forum recommends that the Federal Government take comprehensive measures to promote foresight, resilience and technological sovereignty.

## Bringing cutting-edge research into large scale application

German cutting-edge research is competitive in important future fields, such as in parts of quantum, bio, nano, information, sensor and hydrogen technologies. However, the development of sustainable innovations and technological sovereignty require much more intensive networking of basic research, education and training, and business. There is a need for binding architectural and support frameworks which consider all stakeholders, systems and elements that are necessary for sovereignty and scaling in a technology field. They must always be based on the analysis of the whole technology architecture and the existing competencies and stakeholders in Europe. These include key technologies, infrastructures, materials, qualifications, services and possible users. An unstructured and small-scale patchwork of support measures and individual initiatives should be avoided at all costs. → 🇪🇺 3,5% 🇩🇪

On the whole, the Federal Government has to urge all stakeholders to apply excellent research results more widely for the benefit of society. (See central topic: *Initiative for freedom of technology transfer – promotion of knowledge-intensive start-ups*). Resilience and technological sovereignty require a critical market size or scaling of innovations. Policymakers, business and science should commit to joint efforts in an innovation pact, which ensures achieving the 3.5 percent target by 2025. In order to achieve higher R&I investment in business, especially for scaling up pilot projects and prototypes, suitable incentives have to be set. Sustainability-oriented deregulation in key innovation fields, such as mobility and the energy industry, is important. Regulatory measures should be reduced to a required minimum and other political obstacles to innovation, including complicated funding models, bureaucratic procedures and long decision-making periods, need to be removed. Within the framework of the European Green Deal and economic stimulus packages, the government must call for European innovation and infrastructure projects and promote them together with business, science and society in order to develop lead markets for future technologies and sustainable innovations in Europe. → 🇪🇺 3,5% 🇩🇪

Basic research remains the foundation for the knowledge society and makes a significant contribution to technological sovereignty and resilience. Specifically in times of tight budgets, the Federal Government needs to allow science sufficient financial and structural freedom. However, the knowledge and technology transfer to society must be encouraged more strongly via success-based incentives. → 🇪🇺 3,5% 🇩🇪

Resilience describes the abilities of societies and organizations to prepare for sudden and hard-to-predict adverse events (shocks and crises), to cope with them and, based on the experience gained, to adapt and improve their systems for foresight and provision. In some areas, resilience issues overlap with technological sovereignty issues.<sup>1</sup>



**“The pace at which technologies and their applications change is significantly higher than that of our innovation processes. Not only do we need to find the right framework, we will only be successful if we can increase or keep up with this pace.”**

Frank Riemensperger

Technological sovereignty means the ability of a state or federation of states to provide and develop technologies that it defines as critical to its welfare, competitiveness and ability to act, or to obtain them from other economic areas without unilateral structural dependence. Sovereignty requires competencies to test, deploy, improve, and develop new technologies.<sup>2</sup>

It is not only when crisis strikes that science takes on an advisory and formative role. Science is key to modern foresight systems and provides valuable insights into dealing with risks and uncertainties. There is a need to significantly strengthen research into foresight and resilience, in particular, the development of models and simulations that combine scientific with societal and economic perspectives. Furthermore, the Government should promote the regular exchange of ideas about precautionary measures, preparation and resilience between policymakers, science, business and society, for example in open science and foresight projects. (See central topic: *Participation as a strategic instrument of innovation policy*)



## Promoting digital sovereignty

The Federal Government should advocate a European digital strategy that promotes technological independence and security for all Member States. In this case, the entire technology architecture must be taken into account. Only if the areas of software, hardware, ecosystems, connectivity and raw materials are considered holistically, can providers and competencies be promoted in a targeted manner and technological sovereignty in Europe thus be achieved.



The High-Tech Forum emphasizes that innovation-friendly framework conditions are necessary for developing digital ecosystems. In particular, the Federal Government should improve competition law so that it enables scalable digital business models and ensures a fair exchange between stakeholders. For a common European research and data space, the Federal Government should push for synergies and interfaces of the National Research Data Infrastructure (NFDI) and the European Open Science Cloud (EOSC) with the GAIA-X data infrastructure project.



Future competition in the digital economy will be decided by data availability and data access as well as digital business models. The High-Tech Forum recommends creating more opportunities for data-driven application models. The state should lead the way here as a model for a culture and practice of controlled opening. At the same time, citizens' sovereignty over their personal data must be preserved or established in the first place. (See central topic: *Participation as a strategic instrument of innovation policy*)



## Strengthening future competencies and qualification

Foresight, resilience and technological sovereignty require competencies and qualifications other than those being taught today. For this, education and training need to be systematically enhanced in Germany. New requirements and future competencies should be defined in a regular dialogue between companies, training providers, social partners, ministries and the chambers of industry and commerce. Consequently, appropriate educational offerings for all phases of learning have to be developed and rolled out.



Reading, writing, arithmetic – digital literacy: Confident use of digital technologies and data has developed into a fourth basic skill. At the same time, non-digital skills such as creativity, adaptability and entrepreneurial thinking are highly important. Teachers and learners must be better enabled to deal with current and future challenges. The High-Tech Forum calls for new curricula, an appropriate digital infrastructure alongside professional equipment and support in teaching, for example establishing IT service desks or online education officers.



Around

60%

of Germans think that it should be as natural for schools to teach programming as it is to teach arithmetic or writing.

Around

70%

of Germans think that computer science/informatics should become a compulsory subject in school.

N=1012 respondents

Source: Representative survey conducted by Bitkom Research on behalf of the digital association Bitkom, 2018, available at: [www.bitkom.org/Presse/Presseinformation/Drei-von-vier-Buergern-wollen-Bildungsfoederalismus-abschaffen.html](http://www.bitkom.org/Presse/Presseinformation/Drei-von-vier-Buergern-wollen-Bildungsfoederalismus-abschaffen.html)



**“Well-educated people are better equipped to deal with change and uncertainty. They make our companies innovative and fit for global competition. The German education and training system must be modernized in such a way that it includes everyone and prepares them for lifelong learning.”**

Dr. Marion Jung

Continuing education must become an integral part of (working) life and better adapt to people's circumstances. For example, more and more people are using time-flexible formats such as web tutorials, podcasts, online courses (MOOCs) or digital coaching. The Federal Government, with business and education providers among others, should analyze the respective need, derive new offerings and (further) develop trustworthy certifications for these formats.



The state should enable everyone to participate in new technologies and innovations. This requires innovative programs and initiatives even for groups in socially weaker positions or with lower levels of education. Clear incentives are needed to ensure that people use periods of short-time work or unemployment for further training or retraining in future competencies. At the same time, there should be stronger promotion of qualification around so-called “system-critical” and bottleneck occupations.



## Promoting international partnerships for resilience and technological sovereignty

In Europe, there is a need to develop and implement common resilience strategies for critical areas of provision. In addition to traditional fields of provision, this particularly applies to digital systems, basic data provision and security, and new value creation models. They are to be bolstered or complemented by national strategies. Resilience entails additional costs which have to be justified by the societal goals it pursues, such as additional costs for securing education, nutrition, health and environmental protection.



Against the background of geopolitical competition, multilateral agreements in innovation policy, for example on technology standards, security considerations or research ethics, are gaining importance. The government should encourage and promote the participation of German stakeholders in such international fora and working groups to a greater extent.



In terms of the strategic capacity to act and the avoidance of structural dependencies on particular countries, there should be further support for expanding international R&I partnerships. As a global economic player, Germany also has an interest in and a certain responsibility to support and empower countries with lower innovation capacities.



Around

80%

of German companies see digital sovereignty as an important location factor.

N=500 decision-makers surveyed in companies.

Source: Representative survey conducted by YouGov on behalf of eco – Association of the Internet Industry – among 500 corporate decision-makers from various industries, available at: [www.eco.de/presse/mehrheit-der-deutschen-unternehmen-ueberzeugt-digitale-souveraenitaet-sichert-wirtschaftsstandort-deutschland/](http://www.eco.de/presse/mehrheit-der-deutschen-unternehmen-ueberzeugt-digitale-souveraenitaet-sichert-wirtschaftsstandort-deutschland/)



**“Europe is our future. We must aspire to be at the forefront of new technologies. This also means expanding our competencies, for example in the areas of AI, high-performance computing and 5G.”**

Prof. Dr. Sabina Jeschke

### Referenzen

- 1 Based on: Fifth innovation dialogue in the 19th parliamentary term: Resilience of supply chains and value creation networks
- 2 Edler, J., et al. (2020). Technological sovereignty. From demand to concept. Fraunhofer Institute for Systems and Innovation Research

Central topic

# Agile research and innovation funding



More knowledge, more stakeholders, more complexity, more speed: Research and innovation funding must cope with a constant "more" in various dimensions. Policymakers are expected to timely address societal, technological and environmental changes and help shape them proactively. Greater innovative strength and agility in public administration and in the entire innovation system are considered a basic requirement for this.

Ministries and public institutions face conflicting tendencies. While increasing uncertainties and rapid changes highlight the limits of long-term planning and fixed structures, a reliable state precisely depends on them. However, it is possible to solve this dilemma, as the early handling of the COVID-19 pandemic in Germany showed. More agile than ever, government agencies broke new ground by thinking in terms of challenges instead of public authority boundaries, government levels, and budget items, and by bringing in outside expertise where necessary. This agility emerged from the hardship of the crisis, was sometimes too hectic and dwindled as time passed. In future, agility must become the norm.

Agile government approaches can improve agenda setting as well as policy formulation and implementation, and they can strengthen the innovation capacity of all stakeholders. The High-Tech Forum recommends that the Federal Government take the following steps to provide the necessary stimuli and framework conditions.

## Promoting government agility and innovative strength

Agility requires a comprehensive cultural change and particularly modernization of human resources policies in public administration. Currently, it is difficult to assess the innovative strength and agility of the German public administration due to lack of data. A future innovation strategy should promote ambidexterity and, to this end, establish and fund regular innovation measurements (e.g., innovation barometers), agile implementation projects and government incubators, as well as coaching on agile leadership in public administration.



## Establishing the public sector as an innovative procurer

Federal, state and local governments too rarely use their purchases as a funding lever for future technologies and innovations. The High-Tech Forum emphasizes the need to analyze and report public procurement statistics with regard to innovation procurement. Based on this, innovation-oriented public procurement strategies should be developed. On the one hand, the High-Tech Forum recommends that government agencies define sustainability and innovation as strategic procurement goals and report regularly on their achievement. On the other hand the Government should set measurable targets for applying modern procurement methods. In particular, agile procurement approaches, such as pre-commercial procurement (PCP) and public procurement of innovative solutions (PPI), should be used more frequently and developed further.



## Opening up funding programs

To date, research and innovation funding programs have covered a limited share of the economy and an even smaller portion of society. It should be examined whether additional innovation potential can be leveraged by opening up funding programs more widely to new groups of stakeholders. In particular, small businesses often with outstanding craft skills, start-ups with new ideas and civil society stakeholders with a special understanding of problems and needs in society have been given too little consideration so far. If more and possibly less experienced stakeholders participated, it would still be necessary to provide the funding programs with additional resources for mentoring, project coordination and results processing.



In politics and business, **agility** is associated with a cultural change toward greater initiative, responsiveness, customer orientation, learning ability and adaptability, especially of bureaucracies and systems. Agility in politics and public administration means that interdepartmental teams are increasingly being deployed to deal with and help shape new trends quickly and according to needs. Business, science and society are being actively involved in developing and shaping innovation policy. The focus is on the needs of innovators, grantees and users of public services or society.<sup>1</sup>



**“In times of rapid developments and radical technological changes, as well as global pandemics like the one we are currently experiencing, Germany needs an innovation system that is distinguished by responsiveness, creativity and adaptability.”**

Prof. Dr. Holger Hanselka

## Setting up agile research and innovation funding

Public programs and tenders must be managed in a leaner, more flexible and more goal-oriented manner. →

### The recommendations for this are:

- Simplified and above all digital application procedures
- Rapid processing times and ongoing agile support
- Longer-term, goal-oriented programs with agile elements, particularly with tranche-based disbursement of funds in advance, as well as per milestone achievement, while at the same time allowing project plans to be adjusted in an agile manner within a reasonable target corridor
- Targeting “smaller” and new players with more funding formats that are low-threshold and technology-neutral such as prototype funding or competitions
- Lean evaluation and reflective accompanying research
- Considering knowledge and technology transfer in society and business from the outset, by using appropriate funding conditions and structures; enabling co-financing by private investors (See central topic: *Initiative for freedom of technology transfer – promoting knowledge-intensive start-ups*)



**“Innovations ultimately originate in creative minds that combine a wide range of expertise and experience. This is also why professionals should sometimes switch between the spheres of science, business and politics.”**

Prof. Dr. Birgitta Wolff



**In future, agility must become the norm.**



**“We need new, agile formats, such as living labs, so that science, business, society and politics can try out new things together and develop the most suitable framework conditions for innovations.”**

Prof. Dr. Reimund Neugebauer

## Expanding living labs and experimental spaces

For the application and commercialization of new and converging technologies, such as artificial intelligence, bio-IT, blockchain or quantum technologies, it is often necessary to define the appropriate framework conditions and regulatory approaches. Living labs or experimental spaces provide the opportunity to develop and test the conditions and regulatory requirements for using new technologies and innovations initially in protected spaces with all stakeholders. The Federal Government has clarified that experimentation clauses can be used for living labs and has developed a working aid for formulating legally secure experimentation clauses.<sup>2</sup> Now it should build capacity for such living labs, strengthen their financing and promotion and expand the areas of funding beyond energy research.

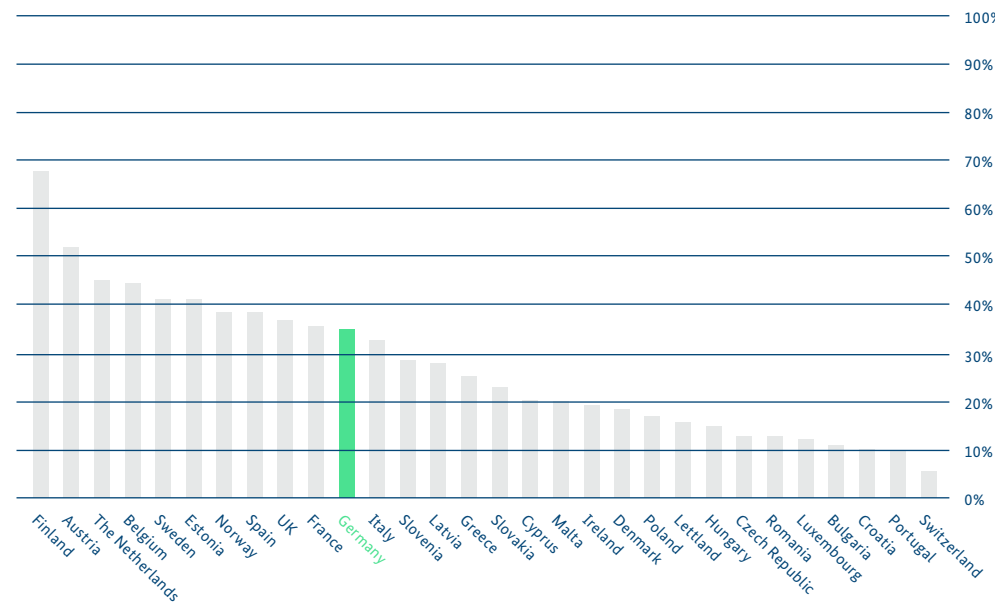
→ 35%



**Living labs for energy system transformation in Germany**

Source: Federal Ministry for Economic Affairs and Energy: Implementing the energy transition in practice. Living labs for energy system transformation

## Innovative procurement: Need to catch up in Germany



**34%**

Germany exploits only 34% of the opportunities provided by innovative public procurement.

Source: European Commission, Directorate-General for Communications Networks, Content & Technology (2019): The Strategic Use of Public Procurement for Innovation in the Digital Economy. Available at: DEcountryreport\_12-10-2020\_newcover\_v10pdf.pdf, page 4: www.upravno.pravo.blog/wp-content/uploads/2019/08/Comparativeanalysisofcountryperformancespdf-2.pdf

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1 High-Tech Forum (2020): Agility in the innovation system. Discussion paper

2 Federal Ministry for Economic Affairs and Energy (2020). Recht flexibel. Working aid for formulating experimentation clauses

Central topic

# Initiative for freedom of technology transfer – promotion of knowledge-intensive start-ups



A central goal of the knowledge and technology transfer is to pass on information and data, inventions and ideas from science in such a manner that companies can use them to develop marketable technologies, products and services and, in terms of societal goals, also bring effective innovations into use as a result. The transfer of knowledge and technology from science to business, referred to here as “technology transfer”, is the task of universities and public research establishments.<sup>1</sup> However, for years it has been considered that the results and the efficiency of this transfer need improvement in Germany and Europe (European paradox). This is particularly true for the transfer path of knowledge-intensive spin-offs and start-ups.<sup>2, 3, 4</sup>

The High-Tech Forum has addressed issues relating to the promotion of knowledge and technology transfer and the “venture and start-up culture” in various advisory papers. Spin-offs and the promotion of knowledge-intensive start-ups are an important path for technology transfer. Particularly in the area of future technologies and sustainable innovations, knowledge-intensive spin-offs and start-ups are vitally important for resilience, technological sovereignty, industrial transformation, and achievement of the Sustainable Development Goals. In Germany, the start-up rate in these areas is too low by international comparison with the most innovative countries.<sup>5, 6</sup>

A number of political and legal framework conditions that impede the transfer to knowledge-intensive start-ups became apparent during the High-Tech Forum deliberations. For this reason, the High-Tech Forum proposes an initiative for more freedom of technology transfer that focuses on these aspects. They are important, but not sole, elements for encouraging more knowledge-intensive start-ups.

The recommendations thus complement the improvements proposed in previous advisory papers with regard to activating venture and growth capital, stronger networking of science, business and society, opening up science and innovation, and building up entrepreneurial skills.

Based on the basic ideas of the “Freedom of Science Act”, this initiative aims to create clear political goals and encouraging framework conditions for spin-offs and knowledge-intensive start-ups in Germany. As not all research institutions and universities already have the strong start-up culture that is necessary to provide startup-friendly conditions special efforts are needed in these institutions. → 3,5% 🧪 🌱 🏢 📊

The High-Tech Forum recommends the following key points for the initiative:

## Strengthening all technology transfer paths for SMEs in Germany

All transfer paths are very important for the economy and society. They must be supported politically and promoted in a results-oriented manner. In Germany, the contribution of SMEs to overall economic innovation performance is declining and threatens to decline further as a result of the COVID-19 crisis.<sup>4, 6, 7</sup> The Federal Government’s future innovation strategy must therefore set clear priorities to substantially strengthen technology transfer to small and medium-sized enterprises (SMEs) and knowledge-intensive start-ups. The politically expressed desire for more technology transfer to business must not, however, result in the restriction of scientific freedom in basic research. In principle, it is the scientific institutions that select the paths and conditions for technology transfer.

In the future innovation strategy, the transfer tools of all scientific institutions are to be further developed in a results-oriented manner. The agreements of the Pact for Research and Innovation are to be implemented.<sup>8</sup> Universities should be systematically supported in their efforts to strengthen technology transfer and entrepreneurship. Successful transfer models and strategies, particularly for small and medium-sized businesses, should be evaluated and rolled out across Germany. Further professionalization of technology transfer is to be promoted. Strong funding support for validations (e.g. prototypes) and demonstrators is important for making the economic potential of inventions and new technologies more tangible for start-ups and SMEs. The Federal Government should further use its funding policy to put incentives in place for cooperative value creation with SMEs in order to leverage government-funded programs with a clear application focus. → 3,5% 🧪 🌱 🏢 📊

**Spin-offs** are based on intellectual property and other results of the research establishment, which in turn has a direct (shareholding) or only indirect (through researchers) interest in the company. The transition from non-profit research activity to economic activity is often fluid.



**“Germany’s research is world-class in many areas. Far too often, however, the results of research do not find their way into business and society. We need more incentives and better framework conditions for spin-offs and more recognition for application-oriented research so that high-quality ideas become innovations.”**

Prof. Dr. Katharina Hölzle

Start-ups is an umbrella term for young companies which are based on an innovative business idea and aim for rapid growth. **Knowledge-intensive start-ups** seek to leverage the expertise, infrastructure and/or intellectual property of a scientific institution.

## Transfer culture: Political narrative and clear objectives to encourage spin-offs and knowledge-intensive start-ups

Technology transfer via spin-offs and start-ups requires that young companies have access to the research establishment's intellectual property (IP), resources and expertise. The scientific institutions can negotiate the conditions under which these accesses are granted.<sup>10</sup> However, political expectations and legal framework conditions regularly result in goal conflicts in this area. On the one hand, public research organizations should motivate companies to pick up more results of publicly funded research by offering the most favorable conditions possible<sup>8</sup>, while on the other hand the highest possible monetary return should be achieved for the public investments (e.g. in accordance with budgetary law requirements). Particularly in the case of spin-offs, research establishments worry about discriminating against start-ups, losing top talent, or not having a big enough stake in future success of the spin-off. Technology transfer also generates costs that are usually not covered in the short term by exploiting intellectual property, especially in the case of spin-offs and start-ups.<sup>11</sup>

The High-Tech Forum recommends a new political narrative for the transfer to spin-offs and knowledge-intensive start-ups. To this end, it is important to promote an encouraging transfer culture that aims to work with founders to get knowledge-intensive start-ups off the ground in such a way that they can be successful. Spin-offs and start-ups serve important societal goals of publicly funded science. The measure of success in spin-offs and start-ups should not be the naturally uncertain exploitation income or return of funds, but the contribution of science to innovations, new companies and jobs, as well as to solving the grand challenges facing society. Research and transfer institutions should be measured against the achievement of these longer-term goals and funded accordingly. To achieve this, the federal and state governments must also resolve existing goal conflicts, e.g. with budgetary or funding law requirements.

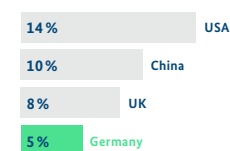
## Promotion of knowledge-intensive start-ups as a non-profit objective

Until now, universities and research associations have derived their non-profit purpose exclusively from their social mandate to conduct research and development. This is a statutory purpose recognized as non-profit-making as defined by Section 52 of the German Tax Code. However, if the institution fulfills its politically formulated mission of offering technology transfer in the form of start-up consulting and support, it leaves the territory of non-profit status. The goal must be to be able to offer support for spin-offs in the pre-start-up phase free of charge in universities and public research organizations as part of institutional start-up support.<sup>12</sup> The High-Tech Forum recommends examining whether including a non-profit purpose of "supporting knowledge-intensive start-ups" in Section 52 of the German Tax Code would provide more room for maneuver for technology transfer in the pre-competitive and pre-start-up phase. Alongside research and teaching, the promotion of knowledge-intensive start-ups and entrepreneurship should be recognized as an important, non-profit mission of universities and public research establishments. Corresponding consideration in the law on non-profit organizations would be a widely visible political contribution to a cultural change in the direction of a "start-up and venture culture" in Germany. Integration in the law could make it possible for pre-competitive and initial start-up support services (e.g. education, training, consulting, use of infrastructure, proof-of-concept) to be conducted on a non-profit basis. This would have the advantage of significantly simplifying the spin-off process for scientific institutions and start-up teams because there would no longer be any need to refund (or negotiate) pre-start-up services via company shares or payments.

Transfer conditions that are transparent, comprehensible and fair for all parties (e.g. higher risk means greater opportunity for return) are considered **start-up friendly**. In the start-up phase, pragmatic solutions which protect liquidity are particularly critical in order to enable funding and growth of the company. This means, for example, foregoing high one-off payments at the beginning and agreeing on performance-based instead of fixed payments. Since the level of uncertainty regarding the business model and future development is high when the contract is concluded, the recommendation is to provide dates in the contract for subsequent improvements. There are many contractual options for implementing start-up friendly conditions, particularly by combining payment modules. This variety should be preserved for the founders' benefit. What is important is the common desire of the contracting parties to get the spin-off underway quickly, in a legally compliant manner, and as sustainably as possible.

**Entrepreneurship** refers to being a founder and the associated entrepreneurial thinking and action of individuals

### Entrepreneurship in international comparison



Percentage of those aged 18-64 who started and/or are starting a business during the last 35 years.

Source: Global Entrepreneurship Monitor – Country report Germany 2017/2018, Global Entrepreneurship Monitor Global Report 2017/2018

## Clarification of the rules on EU state aid law and harmonization of the law

During the start-up phase, scientific institutions, founding teams and investors must agree on terms of use and transfer of intellectual property and other resources. They operate here within a complex legal framework. In principle, EU state aid law as well as budgetary and funding law impose tight limits on support for research establishments after a company is set up or in cooperation with SMEs, limits that often impede effective technology transfer. However, there is legal room for maneuver for establishing start-up-friendly conditions in the technology transfer to knowledge-intensive start-ups and not all research and transfer institutions make best use of this. Time and again, this leads to uncertainties regarding interpretation of the rules and associated delays and irritations during contract negotiations. In Germany in particular, the length of negotiations appears too long by international standards.<sup>13</sup> Valuation of the young company and assessment of the necessary returns for the (mostly) exclusive transfer of intellectual property gained during employment in the scientific institution are based on the criterion of prevailing market price. However, interpretation of the prevailing market price (EU state aid law) and the valuation of a spin-off, particularly if there is not yet a market for a technology/invention, vary greatly depending on research establishment and contracting parties.<sup>14</sup> This results in opacity, uncertainty and inefficiency in the transfer process and can have a deterrent effect on the group of potential founders.

The Federal Government should work to ensure that clarifications are included in the R&D&I Community framework (Community framework for state aid for research, development and innovation) that regulate the transfer or use of intellectual property and infrastructure to knowledge-intensive start-ups. In particular, this should address the following issues: a) selection of the spin-off/start-up as (exclusive) user, b) start-up-friendly conditions, and the question of c) who bears the economic risk. This must be harmonized with national law (especially budgetary law at federal and state level).

## Handouts and start-up-friendly template agreements

The expectations of founders, investors and scientific institutions are clarified at an early stage by simplifying and disclosing start-up-friendly and legally compliant contractual terms for the transfer of intellectual property and other resources.<sup>15</sup> Template agreements or standardized templates are already being used, in the USA for example, to speed up negotiations and to save financial and staff resources.<sup>16</sup> The Federal Government should support scientific institutions in Germany with formulating guidelines, template agreements and handouts which make legally compliant and conducive terms for using intellectual property and resources by spin-offs and start-ups transparent. A start has been made by the German Rectors Conference's handout about applying the de minimis rule in EU state aid law,<sup>17</sup> as well as the development of a guide on the marketing of intellectual property to spin-offs<sup>18</sup>, an IP toolbox and a process guide for EXIST grants. These efforts should be expanded and give equal consideration to the needs of different transfer organizations, start-up teams and investors. The conditions should be designed to be start-up-friendly and science institutions should be rewarded for efficient start-up processes.

### Ranking of strong start-up universities in Europe

1	University of Cambridge, UK 529 companies 421 founders
2	London School of Economics, UK 329 companies 267 founders
3	University of Oxford, UK 327 companies 242 founders
10	Technical University Berlin 193 companies 197 founders
13	Technical University München 176 companies 213 founders

The ranking shows the number of business start-ups since 1990.

Source: European Startups (www.europeanstartups.co), accessed on 15.10.2020



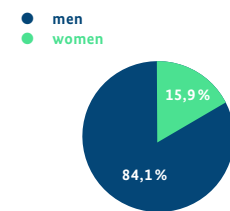
## Flexible science careers and encouraging spin-offs and start-ups

For most researchers in Germany, company start-ups are a novelty and often represent a break from their previous (scientific) career. However, in high-tech areas their importance is increasing, particularly internationally. The perceived role conflict between science and entrepreneurship is one of the biggest personal barriers to spin-offs in Germany.<sup>5</sup> Following international models, scientists closely involved in a spin-off should have the opportunity to devote up to 50 percent of their time to the spin-off for one to two years. A research establishment or university should issue rules on the extent to which this can be done. During this time, they will work with the startup's research team to develop the technology and expertise, and then hand it over to the startup's management team (CTO or CEO). After this phase, they will return to research but retain for example a minority shareholding in the start-up. Researchers from the scientific team will often move entirely to the start-up team.<sup>19</sup> The science unit will benefit from the valuable expertise of its researchers<sup>20</sup> and from the development of a start-up ecosystem around the unit.

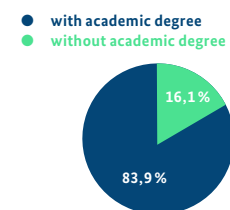
Scientific founders should be offered collective agreements and compliance regulations which are based on international practice and which are becoming increasingly vital for the recruitment of top talent. This allows researchers to be involved in (multiple) companies according to their expertise while at the same time continuing their scientific track record. As is customary internationally, scientists can act on the Scientific Advisory Board and/or hold a virtual/silent minority shareholding in the company. Greater consideration and reward should also be given to transfer and spin-off experiences in scientific careers. If spin-offs fail, options for returning to public research are opened up by international role models to avoid career breaks for people with first-class training. It should also be possible to do this in Germany. When spin-off/start-up processes are positive and based on partnership, long-term relationships and networks emerge, including exciting jobs for graduates and future collaborations and research assignments. They represent indirect returns from investments in technology transfer activities.

### Who are the founders?

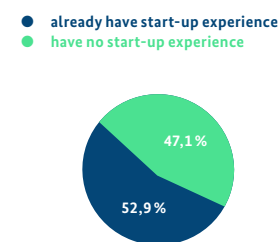
#### Women are underrepresented



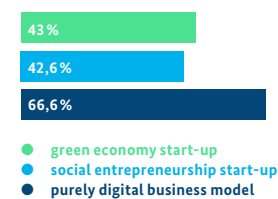
#### High level of education



#### Start-up experience



#### Business models promoting sustainability and innovative capacity \*



\* Multiple answers possible

Source: German Start-up Monitor 2020: Innovation statt Krise. Bundesverband Deutsche Startups e.V., available at: [www.deutscherstartupidmonitor.de/wp-content/uploads/2020/09/dsm\\_2020.pdf](http://www.deutscherstartupidmonitor.de/wp-content/uploads/2020/09/dsm_2020.pdf)

## Accompanying research and benchmarking on start-up activity

In Germany, there are a many different formats for start-up grants as well as different transfer organizations and practices. The budgets for start-up support come predominantly from third-party funds and are accordingly volatile.<sup>21</sup> This heterogeneity leads to unequal conditions and requirements for founders. There have been too few initiatives to date for assessing the overarching transfer culture and the success of various spin-off and start-up support programs, for making them visible and increasing the implementation of good practices.

The Federal Government should promote a systematic survey of the propensity to start-up and perceptions of start-up support in science, as well as of start-up activity.<sup>22</sup> To improve start-up support and transfer practices, it is also essential to document and compare existing support schemes, funding allocations, spin-off practices and results from research institutions within Germany and in comparison with leading international institutions.



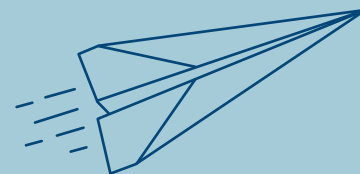
**“I would like to ensure that the challenges facing innovative, young companies are understood and that support options in the innovation system are adjusted accordingly.”**

Julia Römer

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# Further developing the innovation culture in Germany together



Against the background of ongoing discussions on how to better reconcile foresight and innovation, the High-Tech Forum, in its discussion paper “Paths to the 3.5 percent target”, recommended that a stakeholder process be set up to address the question of what a responsible framework for innovation might look like. Consequently, in 2020 we held two digital stakeholder dialogues on the topic of how to align innovation and precaution. Twenty-two experts from science, business, politics and civil society took part in these dialogues. The results of these two dialogues were agreed with all participants and summarized in an ideas paper. The High-Tech Forum would like to put the interim results of this on record and contribute to further developing the innovation culture in Germany. This form of consultation processes and dialogues should also be continued in the future in order to learn from each other, and to jointly plan and advance concrete implementation measures.



**“Municipal role models should be given greater encouragement. We need beacons for systemic change.”**

Prof. Dr. Günther Schuh



**“We must provide opportunities for innovation and permit bold action.”**

Johannes Oswald



**“We need an Enlightenment 2.0 where we put systemic thinking in the foreground. Not only in initial training, but in the education and training of senior executives in the administrative and political system.”**

Prof. Dr. Patrizia Nanz



**“There is an urgent need to further develop strategies and options for international collaboration with other economic zones, such as Africa and Asia.”**

Prof. Dr. Antje Boetius



**“In the future, competitiveness will be decided by the interaction between innovation and regulation. We must therefore move away from regulation that prohibits and toward regulation that rewards sustainable innovation on a large scale.”**

Dr. Martin Bruder Müller

## Ideas paper

### An open innovation culture for sustainable provision for the future

An open innovation culture for sustainable provision for the future.  
Recommendations for further developing a sustainable innovation strategy

Innovation can provide answers to major challenges. However, the use of new ideas and practices, understood as innovation, is always accompanied by questions: Which innovations can solve problems sustainably and quickly? Who produces innovation and what is its effect? What role do citizens play in the interaction between science, business and the state? Anyone wanting to strengthen sustainable development and competitiveness in equal measure in Europe in order to survive in the global innovation competition needs a new innovation culture which enables openness and agility and is at the same time committed to providing for the future. Openness to innovation and precaution for the future are mutually reinforcing.

Civil society, business, science and politics should engage together in order to utilize technical and social innovations for sustainable development. This idea was developed in two stakeholder dialogues, together with participants from science, NGOs, business and politics. Recommendations are given below on how innovation and precaution can be systematically aligned towards a sustainable innovation strategy. This requires the courage to leave old paths and try out something new.

The participants of previous dialogues would like to see the dialogue continue with the involvement of other stakeholders to amplify and give tangible form to the recommendations.

To promote an open innovation culture, the Federal Government should:

#### 1 Create space for experiments

An open innovation culture needs scope to develop. If the Federal Government promotes experimental spaces broadly and in many different ways, it will be possible to accelerate research and development processes and their application, make them more flexible and reduce bureaucratic burdens. At the same time, the spaces will provide the opportunity to open up innovation processes to new stakeholders. Companies, scientific organizations and civil society stakeholders can use these spaces to jointly co-develop technology and regulation within a responsible framework, as well as to test their benefit to society.

Openness means trying out and being able to make mistakes. Precaution for the future means being able to do this under transparent and responsible framework conditions. Openness to innovation therefore requires taking a fresh look at the opportunities of and for responsible innovation. The basis for this is a set of basic values (including sustainability), a strong technology base and clear provisions. Within these framework conditions, it must be possible to articulate values and cooperatively define and solve problems. The necessary future investment in innovation is considerable and requires societal consensus.

Images of the future are drafted on a local scale, bottom-up or out of society, so that concrete benefits may emerge – for the urban district, the municipality or the region, but also beyond.

There is a need to further explore the potentially conflicting tensions around the demand for scalability on the one hand and local embeddedness on the other. Citizens are the key stakeholders shaping their future. The state should align its science and innovation policy with the development of these multi-layered and jointly developed images (“Leitbilder”) of the future. In this way, a sustainability-oriented innovation culture can ensure prosperity, promote social progress and achieve environmental compatibility.

## 2 Strengthen the interplay between local and international level

An open innovation culture is a European joint effort. Shaping it requires consistent governance of innovation processes and the cooperation of all political bodies, from EU level to municipality. Embedding European thinking locally and making it globally effective requires international partnerships and new institutionalized interfaces between society, science and politics to make it possible to practice innovation responsibility in a networked system. The external perspective in the form of an international exchange, e.g. international innovation dialogue, is assumed to be an essential component of German and European science, technology and innovation policy.

At local level, it is vital to empower municipalities and regions as strong innovation partners for sustainable development, e.g. by means of investments and low-threshold funding opportunities. They must be capable of offering solutions to the specific challenges locally. In addition, the Federal Government should consistently develop regional funding and cluster competitions in order to strengthen local, regional and supraregional cooperation between business and science, e.g. via industry networks, transfer and competence centers.

Early and local participation offerings, e.g. in municipal innovation projects, help to better

synchronize societal change and innovation processes. Citizens must be involved in the development of innovation in a much stronger, more transparent and more experienced manner (e.g. using the concept of the citizens’ council). At federal level too, there is a need for new, societal interfaces and institutionalized exchange formats which enable early and long-term (not project-based) participation. This would provide a basis of trust for cooperation between civil society, business and science.

## 3 Focus on systemic innovation

An open innovation culture needs a change of perspective. An innovation policy that is serious about precaution must take the entire innovation system and its effects into account. The Federal Government should strengthen collaboration across the boundaries of sectors and disciplines, both within public administration and with new, external stakeholders. This is the only way to understand societal problems in their complexity and work on them together. This requires new infrastructures and spaces for exchange that bring together innovative forces across organizational and subject boundaries and remain flexibly adaptable. The federal and state governments should promote and evaluate such incubators for systemic innovation and roll out successful models.

Managing the COVID-19 pandemic shows: Innovations such as the rapidly-developed vaccines offer solutions to challenges. The state must set the framework for their use. It can then act accordingly and solve problems if it simultaneously assumes its role model function (e.g. for sustainable procurement), acts agile, and also courageously initiates the exit from non-sustainable structures, technologies, processes and habits beyond established interests. With a view to speeding up processes, the Federal Government should critically review existing funding programs to ensure that they can be implemented quickly and are effective.

An open innovation culture is based on a systemic view of the innovations of and for the future. In education policy, it is necessary to teach the confident use of new technologies (e.g. digital literacy) and to convey skills packages as a complement to individual expertise (e.g. by education for sustainable development) in order to expand the understanding of systemic interrelationships and their design.

An open innovation culture and supporting infrastructures also shed light on a new role for their epistemic and evaluation principles. The

Federal Government should therefore continue its consistent revision of the prosperity indicators and accelerate their implementation. It is the lever for measuring the success of a sustainable innovation policy.

The following participants took part in the discussions and jointly developed the ideas in this paper. They support further discussions to advance these proposals.

The following participants of the dialogues and other supporters of this ideas paper are in favor of continuing the discussions:

### Prof. Dr. Dr. Andreas Barner

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### Prof. Dr. Antje Boetius

Director, Alfred Wegener Institute (AWI)

### Dr. Martin Bruder Müller

CEO, BASF SE

### Ulla Burchardt

Member, German Council for Sustainable Development (RNE)

### Prof. Dr. Holger Hanselka

President, Karlsruhe Institute of Technology (KIT)

### Prof. Dr. Anke Hassel

Professor of Public Policy, Hertie-School of Governance

### Prof. Dr. Katharina Hölzle, MBA

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### Dr. Marion Jung

Managing Director, ChromoTek GmbH

### Jörg-Andreas Krüger

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### Prof. em. Wolfgang Lücke

President (ret.), University of Osnabrück

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### Frank Riemensperger

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### Julia Römer

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### Dr. Werner Schnappauf

Chairman, German Council for Sustainable Development (RNE)

### Prof. Dr. Günther Schuh

Chair of Production Systems and Director of the Machine Tool Laboratory WZL, Aachen University of Technology

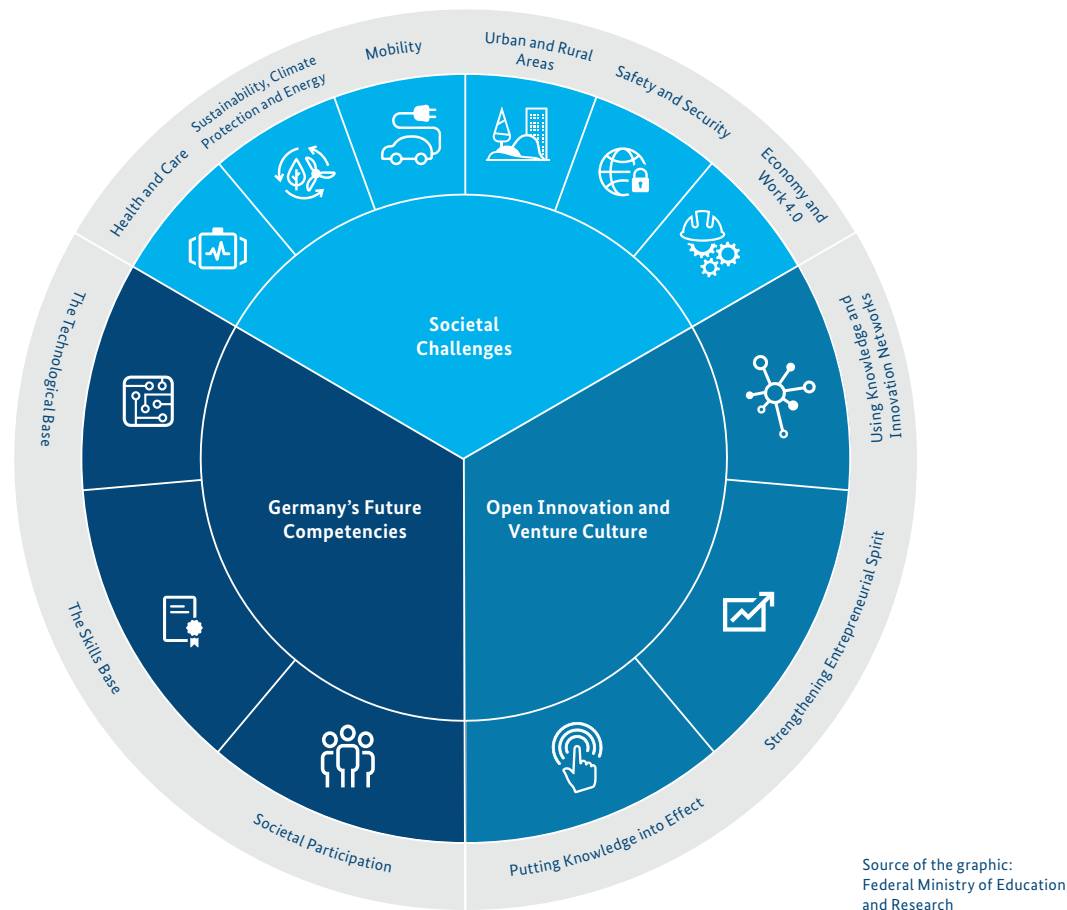
### Prof. Johannes Vogel, Ph.D.

General Director, Natural History Museum

### Prof. Dr. Birgitta Wolff

Professor of General Business Administration, President (ret.), Goethe University Frankfurt am Main

# The High-Tech Strategy 2025



The High-Tech Strategy 2025 (HTS 2025) focuses on three major fields of action:

## 1 Tackling the grand challenges

The Government wants research that is geared to current and future needs and that is relevant to people's everyday lives. Its goal is to achieve technological and non-technological innovations, including social innovations, which focus on benefiting the people. To this end, the Government is developing missions and setting itself concrete goals which unite the support of science, business and society. With the High-Tech Strategy 2025, it is specifically promoting research into issues that are relevant to the German economy and society.

The High-Tech Strategy 2025 is focusing in particular on the areas of "Health and Care", "Sustainability, Climate Protection and Energy", "Mobility", "Urban and Rural Areas", "Safety and Security", and "Economy and Work 4.0". The Government will work on these areas together with all stakeholders in the innovation process.

## 2 Strengthening Germany's future competencies

The Government aims to systematically and consistently evolve future competencies for a progressive Germany. To this end, it is promoting key enabling technologies that also open up new and disruptive innovation potential with their broad range of applications and strengthen the German economy in international competition. At the same time, it

closely dovetails the promotion of research and technology with training and further education, because it is only possible to shape progress with specialists who are equipped for the tasks of the future and can use and further develop new technology.

And Germany relies on committed and enlightened citizens to help shape change and benefit from it in their daily lives.

## 3 Establishing an open innovation and venture culture

Creativity, agility and openness to new ideas are the keys to shaping the society of the future and opening up new perspectives for growth and prosperity. For innovative results, the Government needs innovative forms of co-operation that create spaces for ideas and involve new stakeholders in the innovation process. It is committed to achieving the greatest possible networking and cooperation, because a wealth of perspectives creates space for the development of ideas.

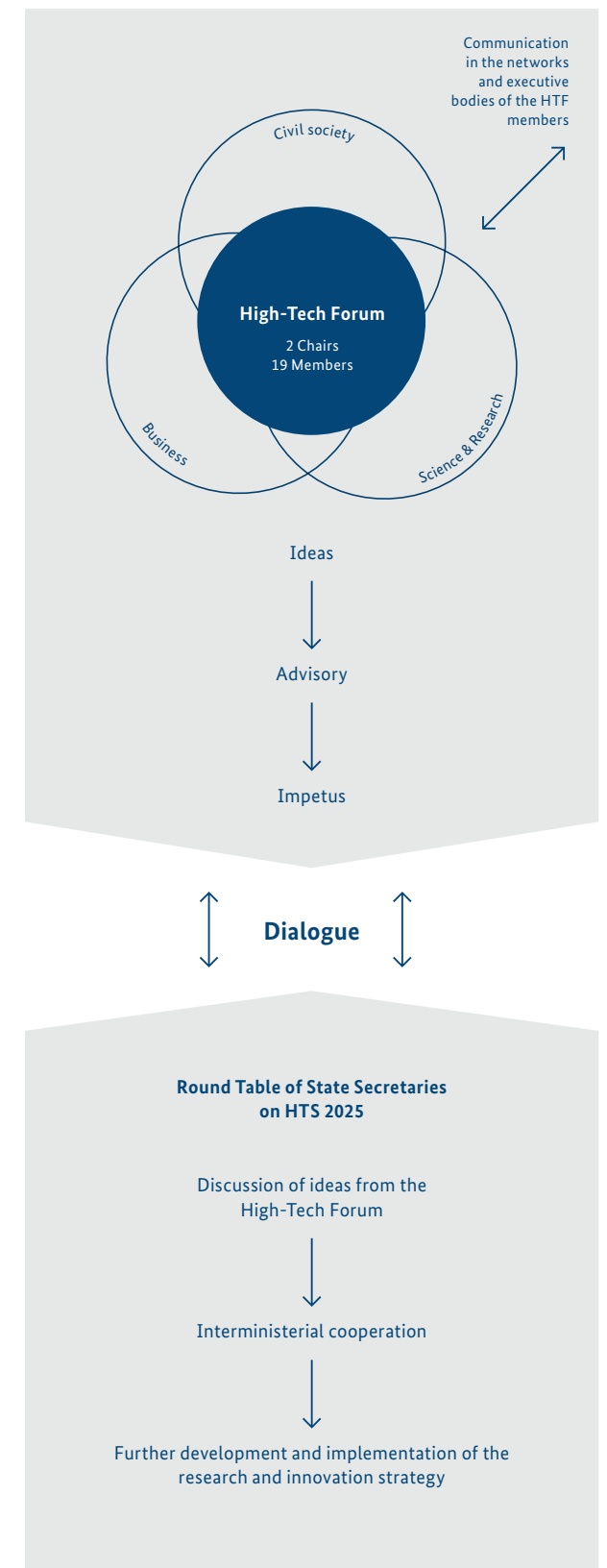
## Governance of the High-Tech Strategy 2025

As an adaptive strategy, HTS 2025 is designed to react quickly and purposefully to changing trends in the innovation system. Implementation and further development of the HTS 2025 is therefore accompanied and supported by the High-Tech Forum, composed from science, business and society. The results of the High-Tech Forum's deliberations are continuously fed into the HTS 2025 round table of State Secretaries. A continuous dialogue between policymakers and the High-Tech Forum is thus established.

The Federal Government coordinates its activities across government departments and actively involves science, business and society in the shaping of its research and innovation policy. The possibility of making adjustments to current technological and societal developments, as well as broad participation, are firmly embedded in the HTS. Governance of the HTS 2025 was established accordingly with the round table of State Secretaries and the High-Tech Forum.

The High-Tech Forum office provides organizational and content support to the co-chairs as well as to the members for the advisory topics on implementing the High-Tech Strategy.

Further information: [www.hightech-strategie.de/en/index.html](http://www.hightech-strategie.de/en/index.html)

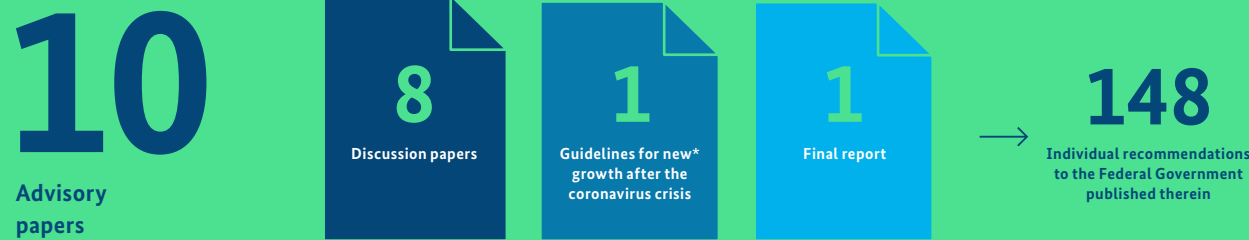


Source: Federal Ministry of Education and Research "The High-Tech Strategy 2025 Progress Report"

# Insights

## The High-Tech Forum and its work

The High-Tech Forum provides a wide range of recommendations to the Federal Government

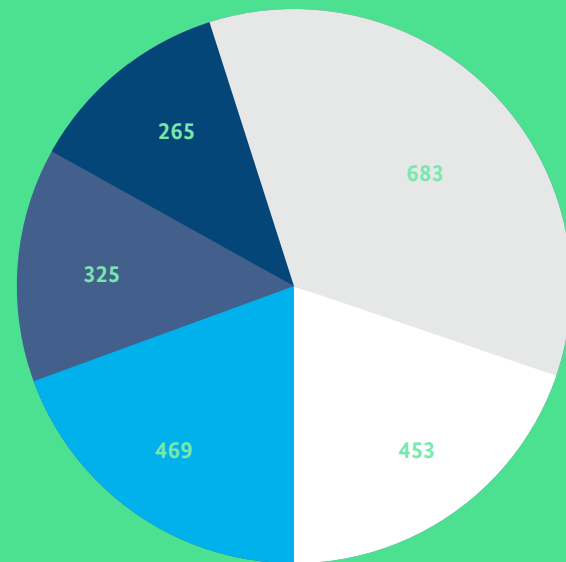


The High-Tech Forum stands for dialogue and transparency

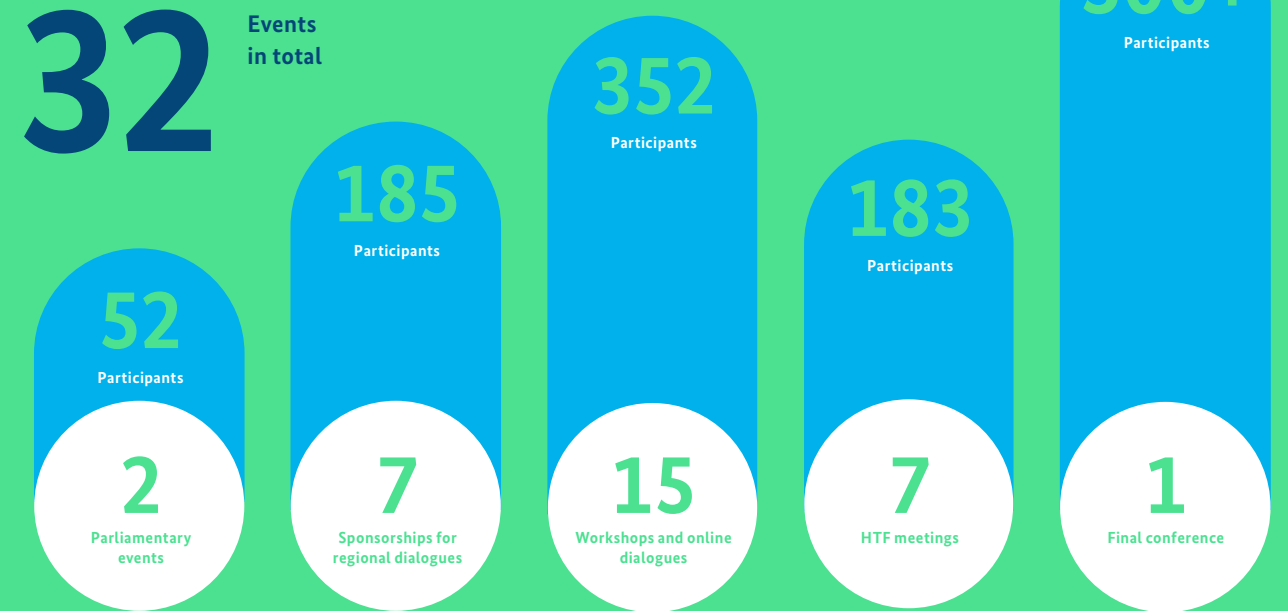
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People in the High-Tech Forum's network

- Policy & Public administration
- Science & Research
- Associations
- Civil society
- Business



The High-Tech Forum works competently in many flexible event formats

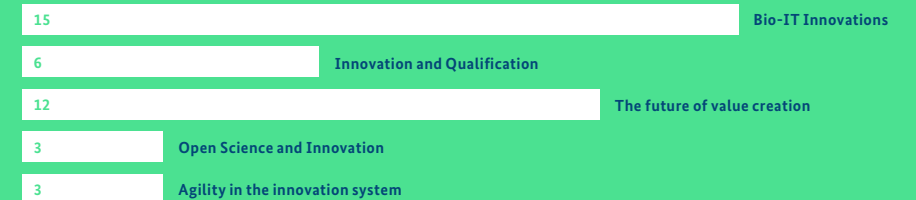


\* Regional dialogues in the BMBF (Federal Ministry of Education and Research) participation process for further development of the High-Tech Strategy 2025 (pilot)

The High-Tech Forum is distinguished by high quality advice

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Expert reports and interviews



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Public comments and opinions



The High-Tech Forum is the central committee that advises the Federal Government on implementing the High-Tech Strategy 2025. Its task is to provide tangible recommendations for implementing and actioning the Federal Government's research policy.

The duration of its advisory activities is tied to the current parliamentary term. Ensuring that the advisory process is transparent and accessible is a key concern of the High-Tech Forum.



“We want to lead the next technological developments. This is why we seek continuous dialogue with science, industry and society. Knowledge is not just an end in itself, but should have the greatest benefit possible for the citizens of our country.”

Christian Luft



Christian Luft, Co-Chair and State Secretary at the Federal Ministry of Education and Research, and other participants during the Parliamentary Evening.



Sixth meeting of the High-Tech Forum, on September 30th 2020 in virtual format.



“Digitalization is helping to mitigate inequalities in many areas. At the same time, however, it also leads to new inequalities, for example in the area of digital education and digital work. As we move toward an inclusive society, it is crucial to recognize and counteract these societal trends.”

Prof. Dr. Hanna Krasnova



High-Tech Forum members in discussion during the HTF's third meeting on November 20th 2019



“The High-Tech Forum makes it possible to bring together different scientific competencies and experience and make them fruitful for technological progress in Germany.”

Prof. Dr. Christiane Woopen



Participants of the workshop "Social innovations in the application field of mobility" in July 2019



The members of the High-Tech Forum during the second meeting at the Federal Ministry of Education and Research



“The High-Tech Forum has, of course, dealt with highly technical issues, but has engaged just as intensively with many different social aspects of innovations. A High-Tech Strategy must unite these two perspectives well.”

Prof. Dr. Manfred Prenzel



Participants in the Parliamentary Evening of the High-Tech Forum, members Birgitta Wolff and Christiane Woopen.

# The members of the High-Tech Forum

The members of the High-Tech Forum



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State Secretary at the Federal Ministry of  
Education and Research



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### Recommendations of the High-Tech Forum

All advisory papers from 2019 to 2021 are available on the High-Tech Forum's website.

[www.hightech-forum.de/en/publications/](http://www.hightech-forum.de/en/publications/)

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