



Federal Ministry
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Ideas. Innovation. Prosperity.

High-Tech Strategy 2020 for Germany

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The Hightech-Strategy for Germany

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High-Tech Strategy 2020 for Germany

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1. Initial situation

Germany is facing one of the greatest economic and financial policy challenges in decades. We need to make the most of existing growth potential and open up new prospects for German industry. As we emerge from the economic and financial crisis, the global race for knowledge is accelerating. The international competition for talents, technologies and market leadership will continue to intensify.

Global challenges such as climate change, demographic development, the spread of common diseases, shortages in the global food supply and the finiteness of fossil raw materials and energy sources require viable solutions. These can only be provided with the help of research and new technologies and through the dissemination of innovations.

Against this backdrop, we want to stimulate Germany's enormous scientific and economic potential in a targeted way and find solutions to global and national challenges. Germany must continue its efforts to open up promising lead markets through innovation, develop these markets through social changes, and thus secure material, cultural and social wellbeing.

2. The High-Tech Strategy – A Successful Model

The High-Tech Strategy is the first broad national concept in which the key stakeholders involved in innovation share a joint vision. It has formulated goals for a wide range of different fields of innovation, defined priorities, and introduced new instruments such as the leading-edge cluster competition and the innovation alliances.

The existing indicators and evaluations suggest that the High-Tech Strategy has had a high mobilization effect:

- R&D investments by industry have increased significantly. In 2008, companies in Germany increased their R&D investments by 7.4 billion euros; in the period from 2005 to 2008, private R&D investments rose by approximately 19 per cent.
- In 2008, the number of researchers, laboratory technicians and other technicians employed in industry increased to 333,000. This means that German industry increased its R&D personnel by almost 12 per cent between 2004 and 2008.
- The R&D intensity (percentage of GDP spent on research and development) reached approximately 2.7 per cent in 2008, the highest level since Germany was reunited.
- The innovation report of the German Association of Chambers of Industry and Commerce (DIHK), which was published in the summer of 2009, shows the positive changes in the innovation environment until the end of 2008: about 30 per cent of all companies attribute their innovations to improved research and innovation policies at federal level.

The High-Tech Strategy has linked up topics in various fields of innovation policy across Federal Ministries. Aspects related to funding are addressed in connection with efforts to improve general conditions. Individual fields of technology are seen as contributions to realizing important social policy aims or as innovation drivers for other fields of technology (“key technologies”), while social change is considered to be an important prerequisite for the generation of technological knowledge. This integrative approach has received a great deal of international recognition and broad support in the research community and the private sector.

The Federal Government is now presenting an updated version of the High-Tech Strategy. The aim is ensure continuity in the overall approach of the High-Tech Strategy and at the same time to update it by making certain modifications, focusing on specific topics and engaging in social dialogue.

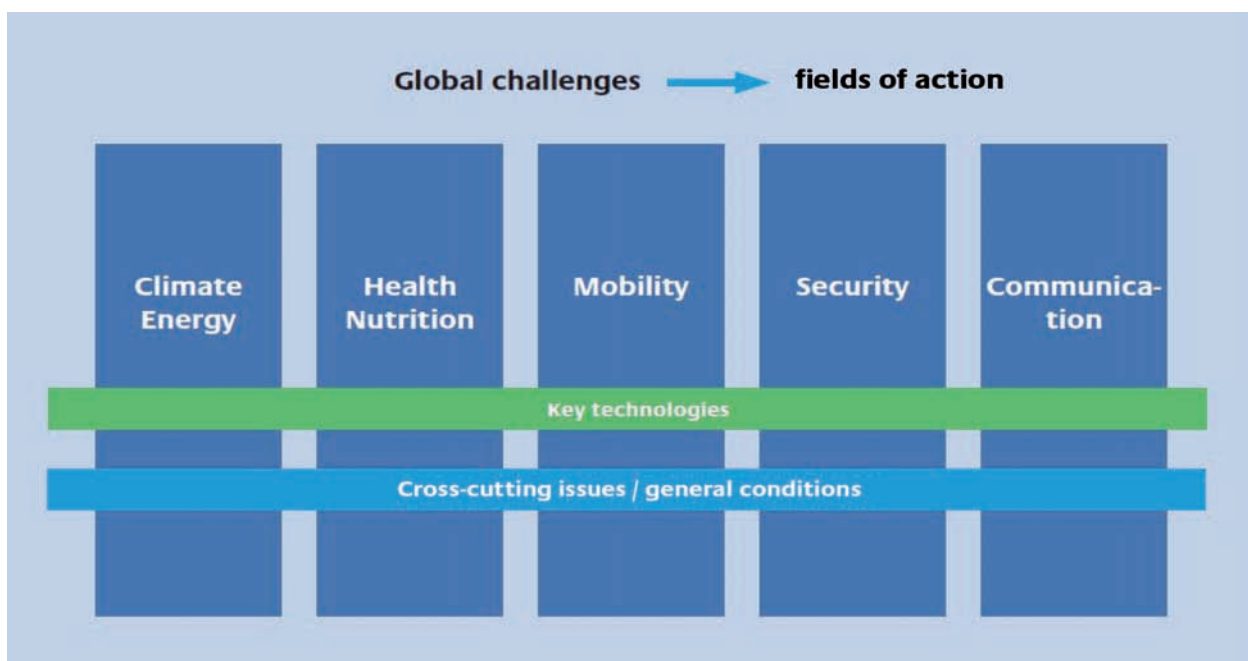
3. New Aspects

Focus on global challenges

Innovation is achieved through new technologies, innovative services and social change, but it is also driven by the global challenges which demand new solutions and answers. Most of these challenges can be found in the areas of climate/energy, health/nutrition, mobility, security and communication. The aim of the High-Tech Strategy is to make Germany a leader when it comes to solving these global challenges and to provide convincing answers to the urgent questions of the 21st century. This will not just improve people's lives and standards of living; it will also offer new value creation potential for the private sector, create high-level jobs in Germany and help us make better use of talents here in Germany. For this reason, the Federal Government's innovation policy activities are geared towards these five fields of action, with the aim of tapping emerging markets (see section 4: "Overview of the fields of action"). Important key technologies and measures to improve the general conditions for innovation will be funded in order to encourage new developments in these five fields of action.

A dynamic, productive science system is a key prerequisite for this. The Federal Government and the Länder are making important contributions in the form of the Higher Education Pact, the Initiative for Excellence, and the Academic Freedom Act. Giving creative minds more freedom is the best way of ensuring that intelligent ideas are turned into marketable products as quickly as possible and that successful companies can set new standards on global markets. The Federal Government's Strategy for the Internationalization of Science and Research is designed to help German companies enter into partnerships with leading and emerging high-tech locations and with the world's most innovative R&D centres. This will increase Germany's attractiveness as an innovative environment, particularly for companies with strong R&D departments.

At the Education Summit in Dresden in 2008, the Federal Government and the Länder set themselves the target of increasing overall spending on education and research to 10 per cent of GDP by 2015. This includes the Lisbon Strategy target of increasing R&D expenditure to 3 per cent of GDP. These targets are



the parameters of the research and innovation policies of the Federal Government and the Länder.

The Industry-Science Research Alliance includes leading representatives from science and industry and is designed to accompany the implementation of the High-Tech Strategy. It is a forum in which specific innovation strategies and measures are proposed and initiatives for their implementation developed. The High-Tech Strategy will continue to undergo systematic evaluation within the Industry-Science Research Alliance.

The various measures of the High-Tech Strategy are financed within each Ministry's own operating budget.

Mission-oriented approach:

Forward-looking projects

One of the main objectives of the new High-Tech Strategy is to gear research and innovation policy towards a number of central missions. To this end, the Federal Government will define "forward-looking projects" that study the most important challenges within the individual fields of action.

These projects will pursue specific objectives related to scientific, technological and social development over a period of ten to fifteen years. Innovation strategies for the realization of these objectives will be formulated and will form the basis of road maps for achieving interim milestones. In this context, a number of questions need to be addressed: What research and development priorities need to be set? What steps will need to be taken for the dissemination of important innovations? How will general conditions need to change, and what effects will these developments have on the private sector and society? These deliberations will also take into account international – particularly European – developments, for example Joint Programming.

Examples of priority topics include :

- **Forward-looking project: CO₂-neutral, energy-efficient and climate-adapted cities**

Technology-related CO₂ emissions and the effects of climate change significantly reduce the quality of life, particularly in urban areas. This project highlights the development of model regions in which new technologies and services are used and in which measures for the technical and natural reduction of CO₂ emissions, the use of renewable energy sources, and the increase of energy efficiency are specifically adapted to buildings, traffic, production sites and urban vegetation. In this context, the vision of a sustainable, climate-adapted city infrastructure is being pursued, with the ultimate aim of developing a CO₂-neutral city. Sustainable infrastructure needs to anticipate the effects of climate change that have already become inevitable due to past emissions, and it needs to include effective adaptation measures.

- **Forward-looking project: Intelligent restructuring of the energy supply system**

The rapidly increasing use of renewable energy sources and the rising decentralization of energy production are leading to a significant change in energy supply structures across the world. By 2020, more than 30 per cent of Germany's electricity is to be obtained from renewable energy sources. The transition to sustainable energy supply requires, among other things, smart grids and the provision of large power storage capacities. The flexible management of power supply grids with the help of IT-based solutions and a wide range of different storage technologies is necessary in order to take full advantage of the potential of volatile renewable energy sources – particularly wind and solar energy – also or inter alia in connection with the advent of electric mobility. New grid concepts, intelligent control systems and new, dedicated storage technologies enable the highest possible level of flexibility across the entire energy supply structure. This increases economic efficiency, supply security and environmental friendliness.

- **Forward-looking project: Renewable resources as an alternative to oil**

Supplies of fossil fuel and raw materials are limited. We need to preserve nature's great assets by making use of renewable energy sources and raw materials. In this way, we can ensure that the earth remains a place worth living in – for ourselves and for future generations.

- **Forward-looking project: Treating illnesses more effectively with the help of individualized medicine**

The individualization of medicine is a great challenge for health researchers, the health care system and the health industry. Personalized medicine not only enables more effective treatments with less severe side effects; it also has great potential for improved health care and new business models. Data protection and patient safety represent special challenges in this context.

- **Forward-looking project: Better health through an optimized diet**

A healthy diet can help people maintain good health. We want to increase our basic knowledge in the area of nutritional science in order to improve our understanding of the links between food and the human organism and between the different determining factors in people's dietary choices. In this way, we aim to contribute to preventing diseases, reducing symptoms and improving people's quality of life. In addition, a new funding concept for the area of nutrition research will help prepare the ground for the development of new foods and increase the competitiveness of the German food industry.

- **Forward-looking project: Living an independent life well into old age**

Demographic change is reshaping our society. People are living longer and remaining active longer. They want to live independent lives well into old age. In view of the consequences of demographic change on our society, economy and social security systems, we need to revise our traditional views on ageing. We need innovations in order to meet future challenges and improve older people's quality of life.

- **Forward-looking project: A million electric vehicles in Germany by 2020**

The public debate on climate and environmental protection is increasing the demand for innovative vehicles that use new engine technologies and fuel options. Car manufacturers and their suppliers have to adapt their strategies in order to maintain and improve their competitive position in the long term: completely new vehicle, battery and mobility concepts need to be developed, and the matching infrastructure needs to be designed from scratch. Research projects and pilot applications are to make Germany a lead market for electric mobility and the associated information and control systems.

- **Forward-looking project: More effective protection of communication networks**

Security research helps to protect our information and communication networks from damage caused by threats such as terrorism and crime. We want to develop efficient organization forms and technical solutions to prevent, protect ourselves against and deal with damage and failures. The idea is to use communication networks in a comprehensive manner; establish new, needs-based services on the basis of new technologies; and develop solutions that are in line with our fundamental democratic values.

- **Forward-looking project: Increasing Internet use while decreasing energy consumption**

In 2007, information and communication technologies accounted for 10.5 per cent of Germany's entire electricity consumption. If no measures are taken, this share will probably increase by more than 20 per cent by 2020. This project aims to break the correlation between the growth of information and communication

technology on the one hand and increased energy consumption on the other. To this end, new computer architectures, energy-saving chips and efficient software programs need to be developed and marketed.

- **Forward-looking project: Making global knowledge digitally available and accessible**

Information and knowledge are increasing at a rapid rate and are set to transform our lives in coming years, both from an economic and from a cultural point of view. In addition to (generally unstructured) texts, the Internet and intranets are providing more and more audio and video files daily. Our knowledge society is largely based on free access to information, the processing of information for users, and new digital communication opportunities. This will form the basis for new methods, platforms, services and business models, the exact nature of which cannot yet be fathomed. For example, it is not yet clear what research opportunities the development of cloud computing will offer – an area that enables the external use of knowledge sources and software in an “Internet of Services”. Moreover, the far-reaching cultural and societal implications of this development need to be reflected upon.

- **Forward-looking project: Tomorrow’s working world and its structure**

The working world of the future will have to respond to the challenge of demographic change. This forward-looking project aims to improve the general conditions of people’s working and private lives and thus enable people to participate in working life until the age of 67. Research activities are being carried out to develop new work organization models that permit a high level of participation, increase the employability of parents of young children, older people and disadvantaged people, and allow for flexible working hours. To this end, concepts for situation-oriented personnel policies are being developed which open up new options for more individualized working models. These concepts are being developed, tested and implemented by means of alliances with the social partners.

Key technologies

Key technologies are the drivers of innovation and the basis for new products, processes and services. The future viability of the German economy depends on whether Germany can achieve a leading position in the areas of biotechnology, nanotechnology, micro- and nanoelectronics, optical technologies, microsystems technology, materials technology, production technology, services research, space technology, information technology and communication technology. In many cases, success can only be achieved if technological and service innovations are linked to each other. They are prerequisites for many applications in a wide range of different sectors. The effectiveness of key technological developments is critically dependent on their successful transfer to commercial application and on their production being harmless to human health and the environment. For this reason, funding of key technologies is geared towards solving specific problems in the selected fields of action.

Towards a European High-Tech Strategy

The Federal Government wants to extend the successful approach of the High-Tech Strategy to the rest of Europe. This is not a one-way street; it is about working together to develop consistent innovation policy approaches.

- A European innovation strategy should be based on societal needs and global challenges. Its added value over national innovation strategies would mainly consist in its ability to pursue overarching innovation policy measures that could contribute to the realization of European objectives and to establish the five fields of action (climate/energy, health/nutrition, mobility, security and communication) at a European level.
- In addition, research and innovation in Europe need better legal conditions and should be given high priority in the EU budget.
- The development of strategic partnerships to achieve global technology and market leadership is also the best innovation policy instrument for Europe. In this context, it is vitally important to strike the right balance between cooperation and competition in a way that is beneficial for all partners involved.
- Europe needs outstanding European clusters with

a worldwide appeal. Germany is strongly involved in the development of the first Knowledge and Innovation Communities (KIC) of the European Institute of Technology (EIT). This will also provide a strong stimulus for the fields of action of the High-Tech Strategy.

Germany will engage in mutual exchanges with the other EU Member States and the EU Commission to further develop the 8th Research Framework Programme and the programme to enhance European competitiveness and to strengthen variable cooperation through cross-border measures. The Federal Government will continue to support the independence of the European Space Agency (ESA). The Federal Government will also make an effort to enable as many German companies and research institutions as possible to take part in European programmes.

Global challenges cannot be met at a national or even a European level. Developing competitive products and opening up new markets requires global cooperation, and this is something that needs to be strengthened.

Cross-cutting issues / general conditions

Companies need a positive innovation climate and planning security to be able to take far-reaching investment decisions. Both factors depend on individual political measures. Creative people need the best possible environment throughout the entire innovation process. For this reason, the Federal Government aims to review the innovation-friendliness of legal and extra-legal parameters at national and European level. New initiatives should be structured in such a way that they provide sufficient scope and incentives for invention and innovation and enhance companies' innovative strength.

Conditions for setting up businesses. Germany needs to go back to being a country of start-ups. It needs to increase its entrepreneurial dynamics, particularly in the area of cutting-edge technology. To this end, we are encouraging the entrepreneurial spirit and start-up culture at universities and research establishments and providing better guidance and funding for spin-offs from science and research institutions. In addition, the general conditions for young technology companies and their financial backers need to be improved. Entre-

preneurship training should become an integral part of the curricula at schools, vocational schools and universities.

Small and medium-sized enterprises/SMEs.

Germany needs to increase the long-term participation of SMEs in R&D activities and enhance the innovative strength of small and medium-sized companies. These efforts focus on creating sustainable links among SMEs and between companies and science institutions. In line with the coalition agreement, non-technology-specific and market-oriented innovation support for SMEs will be continued under the SME Central Innovation Programme (ZIM) and the KMU-innovativ funding initiative. In addition, pre-competitive research will be strengthened, and guidance and information services will be expanded.

Innovation financing / venture capital. Innovation requires sufficient financing options. Borrowing constraints are one of the greatest obstacles in the innovation process, particularly for SMEs and innovative start-ups. Germany's market for venture capital and direct investment capital remains weak. For this reason, we need to create the right conditions for an internationally competitive venture capital and direct investment capital market. At the same time, we need to create more and better funding instruments for the mobilization of venture capital.

Standardization. Standards create transparency and comparability. They also improve the quality, security and sustainability of products and services. They open up new markets and offer equal access conditions, particularly for small and medium-sized companies. Standardization is becoming an increasingly important element of the research and innovation process in Germany – if initiated at an early stage, it can enhance the transfer of research results into marketable products and services and reduce the time it takes for innovations to reach the market. Active participation in standardization activities also gives German industry global competitive advantages. That is why we are trying to make better use of the potential of standardization by integrating it more firmly into research funding – in line with the Federal Government's standardization policy concept.

Innovation-oriented procurement. According to the most recent estimate, innovation-relevant public procurement has a volume of approximately 23 billion euros. Spending this money on innovative solutions in a targeted way would not only increase cost effectiveness in the administration; it would also strengthen innovative companies. This would accelerate the spread of innovations.

A well-qualified workforce. Successful innovation policy requires well qualified specialists. Through vocational training, continuing vocational education and training, and higher education, the Federal Government aims to strengthen Germany's highly-qualified workforce and thus help secure Germany's future. In addition, support is to be provided to increase the number of young engineers working in SMEs. This is reflected in the Qualification Initiative for Germany, which was agreed between the Federal Government and the Länder in 2008.

From knowledge to product

The generation of new knowledge is always the first step of innovation. It can only be achieved if scientific insights are put to commercial use both quickly and efficiently. For this reason, the Federal Government intends to continue improving the links between science and industry. It will provide further support to facilitate exchanges between universities, non-university research institutions and companies and strengthen the transfer of knowledge and technology. In this way, research results can be developed into market innovations and made available to end users more quickly.

Patent policy is an important instrument in this area. The Federal Government will continue to promote activities for the utilization of research results obtained at universities and R&D institutions and support SMEs in filing patents and utility models. Access to industrial property rights needs to be improved, particularly for SMEs.

The Federal Government will launch a new measure for the validation of results. The aim is to improve the commercial application of the results of academic research. In addition, a funding instrument for new "campus models" is to be developed.

The idea is to bring together universities, non-university research institutions and commercial companies at a single location so that they can engage in collaborations on a medium- to long-term basis.

Successful instruments, for example the Leading-Edge Cluster Competition and the innovation alliances, will be continued.

Dialogue on innovations

Research and innovation require a dialogue with society and the working world. To this end, new dialogue platforms have been created so that the general population can take part in the debate about emerging technologies and research results that can contribute to meeting the great global and societal challenges of our time. Particularly in the case of technologies that are controversial, an open dialogue based on tolerance can help us to realistically assess the benefits and risks for individuals and society and determine what sort of consensus can be

achieved. Interdisciplinary cooperation among researchers working in the natural sciences, humanities, law and social sciences is particularly important in this context. The results of these public dialogues will be taken into account when shaping the fields of action of the High-Tech Strategy.

Emerging topics

Certain knowledge is required to prepare for future developments in a targeted way. The foresight process was initiated by the Federal Ministry of Education and Research (BMBF) in September 2007. We are now investigating new thematic options for future activities and opening new horizons for research and development trends. In these activities, we are looking more than ten years ahead. The individual Ministries are also putting together research, development and innovation strategies for their areas of responsibility.

4. Overview of the fields of action

Climate/energy

Climate change is one of the biggest challenges that humanity is currently facing. If it carries on unchecked, it will have dramatic consequences on people's lives and on the survival of entire societies in many countries. Unless we take effective measures against global warming now, and unless we develop adaptation strategies and strengthen the ability of societies and natural environments to adjust to the risks and consequences of climate change that are already inevitable, climate change will transform people's lives in ways that cannot yet be predicted.

By expanding the knowledge base and applying climate protection technologies and adaptation solutions in a targeted way, better alternatives for action can be provided for politics, science, industry and society. To this end, the Federal Government will intensify its cooperation with industry and the financial sector. It is developing instruments and structures that will enable it to provide better

support for decisions on climate protection and adaptation. Intensifying international cooperation – both in Europe and beyond – is particularly important in this field of action. The transition to sustainable energy supply is an extremely important topic for the future. In this context, the Federal Government is promoting the increased use of renewable energy and the efficient use of energy in general. This can mainly be achieved through the use of innovative technologies. Research and development in the areas of climate and energy are vitally important. The socio-economic and societal implications need to be given more consideration than in the past.

Forward-looking projects such as “**CO₂-neutral, energy-efficient and climate-adapted cities**”, “**Intelligent restructuring of the energy supply system**”, “**Renewable resources as an alternative to oil**” and “**Increasing Internet use while decreasing energy consumption**” represent possible paths towards sustainable climate policy and resource and energy use.

Lines of action

- **6th Energy Research Programme of the Federal Government:** The Federal Government regularly defines the objectives and priorities of its energy research policy and the associated funding mechanisms in an energy research programme that remains in place for several years. It makes an important contribution to renewing and modernizing the German energy supply structure and to increasing energy productivity. The BMWi is coordinating the preparatory work for the new energy research programme, which is to be approved in early 2011. This programme is closely linked to energy policy and will take into account the provisions of the Federal Government's National Energy Concept, which is to be issued in late 2010.
- **Framework programme on “Research for Sustainable Development”:** This BMBF framework programme focuses on the development of innovative technologies and concepts to overcome global challenges such as climate change. A special emphasis is put on improving the links between basic and applied research. For this reason, the programme concentrates on areas with great growth potential – such as sustainable water management, resource efficiency and energy efficiency. Further priorities include improved resource productivity and international research collaborations, particularly with developing and emerging countries.
- **Bioeconomy framework programme:** Providing the world's growing population with enough food, medicine, renewable raw materials and energy sources while ensuring effective climate protection is the biggest challenge of the 21st century. That is why the Federal Government has put the BMBF in charge of

developing an internationally competitive strategy for a knowledge-based bioeconomy. Important fields of action will include the development of new energy and resource-saving industrial processes, new renewable resources for industry, new medicines, securing the food supply for the world's growing population, and renewable energy sources as a replacement for finite resources. This requires a significant increase in agricultural productivity, the yield of plants under different climate and soil conditions, and the development of innovative agricultural technology. The new bioeconomy research programme will therefore address technology, the environment and the economy. It will take into account the recommendations of the Bioeconomy Research Council, which was established at the suggestion of the Industry-Science Research Alliance.

- **Maintaining competences in nuclear technology:** Research competences in the area of nuclear safety need to be maintained to be able to use nuclear energy as a bridging technology. This is the only way to ensure that the state can fulfil its protective duty and guarantee the safety of nuclear plants and disposal practices in accordance with the international state of the art.
- **Coal chemistry as a bridging technology:** Until oil can be fully replaced by renewable energy sources, we need to promote innovative processes for the environmentally friendly use of domestic coal deposits as a basic material for the chemical industry.
- **Research Service Centres for Climate Change and Adapted Land Management in Africa:** Regional science service centres are being set up in Africa with the aim of generating new networks. In this way, better guidance is to be provided in the areas of climate change and adapted land management.
- **Climate system research:** Model simulations and scenarios provide a central knowledge and decision-making basis for climate protection, adaptation, and energy supply.
- **Earth observation from space:** Space-based earth observation provides important insights and prognoses in the area of climate and energy research. We want to support the development of new commercial markets and the long-term provision of remote sensing data for global geoinformation.

Health/nutrition

Demographic change and the spread of common diseases will affect the future of our society and pose great challenges to our health system. Research into and the prevention and treatment of widespread diseases are set to become important fields of action in medicine – not just in Germany, but across the world. Research funding needs to focus on important scientific priorities without threatening basic research, which is very broadly based in Germany. This includes prevention and nutrition research as well as interdisciplinary research into widespread diseases. Research and translational medicine need to concentrate on and be geared towards people. By developing a new research strategy on individualized medicine and promoting efficient patient care research, we want to ensure this focus on people's needs. After all, the need for validation studies to determine the clinical benefits of treatment options

and for patient-oriented research is particularly strong in the area of individualized medicine. In addition, companies – particularly SMEs – need to be included in the prevention strategy through company health management structures. Insights into the care situation under everyday conditions are particularly important for efforts to further increase the quality and efficiency of health care despite limited resources. For example, telemedicine is to be further developed and tested in rural areas where there is a shortage of doctors.

The forward-looking projects “**Treating illness more effectively with the help of individualized medicine**”, “**Better health through an optimized diet**” and “**Living an independent life well into old age**” are examples of how individual research lines can be linked to each other in order to work towards a specific goal.

Lines of action

- **New health research programme (to be published in 2010)**
- **Individualized medicine:** Development of a comprehensive research strategy for individualized medicine with a focus on patient benefits and introduction of new concepts of patient care research and health system research.
- **Widespread diseases:** Establishment and expansion of interdisciplinary German health research centres that focus on widespread diseases.
- **Strengthening prevention research**
- **Nutrition research:** Building up basic knowledge in the area of nutrition research in order to improve our understanding of the interactions between food and the human organism; develop new, functional foods; and strengthen the global competitiveness of the German food industry.
- **Genome research / system biology:** Promoting medical genome research, system biology and new strategic areas as a basis for new concepts for the prevention, diagnosis and treatment of diseases.
- **Health industry:** Strengthening the health industry and enhancing its growth potential; providing support for the continuation and expansion of a German lead market in medical technology and associated services; developing the Medical Technology action plan for systematic support of this area
- **Research on ageing:** Research on the complex biology of ageing processes and their correlation with the emergence of diseases

Mobility

Studies forecast an increase in passenger and freight traffic of about 70 percent between 2004 and 2025.

We need new forms of mobility in order to transport people and goods quickly, safely and comfortably, but also efficiently and without wasting resources. The most important research and innovation priorities in this area include the development of new drive systems, fuels and battery technologies as well as the completion and use of the European satellite navigation system Galileo. We aim to develop new information, communication and traffic control systems in

order to help make traffic infrastructures more intelligent. Research on smart logistics concepts and the use of mobile electronic services can contribute to resource efficiency in the transportation of goods and people. The efficient reduction of traffic noise is another technical challenge that needs to be met.

The forward-looking project **“A million electric vehicles in Germany by 2020”** is a milestone on our way towards making Germany a lead market in the area of electric mobility and the associated information and lead systems by introducing hybrid and electric vehicles.

Lines of action

- **3rd „Mobility and Transport Technologies“ transport research programme:** Expanding Germany’s position as the leading research location in the field of mobility. The focus is on research and development activities for new drive technologies and vehicle concepts, all aspects of the transition to electric mobility, telematics and traffic control systems, and alternative and secure logistics systems. Wherever this is considered helpful, we are pooling different fields of technology and research for innovative mobility into strategic partnerships and innovation alliances.
- **Electric mobility:** We want to make Germany a lead market in the areas of electric mobility and telematics. As the centre of Europe’s automobile industry, the location of leading technological companies and a pioneer in climate policy, Germany is in a position to provide the decisive momentum for new technologies, accelerate the marketability of innovative vehicles, and set global standards. Industry and politics are pursuing an approach that is open to all technologies. In addition to the National Hydrogen and Fuel Cell Technology Innovation Programme (NIP), battery technology and electric drive technologies are also being promoted to complement the National Electromobility Development Plan. At the same time, the Germany-wide introduction of intelligent infrastructures – such as intelligent electricity grids – is being encouraged. New services are needed at the crossroads between electricity grids and information and communication technologies (ICT) – for communication, accounting, navigation, and battery and charge management of electric vehicles.
- **General concept – mobility of the future:** Options for a forward-looking and reliable general transport system are being designed on the basis of ongoing initiatives such as the Freight Transport and Logistics Master Plan, the National Electromobility Development Plan, concepts for urban mobility and associated strategic partnerships and innovation alliances. The future of the transport system will also benefit from Galileo, the European satellite navigation system.
- **National Aeronautics Research Programme:** Industry-science research networks for a sustainable air traffic system are being expanded in order to reach the joint targets that were agreed in the aerospace industry with the aim of reducing the effects of air traffic on the climate. These efforts mainly include new light-weight construction methods, alternative fuels and aerodynamics in engine technology. New technologies developed in aeronautics research can also be applied in other fields of action. In other words, aviation can act as a technology multiplier for other sectors.

- **National Maritime Technologies Master Plan:** The National Maritime Technologies Master Plan is intended to provide a framework for technological innovations in the areas of shipbuilding, navigation and marine technology. The aim is to open up future market potential through excellence in areas such as traffic control and monitoring technology for shipping, marine environment technology, marine research technologies and offshore technologies, ice and polar technologies, underwater technologies and new energy sources such as gas hydrates.
- **Research and development projects for noticeable noise reduction in freight transport:** Targeted innovations are to contribute to finding effective and low-priced solutions that noticeably reduce noise in freight transport.

Security

As an open society and a modern industrialized nation, Germany is facing increased security demands. After all, there are an increasing number of global threats, and we need to respond to dangers such as terrorism, organized crime, natural and environmental disasters, and pandemics.

To protect modern democratic societies and their key infrastructure from terrorism, sabotage, organized crime and the consequences of natural disasters or accidents, we need new security technologies for danger aversion and for the protection of

important infrastructures and supply chains. Certain options for decision-making and action require secured access to space-based technologies. In addition to providing protection from threats and creating secure conditions, security technology products and services also offer an excellent opportunity to develop a specific German competence profile and turn Germany into a lead market for security technology.

The forward-looking project “**More effective protection of communication networks**” aims to promote new, needs-based security solutions that are in line with our democratic values.

Lines of action

- **The Federal Government’s 2011 Research for Civil Security Programme**
 - **Developing solutions for the protection of a modern democratic society:** Civil security research is linked to other fields of action of the High-Tech Strategy (health/nutrition, communication, climate/energy). The aims are to study new security culture and security architecture concepts and to engage in a more intensive scientific and social dialogue.
 - **Developing a clear competence profile:** In this area, the aim is to work together with end users (security authorities, private infrastructure operators, etc.) to establish the field of security research in Germany, where it is still relatively new, and to build up the necessary research infrastructure and research excellence. We also want to intensify cooperation within the European Union and expand international research alliances with selected partners.
 - **Developing new security technologies for danger aversion and for the protection of important infrastructures:** In this line of action, the aim is to develop instruments for the aversion and analysis of risks and threats (for example early warning systems, prevention of cascade effects, simulation tools) and provide systems for the prevention of and response to incidents.
 - **Turning Germany into a lead market for civil security solutions:** The aim is to develop solutions that are in line with a democratic understanding of security and strike the right balance between security and freedom and to define standards and introduce them on a global level. Germany is recognized worldwide as a partner with a high level of expertise when it comes to products and services in the area of security technology. Research and development funding is also to be geared more strongly towards small and medium-sized enterprises, while public procurement is to focus more strongly on innovations in security technology.

Communication

Information and communication form the basis for efficient value creation processes in a globalized world and for the mobility and information requirements of citizens in modern societies.

Future activities in the area of information and communication technologies will concentrate on technological and legal developments in connection with the Internet of the Future, on building a global consensus in the area of standardization, and on the creation of a National Roadmap for Embedded Systems.

The forward-looking projects “**Intelligent restructuring of the energy supply system**”, “**Increasing Internet use while decreasing energy consumption**” and “**Making global knowledge digitally available and accessible**” will make it possible to use ICT to increase the efficiency of supply and production networks while reducing the energy consumption of ICT solutions themselves. The forward-looking project “More effective protection of communication networks” also encourages research activities in the area of communication.

Lines of action

- **The Federal Government’s ICT Strategy 2010:** The Federal Government plans to develop a new, comprehensive ICT Strategy for Germany’s digital future before the summer of 2010. This is to be closely linked to the new structure of the IT Summit. The aim is to pool strengths to advance the use of ICT and accelerate the implementation of flagship projects and initiatives, for example in the areas of super-high-speed Internet, digital data protection, and intelligent networks for education, energy and mobility.
- **IT Summit:** The IT Summit process will be continued with new priority areas (including smart grids, cloud computing, new visualization technologies, and security and protection in a digital society).
- **IT Security Research Programme:** Research funding in the area of IT security is to be expanded through the continuation and updating of the IT Security Research Programme (e.g. protection of critical infrastructures and protection from Internet crime).
- **ICT Action Programme on Cloud Computing:** Joint initiatives with the scientific community will promote research, development and testing activities for trust models, protection mechanisms and standards for cloud computing.
- **Smart grids:** As a key area for solving energy and climate problems, information and communication technologies will receive increased support. In particular, new forms of cross-industry cooperation need to be created and encouraged – particularly between the energy sector and the ICT sector. Linking smart grids with electric mobility and smart homes is another research priority in this area.
- **Intelligent objects:** R&D funding in the area of autonomous devices is to be intensified – including service robotics for applications in industry (production, logistics), health (supporting people in their living environments) and consumer goods (including home networking).
- **Electronic identities:** Secure processes for authentication and identity management in electronic media are vital for business and administrative activities, which are becoming increasingly technology-driven. Flexible and reliable infrastructures, such as the new identity card, need to be made available and designed in such a way as to provide synergy effects.

- **National Roadmap for Embedded Systems:** Germany's economic performance as a high-tech location significantly depends on its strength in the area of embedded systems and on their increasing links to the Internet of Things. The rising complexity and interlinkage of embedded systems calls for standardized cross-industry solutions. The National Roadmap for Embedded Systems will address the research activities that are necessary in order to achieve this aim.
- **Communication infrastructures:** The communication infrastructures within the responsibility of the Federal Government should be secure, powerful and state of the art. New technologies should enable the provision of new online services. Based on these modern infrastructures, trend-setting new e-government concepts and modern Internet policy aspects can be developed and implemented. The Federal Government wants to enable a paper-free, multi-level administration by 2012.
- **Satellite communication:** Space-based technologies can facilitate global connectivity, for example through broadband data connections that are not dependent on ground-based infrastructure, particularly in less developed regions. Germany will enhance its capabilities in optical satellite communication and develop selected technologies to achieve global standards.
- **Skilled labour in ICT:** More (young) experts are needed in the area of information and communication technologies. To this end, the Federal Government will develop a dedicated ICT expert policy for small and medium-sized enterprises, enable more young ICT experts to spend time abroad, update continuing vocational training opportunities to meet demand, and expand opportunities for people with vocational qualifications who are interested in studying at universities of applied sciences.
- **Cultural issues related to the Internet:** A public dialogue is to be initiated on social, cultural and legal issues related to the Internet as a public space. In addition, efforts are being made to raise public awareness about the value of intellectual property, to create a fair balance in the area of copyright legislation between creative professionals and users, and to check the viability of stronger government commitment in the digitalization of written cultural heritage, particularly at European level.

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