Development of digital technologies

Content

Chapter 1: Development of digital technologies

The Federal Ministry for Economic Affairs and Energy seeks to promote the development of digital technologies by providing funding for a large number of pre-commercial research and development projects. The relevant programmes pick up at an early stage on promising technological developments for the digital transformation and help speed up the transfer of cutting edge technologies to the market.

The digital transformation is currently one of the most important challenges for maintaining the competitiveness of individual businesses and of the entire economy, and is key to answering fundamental social developments such as the energy transition, demographic change, or equal opportunities across urban and rural areas. Information and communication technologies (ICT) and particularly machine-to-machine communications, data management, digital service platforms, and data and communication security, are fields that offer Germany tremendous potential to become more competitive and to future-proof itself.

The support framework for the development of digital technologies makes it possible for the Federal Ministry for Economic Affairs and Energy to respond quickly and in a flexible way to new key issues and challenges by launching calls for projects that can begin at short notice. The research programmes that receive funding involve model users who pilot the developments in order to establish their technical and economic viability. The outcomes are then taken as a starting point for the creation of new, marketable products, solutions, and business models, particularly for SMEs.

Numerous projects for the development of digital technologies have already received funding and are making an important contribution to our public services and to our efforts to tackle the challenges faced by our society. Among these have been projects for the development of AI-based platforms for the smart use of health data. And the results of platform projects for other use cases can also be transferred to this field in so far as they boost security of supply and support business.

In 2020 and as part of the AI innovation competition, the Federal Ministry for Economic Affairs and Energy was quick to launch a new call for projects designed to prevent and contain infectious diseases and other threatening crisis situations. The outcomes of these projects are to help build a resilient economy and protect the health of our population by deploying data technologies and artificial intelligence, which can make current and future crises easier to cope with.

The spectrum of the technology programmes is large and covers various aspects of the digital transformation:

- **Innovation competition on artificial intelligence.** Serves to create a broader basis for innovations in Germany to ensure that unconventional and disruptive ideas can have a chance to prove themselves. Greater use should be made of AI methods to drive innovative value networks and create new products and business models for various industries.

- **Secure digital identities showcases.** Aims at strengthening digital sovereignty and at facilitating access to trusted German eIDAS solutions that are also user-friendly and economically viable (eIDAS: Regulation on electronic identification and trust services for electronic transactions in the internal market). Gives rise to innovative solutions for digital authentication in business, the public administration, and for applications in everyday life. The large-scale showcases are designed to create application-driven ID ecosystems that are open, interoperable, simple to use, easy-to-grasp and accessible.

- **Smart data economy.** Focuses on artificial intelligence, semantics, and sovereignty. In this digital age, in which value chains are based on data, data use is a serious driver of economic growth.

- **Smart Services Worlds I and II.** Bring together different fields of application by providing secure and targeted links between open-services platforms, data management technologies, and the internet of things. Solutions for manufacturing, mobility, energy, construction, medicine, and home living are being developed.

- **PAiCE.** A technology programme designed to foster the integration of forward-looking digital technologies such as product engineering, agile logistics, service robotics, industrial 3D applications, and industrial communications into industrial processes and applications.

- **ICT for electric mobility.** Focusses on integrating commercial vehicles, including highly automated ones, into logistics and mobility infrastructure. Beyond this, funding is provided for innovative mobility solutions for rural areas and for grid-compatible charging possibilities for large housing blocks and neighbourhoods.

Strategic stand-alone projects have a firm focus on the future and are especially important for Germany's future. The various projects grouped into this category are to give rise to new outstanding technologies and solutions that are expected to have a long-term strategic impact on the ICT sector.

Beyond this, the Federal Ministry for Economic Affairs and Energy also provides some funding for **international cooperation projects** conducted together with selected partner countries, and for projects under European programmes such as EUREKA.

The **Forum Digital Technologies** serves as a networking platform and showcase for selected research projects and innovations made in Germany. The forum fosters dialogue and the transfer of expertise at both national and international level.

More information about
Forum Digital Technologies

All information relating to the field of developing
digital technologies can be accessed at
www.digitale-technologien.de.

Chapter 2: Support framework for the development of digital technologies

Seeking to raise the international competitiveness levels of German businesses, the Federal Government has made it its goal to foster the digital transformation of industry. The measures are designed to strengthen companies' digital skills and capacity and make our industries more innovative. Both elements are key to achieving and maintaining digital sovereignty. The Federal Ministry for Economic Affairs and Energy has developed its support framework for the **development of digital technologies** to ensure that it is in an even better position to swiftly harness the potential of greater efficiency and economic output presented by digital technologies in a more flexible way, and to quickly and nimbly address pressing challenges. Calls for projects are to be made at short notice and pick up on the latest technological trends, developments and market requirements, take into account the priorities of our digital policy and the budget available, and stipulate time frames that cater to the needs of a market-oriented implementation.

Development risks are particularly high for close-to-market research into digital technologies with rapid innovation cycles. The funding is intended to limit these risks and allows for the positive impact of the research projects to be better harnessed – not only by the companies receiving the funding, but by the entire economy. The support framework has been set up around the three focal areas of technologies, applications, and ecosystems. These build on one another, together forming the framework for the projects envisaged. Funding is provided for research and development projects that are at a pre-competitive stage, have a flagship character, and bring together science and industry. SMEs are explicitly invited to become involved. If possible, young companies should also be included in the consortia. The support framework serves as a basis for specific calls for projects and for detailed information about the process of drafting and submitting project proposals. For more information, please consult the support framework and the list of current calls for proposals at www.digitale-technologien.de.

Information about current calls for proposals

Chapter 3: Funding programmes

Innovation competition on artificial intelligence as a driver for key ecosystems with an impact on the overall economy

The national AI strategy is designed to safeguard Germany's future as an industrial location and to open up new markets to German companies. The innovation competition on artificial intelligence (AI innovation competition) is an important tool for the strategy's swift implementation. The Federal Ministry for Economic Affairs and Energy wants to use this competition to support outstanding approaches for the establishment of new forms of AI-based platforms for important economic sectors in Germany.

The AI innovation competition had two phases: the competitive phase was about proving the feasibility and practicality of convincing conceptual ideas for a broad-based application of AI in an important economic sector, identifying potential obstacles, and creating the basis for a swift and efficient implementation of the idea during the second phase, i.e. the implementation phase.

More than 130 consortia formed by business and scientific institutions took part in the competition in 2019. 35 of them were given the opportunity to submit detailed roadmaps for the implementation of their conceptual ideas and for the formation of strong partnerships. Finally, 16 projects made it through to the 3-year implementation phase, which began in early 2020.

These projects are to serve as flagship projects for the use of AI in important economic sectors in Germany. They cover the following fields of application: construction, healthcare, wholesale and retail, agriculture, mobility, manufacturing and process technology, smart living, and quantum computing. Additional research is being carried out to tackle crucial challenges pertaining to data management, the selection and application of standards, and to ethics, law and justice. The focus here is on the development and implementation of viable business models for AI applications.

In 2020, two more calls for submissions were launched for the innovation competition on artificial intelligence: the second one in February 2020, with a focus on construction/building information modelling, sustainability/quality management, the environment/agriculture, and financial services/data sover-

eignty. The third call for submissions was made in May 2020 for projects linked to AI and connected data technologies for infectious diseases and for combating other existential crises that pose a threat to the economy.

Funding programme: innovation competition on artificial intelligence (First call for proposals; implementation phase)
Programme duration: 2020 – 2023
Number of projects: 16
Number of project partners: approx. 250
Amount of funding: approx. €160 million

EXAMPLE OF A PROJECT

SPAICER – Scalable, adaptive production systems relying on AI-based resilience optimisation
Artificial intelligence used to avoid disruption in production and in supply chains

Every day, manufacturing companies have to deal with disruption. Disruption can be caused by external factors, such as delays in logistics, a scarcity of resources, or politically-driven barriers to trade. But there are also internal causes of disruption, such as workers' absence due to ill health, faulty tools, or a halt in production. Now, artificial intelligence is to be used to help companies adapt to these kinds of internal and external disruption, and to do so in a flexible manner. A company's resilience is directly linked to its success and ability to compete – even more so in a crisis, as we have learned in the current COVID-19 pandemic.

The over-arching objective for SPAICER is to establish a new model for AI-based resilience management in manufacturing. In this way, SPAICER wants to address the higher requirements of the "adaptable factory" in an Industrie 4.0 environment in terms of equipment's resilience against disruption, e.g. by predicting such disruption (anticipation) and by adapting

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production plans accordingly so as to keep the impact of the disruption to a minimum (response).

At the heart of SPAICER is an agent-based, modular and open approach for the development of smart resilience services, based on leading AI technologies and Industrie 4.0 standards, all embedded in an ecosystem for the exchange of data, software and models.

EXAMPLE OF A PROJECT

Knowledge4RETAIL
This project's over-arching objective is to build the Knowledge4RETAIL platform, which is to serve as the core for complex AI-based planning and robotics applications for individual retail branches.

The open-source platform provides a high-performance database that can form "semantic digital twins" of individual retail branches, which can then be used by AI and robotics applications issued by various suppliers. This reduces preparation and setup times and also cost-barriers for retail companies wishing to introduce AI solutions. By the same token, the platform will also bring down entry barriers for SMEs in the IT sector that have specialised in individual AI applications. The open standards used by the platform give these SMEs an easy point of access to retail companies' IT infrastructure.

There are four representative pilot applications developed with a view to demonstrating the platform's potential:

- smart intralogistics within the branch office
- strategic trade marketing to personalise branches in line with customers' wishes
- service robotics to support staff
- internet of things (IoT) connection to a smart refrigerator

Innovation competition: showcases for secure digital identities

In the modern world, digital identities are a must for a well-functioning economy. Nearly all business and administrative processes rely on the identification of persons or objects. Digital identities have thus become the entry point to modern administrative and business processes.

The showcases for secure digital identities were established by the Federal Ministry for Economic Affairs and Energy with a view to giving the public administration, businesses (especially SMEs) and the general public access to German eIDAS solutions that are user-friendly, trusted, and economically viable. So far, none of the existing eID solutions have reached the critical mass required for a broad-based application. The showcases, in which technology providers work closely together with municipalities, are to change that. Large numbers of real life use-cases will be practically tested and citizens are to be actively involved in the development of new solutions. In each case, several different eID suppliers are to work together and ensure a high level of interoperability. Tests will be conducted for centralised eID solutions as well as decentralised approaches (e.g. digital ledger technologies) and a combination of the two.

In an initial competition phase, a total of eleven consortia will develop conceptualised ideas for the showcases and demonstrate their feasibility and practicality. At this stage, obstacles are to be identified and the requirements put in place for a swift and efficient implementation of the conceptualised ideas in the ensuing implementation phase. The goal is to form large, powerful research and development unions that can start their work in the pilot regions in spring 2021. The main areas of application of the showcase projects include: municipal companies and services, real estate, mobility, tourism and hospitality, sports and nutrition, wholesale and retail, urban logistics, social and healthcare services, banking and insurance.

Funding programme: Innovation competition: showcases for secure digital identities Competition phase and implementation phase
Overall duration: 2020 – 2024
Number of projects (competition phase): 11
Number of projects (implementation phase): circa 3
Number of project partners (competition phase): 65
Amount of funding (competition and implementation phases): up to €55 million

Smart Data Economy

In this digital age, in which value chains are based on data, data use is a serious driver of economic growth.

The Smart Data Economy technology programme therefore aims at using data for smart business, to process it in a secure way that is compliant with existing regulations, and to treat it as an asset in its own right. The Federal Ministry for Economic Affairs and Energy provides funding for flagship research and development projects that foster smart data products and within which business systems are developed that use machine learning and AI to make companies more efficient or even allow them to break into new fields of business.

In this context, an integrated view is to be taken of a digital data economy and AI-based systems. The key new underlying technologies for the smart data economy are selected AI processes (e.g. for machine learning), data technologies and procedures for the secure use of data in distributed systems (e.g. on

the basis of distributed ledger technologies). Information systems approaches bring together an economic and business view with selected fields of data engineering.

The projects selected began their work in 2019 under the ministry's technology programme for a smart data economy.

Funding programme: Smart Data Economy
Programme duration: 2019 – 2022
Number of projects: 20
Number of project partners: 92
Amount of funding: approx. €45 million

EXAMPLE OF A PROJECT

CampaNeo – Platform for real-time vehicle data campaigns
CampaNeo is about developing an open platform that brings together different types of vehicle data. On this platform, drivers can then decide how their own data can be used and for what purpose.

Thanks to the assistance systems required by law for modern vehicles, these vehicles have the basic sensors required for the creation of a distributed sensor platform. But it has so far been impossible to bring this data together externally and exploit it. This has notably been prevented by the requirements of the GDPR, under which such actions are subject to users' consent.

CampaNeo will give many prospective users of vehicle data (e.g. smart city projects, research institutes, the federal mobility data market place, mobility companies) an opportunity to collect and analyse real-time vehicle data in a campaign-based format. This will be possible on the assumption that users will generally be prepared to share data if there is a clear added benefit to this, e.g. the possibility to prevent subsequent accidents.

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In this way, CampaNeo addresses not only the smart and economically viable use of data in a way that is in conformity with the rulebook, but also paves the way for new smart data products based on the bundling together of large amounts of high-quality, heterogeneous data.

EXAMPLE OF A PROJECT

Telemed 5000 – How artificial intelligence can inform telemedicine
New technologies can deliver significant improvements in healthcare – even beyond dedicated healthcare institutions. For instance, telemedicine has been proven to have the potential to increase life expectancy and quality-of-life levels for high-risk patients with congestive heart failure, and reduce the time these patients need to spend in hospital.

Until now, the maximum number of patients a single telemedicine centre can handle has been 750, which is significantly less than the required capacity. For this reason, the main goal for Telemed 5000 is to improve the medical care received by patients with congestive heart failure with the help of a remote patient management system underpinned by AI. This system should make it possible to reach a maximum capacity of 5,000 patients per telemedicine centre, without the need to boost staffing levels. This would mean that only 20 such centres would be required in Germany (circa 1 – 2 per German state). Before that, some questions pertaining to ethics, data privacy, liability, and medical law have to be answered.

Smart
Service
Welt

Smart Services Worlds

The digital transformation is progressing at high speed and permanently connecting machines, products, and devices via the internet. Devices and users are generating increasing amounts of data that can be automatically analysed, processed, and combined. Bringing this data together provides major opportunities for the development of smart services.

These in turn open up new possibilities for platform-based business models and innovative applications for companies and citizens. Not only will smart services result in a new quality of cross-company and cross-border production and value networks with a high level of automation and the capacity for low-cost manufactured goods tailored to the individual needs of each customer. They will also deliver greater mobility for people and objects, better medical care for the chronically ill, help optimise municipal water and energy supply systems, and provide for safer and more comfortable living conditions for elderly citizens.

The Smart Services Worlds I and II technology programmes are designed around the notion of having specific examples illustrating the benefits of the digital transformation to business and society at large. They are also to improve the framework for the digital transformation and to encourage more companies to embrace this development and profit from it. In this way, businesses in Germany will be able to become even more competitive in the digital economy and Germany has the potential to become even more attractive for investors working in the digital economy.

The Smart Services World II programme follows up from Smart Services I and focuses on projects driving the digital transformation in rural areas and small towns. Overall, 18 projects representing construction and employment, home living, energy, and medicine are receiving funding under the project.

Funding programme: Smart Services World II
Duration SSW II: 2018 – 2021
Number of projects: 18
Number of project partners: 101
Amount of funding: approx. €52 million

EXAMPLE OF A PROJECT

CrowdMyRegion – App-based neighbourhood network for basic supplies in rural areas.
Food and health and beauty shops are now few and far between in Germany's rural areas. Shops are closing down, leaving village centres empty, and citizens flock to supermarkets in the neighbouring town to do their shopping. This has grave consequences for rural economic structures and for the people living in rural areas. Those who do not have a car or a physically restricted in terms of their mobility are cut off from supplies and rely on the help of others.

An app-based service is to address this situation by setting up a sustainable network of neighbours in rural areas. This social delivery network formed by consumers and retailers will take the form of an app-based service platform connected to the regional product management systems used by retailers. Consumers can use the app to order and pay the goods they want from regional shops. Deliveries are then made to an agreed point of collection close to where the customer lives.

This contactless way of purchasing food will prevent crowded shops and long queues and thus help disrupt pandemic infection chains.

The platform (marktfee.app) is currently being tested in the Rhine-Neckar region, where it has been met with great interest on the part of customers, retailers, and municipalities.

EXAMPLE OF A PROJECT

DigitalTWIN

The Digital Tools and Workflow Integration for Building Lifecycles (Digital-TWIN) project is developing a platform designed to bring SMEs in the construction industry into the digital age.

The platform combines Industrie 4.0-type digital technologies with construction planning and building management into a system that is flexible enough to be used across the construction industry. DigitalTWIN uses communications technologies such as 5G to ensure that augmented and virtual reality and cloud-based real-time data analysis can be used throughout the building's entire lifecycle. The development of the passive and active network components required for this is being optimised especially for use on building sites.

PAiCE – Platforms, Additive Manufacturing, Imaging, Communication, Engineering

The PAiCE technology programme was conceived with a view to developing and testing new solutions spanning several elements of the value chain by linking up different fields of technology. This allows for the development of innovative technologies and methods that open up new opportunities for seamless product engineering and its correlation with production processes. Dynamic process optimisation also means an implementation of innovative logistical solutions delivering a high level of agility that makes it possible to quickly respond to changes in market requirements or any other unpredictable events.

3D technologies open up new opportunities for the development and optimisation of products, for process monitoring, and for quality management. There are projects facilitating things like additive manufacturing for production on demand and on-site production. This helps cut storage costs, shortens delivery routes and times, and allows for affordable batch-size-one production tailored to customers' needs.

These far-reaching integration processes rely on communications networks able to handle them and designed for an industrial environment. This includes high scalability, high availability, real-time capability, and high levels of security in the interest of confidentiality and integrity.

Service robots are also becoming highly important for automation and industrial manufacturing. For this reason, one of the core objectives of PAiCE is to provide industry, especially SMEs, with broad-based access to affordable industrial robots.

Funding programme: PAiCE
Programme duration: 2016 – 2021
Number of projects: 18
Number of project partners: 120
Amount of funding: approx. €55 million

EXAMPLE OF A PROJECT

iSLT.NET
The iSLT.NET collaborative project wants to conceive a network for smart, modular special-load carriers and implement and test a prototype network.

The development and use of special-load carriers with individual parts and for short use cycles is associated with high costs for the companies

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involved. The project is to highlight the benefits arising from a modular design on the one hand and the use of technologies underlying the internet of things (IoT) for data-based services within a cross-company network.

The project has already created a realistic demonstrator of a cooled-storage load carrier. In addition to the technical and implementation and the construction of the vehicle, the automotive logistics chain was pictured up to tier TIR2. This has made it possible to gain a holistic perspective on the logistics project and to explore potential business models. Several automotive companies have already signalled a high level of interest in this development.

EXAMPLE OF A PROJECT

IC4F
The IC4F collaborative project focuses on holistic solutions for industrial communications in the context of factory automation. For this purpose, solutions for the design and the construction of a trusted industrial communications and computing infrastructure are to be developed as a basis for seamless digitisation in manufacturing.

The various solutions include the latest innovative approaches for a communications and computing infrastructure, such as 5G networks, edge-cloud, or data management, all of which facilitate real-time industrial applications. A model for a communications kit and the provision of a reference architecture to be used as a basis for digitising processes in manufacturing, logistics centres, and industrial construction make up a key portion of the IC4F project.

The newly developed "Industrial Reference Architecture" (iREefA) is a modular architecture that relies on interoperable building blocks to close the gap between the generic RAMI 4.0 and IIRA architectures that are currently available. The iREfA is currently being translated into a DIN standard.

IKT FÜR ELEKTROMOBILITÄT

ICT for electric mobility: smart applications for mobility, logistics, and energy

Since 2009, the ICT for electric mobility II programme has focused on the latest information and communication technology (ICT) as a crucial factor for the future success of electric mobility. It uses electric mobility as a link between energy generation from renewables and the transport sector.

During the first three phases of the programme (2009–2021, 48 projects, €212 million in funding), the main objective of the project was a smart integration of electric vehicles into the energy system. In addition to that, research was conducted into new ICT architectures for electric vehicles. These will help reduce the weight and cost of future generations of electric cars and lay the basis for more convenience and new entertainment and safety features.

Phase 4, which began in 2019 and to which new projects are added each year, focuses on the development and testing of open, ICT-based approaches for an optimised integration of (commercial) electric mobility into smart mobility, logistics, and energy infrastructure, and business environments.

The objective here is to develop ICT-based innovations in the field of vehicle technology, commercial fleet and logistics concepts, and charging, communications, and platform technologies. A key focus of the research is on integrating electric vehicles into smart energy and transport networks. In the course of this work, highly automated/autonomous and AI-based electric mobility applications are also to be tested. Beyond this, funding is provided for innovative mobility solutions for rural areas and for grid-compatible charging possibilities for large housing blocks and neighbourhoods.

Funding programme: ICT for Electric Mobility (Phase IV)
Programme duration: 2019 – 2025
Number of projects: circa 30
Number of project partners: circa 150
Amount of funding: approx. €80 million

EXAMPLE OF A PROJECT

d-E-mand - Predicting demand for recharging eVehicles as a business enabler
The d-E-mand project wants to arrive at precise predictions of demand for electricity for recharging eVehicles – everywhere and at any time. This knowledge is then to open up new business models for those providing this electricity.

There already are mobile high-power recharging points that work like power banks and can recharge up to 15 electric cars. A needs-based supply of electricity to users of eVehicles is to be ensured even at times when there are local bottlenecks and/or when demand is especially high (due to trade fairs or school holidays, for instance). This is to be achieved with the help of AI-based analyses of short to long-term demand for recharging electricity. The d-E-mand service platform is being tested in a real-life field test in Hanover and Dresden.

EXAMPLE OF A PROJECT

LieferBot-E
If deliveries and waste removal were to be conducted efficiently and using electric vehicles at times when there is little traffic, particularly at night, this could significantly ease the burden on cities and their inhabitants.

For this reason, the LieferBot-E project wants to draw up and develop a holistic logistics concept for the realisation of an innovative form of urban goods transport with the help of distributed, autonomous delivery robots. Goods will be delivered directly to parcel boxes in a fully-automated, safe and secure way, thanks to technology fitted to the vehicle.

More information about the current
funding programmes

Chapter 4: Strategic stand-alone projects

Strategic stand-alone technology projects serve to advance selected cutting-edge, forward-looking technology solutions which the Federal Ministry for Economic Affairs and Energy sees as potential game-changers within the ICT sector. The projects, which are very diverse in nature, are all forward-looking and of key importance for Germany as an economic centre. Most of them pick up on technologies or fields of applications that are not otherwise served by the technology programme, or they address emerging issues which may become focal areas for research at a later point in time.

Examples of strategic stand-alone projects include the following:

- **BIG – The Next Big Thing in Embodied Intelligence:** A study is being conducted to draw up technological, economic, and political recommendations for action as to how Germany can safeguard and expand its position as a manufacturing hub against the background of the digital transformation. This study draws on a combination of market analyses, academic papers, and the views of leading international experts from the fields of economics, science, and politics.
  Programme duration: 2020–2021

- **AUDITOR:** The European Commission's General Data Protection Regulation has been in force since May 2018. On that basis, the AUDITOR collaborative project wants to develop, pilot, and test a pan-European data protection certification system for cloud services. In early 2020, the AUDITOR certification process was submitted for potential accreditation by the German accreditation point.
  Programme duration: 2017–2021

More information about current
stand-alone projects

Chapter 5: Forward-looking dossiers and innovation policy

The ministry's technology policy seeks to ensure that innovations are tested in real life as soon as possible, so that the opportunities and use cases for digital technologies can be demonstrated for key sectors and for society. This is to encourage early adoption and a transfer of technologies in the sense of spillover effects. This is particularly true where markets do not respond or are very slow to respond to recent developments in technology ("market failure"), or where there are other reasons why the transfer into business, particularly SMEs, does not happen by itself.

For any decision made under our technology policy, it is key to choose the right time to pick up on forward-looking issues and foster innovation. Internationally, Germany has to compete with other countries that are also highly technically skilled and where local markets may be much larger and quick to adopt new technologies. It is important to decide when technical innovations are mature enough to be attractive to business and to what extent these developments can generate specific opportunities for suppliers and users in Germany within a foreseeable timeframe. The systematic development of such new dossiers also makes a key contribution to digital sovereignty in Germany and Europe.

The ministry's division for the "development of digital technologies" has drawn up a support framework that has proven to be a flexible and efficient tool for swiftly feeding in technological developments and research findings into technology programmes and platform projects in a systematic way, and for meeting the requirements for these developments to be transferred to market. Market studies and expert meetings with researchers and business experts and also monitoring of international developments in technology help guide the specific focus of such forward-looking dossiers. A small number of early-stage pilot projects can help demonstrate the viability of forward-looking dossiers and make the case for larger-scale programmes.

The forward-looking dossiers currently addressed include the following:

- **High performance computing and quantum computing:** Whereas the field of basic research (EU, Federal Ministry of Education and Research) is focusing on the development of new supercomputers and quantum computers, the Federal Ministry for Economic Affairs and Energy wants to explore potential new applications for these machines and the economic potential they could generate. It is expected that some key technical breakthroughs on the hardware side will be made within the next three years; this also includes commercially usable petascale and exascale computers and some initial quantum computers made in Europe. With this in mind, it is essential to create simple, functional, and user-friendly structures to give business access to these high-performance computers and to develop applications for these new technologies and bring them to market in Germany.

EXAMPLE OF A PROJECT

PlanQK
The PlanQK collaborative project is about developing an open platform for quantum-based AI (QAI) for the creation and support of an ecosystem composed of AI and QC specialists, developers of specific QAI applications, and users, consultants, and service providers. In this way, the PlanQK platform will provide the technical basis for a new community working on quantum-based artificial intelligence.

Customers of the PlanQK platform can purchase algorithms and datapools whose quality has been ensured, or even access some for free. If no algorithm or datapool can be found for a specific problem or domain, or if a certain algorithm has not been implemented in a specific programme, customers can make requests to the community and the platform operator.

Furthermore, the platform has a feature that makes it possible to automatically provide QAI apps in a target environment where it can be used. The platform is being designed as an open ecosystem to which additional services can be added.

- **5G-/6G** communications technologies: Germany's 5x5G strategy is designed to make the country a leading market for advanced communications technologies. In addition to the ongoing rollout of 5G infrastructure, there are already signs of key developments in communications technologies that will open up whole new opportunities for Industrie 4.0, telemedicine, AR/VR, and autonomous driving – all thanks to shorter latencies, higher data rates, and better reliability. At the focus of the planned activities is the development of 'campus networks' in the frequency band between 3.7 and 3.8 GHz, which will allow companies to use private radio networks tailored to their specific needs. New technologies that replace proprietary hardware with software-driven functionalities and open interfaces are giving rise to high hopes for developments from specialised suppliers from Germany.

- Data infrastructure: Through the **GAIA-X** project, the Federal Ministry for Economic Affairs and Energy wants to develop a high-performance, competitive, secure and trusted data infrastructure made in Germany. The application projects funded by the Federal Ministry for Economic Affairs and Energy will help specify the technical and economic conceptualisation of such an infrastructure and to validate it. The objective is to create an ecosystem composed of users and suppliers that can be used to build data infrastructure in Germany and Europe, and to do so together with European partner countries such as France and Austria, but also in cooperation with the European Commission.

- **Distributed ledger technologies (DLT, blockchain):** There are various DLTs that are already being used in the financial industry, in science, healthcare, and logistics. At the same time, there are still challenges that need to be addressed for the technologies to be used in practice, for instance where DLTs need to interact with conventional systems. The Federal Ministry for Economic Affairs and Energy recognised the potential for innovation as early as in 2017 and has been supporting the use of blockchain (a type of DLT) for the distributed organisation of energy associations under its Smart Service World programme. Blockchain technologies provide attractive incentives for authentication functionalities that protect users' identities.

This is why they are also used in the showcases for secure digital identities programme.

EXAMPLE OF A PROJECT

BlogPV – blockchain-based virtual large storage facility for PV system operators
BlogPV centres on the application of blockchain technology in the energy sector. A virtual storage alliance for photovoltaics (PV) system operators is to be organised with the help of a blockchain. Existing platform technologies combine small home storage facilities to form a virtual large storage facility which optimises electricity flows between the participants and also stabilises the grid. The blockchain serves as a simple and secure method for recording the flows of electricity. This will ensure that PV systems will remain profitable for operators and green electricity attractive for consumers once feed-in tariffs have expired.

A pilot project demonstrating a functioning blockchain-based market system within a geographically limited area is being set up in the Hanover region.

- **Service robotics** Service robots are increasingly making their way into our daily lives and can now be found not only in industrial companies, but also in healthcare, logistics, and in supermarkets. Market data backs up the impression that these smart helpers are seeing a rise in take-up. Service robotics was first picked up on by the Federal Ministry for Economic Affairs and Energy in 2013, and supported under the Autonomics for Industry 4.0 programme. The PAiCE – Digital technologies for business programme, under which several projects receive funding, is about consistently developing navigation and control technologies and development platforms that cater to inexperienced users from the industrial sector, logistics and healthcare who want to design and programme service robots in a simple way.

- **Smart living** applications are increasingly making their way into our homes, workplaces, and our leisure time. Far gone are the days when the potential for these applications was limited to smart, digitised buildings (the smart home). The smart home can increase people's safety, security and convenience levels in their living environments, and also improve the building's energy performance. However, this comes at the price of certain privacy restrictions.

The success of smart living applications on the market depends on whether citizens trust this new technology and accept it. For this to happen, data privacy and data security need to be ensured and market transparency improved along with investment security levels. In addition to these criteria, products are to offer clear benefits and be easy to use. Another key requirement for successful market penetration and the creation of a German lead market for smart living applications is interoperability between systems made by different manufacturers.

For this reason, the Federal Ministry for Economic Affairs and Energy uses its funding programmes to support numerous R&D projects designed to demonstrate the feasibility and usefulness of smart living applications in fields including security, energy management, convenience, and preventative healthcare.

A German business initiative for smart living was established with the aim of developing a lead market for smart living products that will give German manufacturers a competitive edge. The Federal Ministry for Economic Affairs and Energy wants to support this initiative and has therefore opened an independent office for smart living. It serves as a neutral arbiter between the different industries involved, facilitates coordination between industry and policy-makers, and acts as a central point of contact at national and international level.

EXAMPLE OF A PROJECT

ForeSight – Platform for smart and forward-looking smart living services mindful of the relevant context
How can people's everyday lives become more safe and secure, energy-efficient, and comfortable? This is the main question addressed by the ForeSight collaborative project, which is part of the innovation competition on artificial intelligence.

The key objective for ForeSight is to develop and establish an open AI-based platform in a smart living environment at a pre-competitive stage, complete with prototypes of the following solutions:

- to overcome current interoperability issues between different smart living components, so as to make it possible to combine products made by different manufacturers;
- to establish machine learning and other AI methods in the smart living context, so that apartments and devices will learn themselves to ever better adjust to their various user profiles and that it will be easy to select the relevant configurations;
- to create an environment that allows for an optimised framework for operating, maintaining, updating, and repairing the technical components used in the housing sector.

ForeSight is to create a new mega-ecosystem for smart living that connects and includes tenants, housing companies, components and systems manufacturers, suppliers of software platforms, investors, and operators from the housing sector, and many more service providers from different industries. At the centre of all this, however, will be the human being.

- There are growing numbers of projects in the field of **healthcare** that draw on specific technology developments and receive funding from the Federal Ministry for Economic Affairs and Energy under its various programmes. Focal areas here include better medical care (doctor-patient communication, remote monitoring), the secure use of medical data in line with applicable legal requirements (e.g. for clinical research, analytics, compliance with reporting requirements for medical technology and pharmaceutical companies), and digital medical technology (interoperability, AI-based diagnostics, 3D procedures). The ambition of the project is to create seamless digital processes where possible. For selected projects, there are possibilities for international transfers.

EXAMPLE OF A PROJECT

KIKS – Artificial Intelligence for clinical studies
One example of a project from the healthcare sector is the KIKS alliance. Its partners are seeking to establish a digital ecosystem for the shared use and exchange of medical data between hospitals, medicine technology manufacturers, and those responsible for the safety of pharmaceuticals.

The platform is to use AI for an automatic extraction of the relevant parameters. This will render data capturing and analysis for clinical treatment and medical research more efficient. The platform will allow for an automated risk and performance comparison of different medical products, and for product improvements. At the same time, it will make it easier for manufacturers to meet the complex requirements of the EU Medical Devices Regulation. The project therefore wants to speed up the digital transformation in healthcare whilst also helping the medical technology and pharmaceutical industries to comply with their notification requirements.

In the longer term, SMEs, in particular, are to be put into a position where they can use data-driven processes and AI applications to create new applications and business models of their own.

KIKS has been explicitly named as a use case for GAIA-X.

- **Crisis management:** The economic impact of the current COVID-19 pandemic is still impossible to predict. However, it is already clear that there are several measures that can help limit the economic damage. In many fields, digitisation (e.g. in connection with having staff work from home) is a way to mitigate the economic impact of the containment measures.

It is becoming clear that it is necessary to combine data about the spread of the virus with economic and social data so as to arrive at new and viable solutions. This makes it necessary to cooperate across different specialisations and sectors, and to form platforms allowing all stakeholders to work together to create and implement these new solutions. In terms of economic policy, it is important to both make existing business models more resilient and also harness opportunities for new business models. Thanks to trusted information and AI-based solutions, businesses will have a much more solid understanding of how they need to act in a crisis.

The Federal Ministry for Economic Affairs and Energy wants to support the development of such solutions and in early summer 2020 therefore used its third call for projects for the AI innovation competition to focus on projects based on digital technologies and designed for the field of crisis prevention and relief (be these crises caused by infectious diseases or other threats), and suitable for boosting businesses' resilience and protecting public health.

EXAMPLE OF A PROJECT

SmartSense&Rescue
This collaborative project is about developing smart procedures for automated head counts, localisation of people, and movement analysis, all of this on the basis of videos recorded by standard operational drones. These solutions are to be integrated into the existing operational command systems used by public authorities and security organisations to support their staff in life-threatening situations and in a simple and automated way. The many potential use cases for SmartSense&Rescue range from searches for missed persons to severe and complex disasters such as floods and industrial fires, and forest fires.

Chapter 6: International cooperation projects

The Federal Ministry for Economic Affairs and Energy is providing funding for bilateral cooperation projects in Europe and internationally to support the transfer of technological developments to foreign markets and for harnessing the specific skills of companies and research institutions. At present, there are ongoing cooperation projects with Austria and Japan. Further bilateral cooperation projects with Finland and Canada are being prepared.

Cooperation with Austria

Since 2018, there has been bilateral cooperation between the German Federal Ministry for Economic Affairs and Energy, under its **Development of digital technologies** support framework, and the Austrian BMVIT ministry under its **ICT for the future** programme.

Both ministries have agreed to step up the level of cooperation between the research and development projects underway under the respective funding programmes. This means that Austrian and German companies and research institutes can complement each others' profiles and jointly create attractive solutions at a pre-competitive stage.

Both the German and the Austrian sides have implemented cooperative project funding for the field of the data economy: the calls for proposals for the German "smart data economy – AI, semantics, sovereignty" programme and the Austrian "smart data economy AT/DE2018 – AI-based data-products" programme are open for joined R&D projects.

The following cooperation projects launched in 2019:

Field of application	Collaborative project
Automotive industry	**CampaNeo** – Platform for real-time vehicle data campaigns
Construction industry	**BIMcontracts** – Automated payment and contract management in the construction sector based on distributed ledger technology and BIM-5D
Business experts	**Future Data Assets** – Smart data calculations for assessing corporate data assets
Healthcare	**Telemed5000** – Development of a smart system for telemedical collaborative care for large collectives of high-risk cardiological patients
Manufacturing and supply chain management	**PLASS** – Platform for Analytic Supply Chain Management Services
Manufacturing and process industry	**ExDRa** – Exploratory Data Science over Raw Data

In 2020, an agreement was made for Germany and Austria to cooperate under the Austrian **Future manufacturing** project. Together with the Austrian FFG research support agency, a call was made for a shared lead project on the smart and sovereign use of manufacturing data. This lead project will be selected by both countries together and is to launch in January 2021.

Beyond this, a call for bilateral cooperation projects for different areas of application was made under the Austrian **ICT for the future** programme. An international jury of experts selected the most outstanding entries to receive funding under the programme. These projects are due to start in early 2021.

Cooperation with Finland

A Finno-German flagship project on 5G technologies for port logistics is currently being prepared and due to start in the second half of 2020. Finnish research institutions and companies are particularly strong on communications technologies and artificial intelligence. In the medium term, the results from the newly formed partnerships could also be fed into European programmes.

Cooperation with Japan

The Federal Ministry for Economic Affairs and Energy has decided to provide funding to the German-Japanese stand-alone project AIRPORT – Artificial intelligence for mobile industrial communications. The German consortium is led by the German Research Center for Artificial Intelligence (DFKI) and is developing and testing technologies for 'wireless communications networks in industrial environments', 'robot teams and populations in industrial manufacturing', 'AI-based sensor data analysis', and 'IT security'. This work will complement the Japanese prowess in the fields of wireless communications for mobile devices and adaptive media use in factory environments. The two consortia began their work in the second half of 2019.

Cooperation with Canada

Overall, there are four German-Canadian research projects in the pipeline: two in the field of healthcare and two in robotics/manufacturing. Both projects will be ready to begin by spring 2021 and are being closely coordinated with the Canadian National Research Council (Montreal) and the Canadian Embassy in Berlin. The two Canadian states of Ontario and Quebec are particularly strong in the field of manufacturing and technology fields including artificial intelligence and quantum computing. Furthermore, there are strong cultural similarities with regard to important horizontal issues such as data security or ethical questions pertaining to AI.

EUREKA activities

From time to time, the Federal Ministry for Economic Affairs and Energy also provides funding for stand-alone projects that are part of the EUREKA CELTIC-NEXT cluster. The last successful project was the VIRTUOSE – Cloud-based service platform for big-data video analysis and processing, in real time (2016 – 2019).

The last addition is the first joint call made by five EUREKA clusters in the field of artificial intelligence. The Federal Ministry for Economic Affairs and Energy has the intention to support one or two projects. These are due to begin in 2021.

More information about
international cooperation projects

bmwi.de