Data Strategy of the Federal German Government

An innovation strategy for social progress and sustainable growth

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The
Federal Government

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An innovation strategy for social progress and sustainable growth

Seizing opportunities: using, sharing and making data accessible

Data forms the basis of a digital society. Using more → data innovatively, responsibly and for the common good can significantly improve social cohesion in Germany, Europe and the world. It can also protect natural resources. Consider, for example, the researcher who is able to use data to better understand and model the spread of viruses. The farmer who can use less fertiliser as a result of data-based soil analysis and, by doing so, protects the groundwater and the climate. The employee who receives suitable information about further training based on detailed employment market data relating to her work situation. All these people are already using the opportunities provided by analysing reliable and available data to make a positive impact on our common future.

Data also helps those in politics and public administration to make soundly based decisions and to create regulations, support measures and services that better meet the needs of citizens, industry and science. Examples of this include using traffic data to avoid traffic jams and facilitate climate-friendly transport strategies that make our cities and towns better places to live in the long term. Finally, the United Nations and the European Commission also use environmental data to protect natural resources for future generations. The targeted use of data makes it possible to pursue the Sustainable Development Goals of Agenda 2030 with even greater determination.

The COVID-19 pandemic has made another effect much clearer: citizens can be better protected if available virus data is *shared and used jointly* by European partners. Scientists from around the world are sharing their data to enable joint research on vaccines against the virus.

This is all possible because data has special properties as a core element of the digital world: it can be used, shared and connected for various purposes by many different stakeholders – without being "used up". Despite the growing importance of data and its special properties, which hold so much potential for cohesion in our society, industry and research, the environment and climate, data is still not being used enough in today's Germany and Europe

We at the Federal Government aim to use this Data Strategy to significantly increase innovative and responsible data provision and data use, especially in Germany and Europe – in industry, science, civil society and public administration. At the same time, we want to ensure fair participation based on European values, prevent data monopolies and consistently counter data misuse.

Issues of how to deal responsibly with the opportunities and risks presented by constantly developing technologies of data generation, collection and analysis are also closely linked to data use. Opportunities need to be utilised but at the same time the fundamental values, rights and freedoms of our society must be protected. Data-driven innovations and services should be facilitated while simultaneously maintaining the internationally recognised high standard of personal data protection provided in Europe and Germany.

Promoting sustainable growth and prosperity through data use

The social market economy's core commitment, "prosperity for all", has significantly shaped Germany's successful economic model over the last few decades. We want this core commitment to apply to the → data economy, too, and to guarantee sustainable growth, social security and fair participation in the data society. Data use creates new opportunities for the long-term reinforcement of productivity and growth. Various studies (e. g. by the OECD) show that knowledge-based resources like databases, digital applications and IT skills are an important driving force behind this. At the same time, however, there is little investment in this sector in Germany compared with the rest of the world, especially in small and medium-sized enterprises (SMEs). The industrial strength of the German economy in particular is key to pushing forward developments in Industry 4.0, the Internet of Things and the use of artificial intelligence through greater data use. Better use of data can lead to the development of new future-oriented business models and role profiles, as well as the generation of growth from new sources of value creation. Data use can therefore make a positive contribution to the common good, for the benefit of the environment and the climate, as well as the individual.

There are many reasons why data has not been used and shared enough in Germany before now. On the one hand, there is a lack of knowledge among some stakeholders about how useful data can be or how it can be used efficiently. On the other hand, however, there is also a lack of incentives for investing in data use and data sharing; sometimes there are even disincentives for sharing data. The Federal Government aims to respond to both these issues in this Strategy.

In terms of the data economy, the last few years have seen strong concentration tendencies which result in a few very large companies accumulating, combining and analysing enormous volumes of personal and non-personal data. This produces an imbalance of power between companies and in how market-dominant companies relate to society and the state. Our institutions need to develop continuously to cope with this new reality, counter the dominance of such companies and prevent the creation of any new data monopolies. Fair competition and open markets are the prerequisite for "prosperity for all".

Responsibility: using opportunities, countering risks

The accumulation of data is not simply a structural issue. It also poses very specific challenges for individuals, especially in terms of their freedom, their private lives and their information-based self-determination.

While an ever more exact digital image of our society can form the basis of innovative processes in many areas of the economy and society, it can also lead to the manifestation of existing inequalities and marginalisation, which may even be reinforced by digitalisation. What is clear to us, however, is that people as individuals and social beings, as enlightened citizens, must remain the focus in a digital society. This is the guiding principle of the European value system. Bearing this in mind at all times is an inherent part of "responsible data use" for us. People must not become a mere object of digital processes. Technology should support and help people, not replace them in their role as decision-makers.

This strategy is based on the strong foundation of the European standard of data protection. Responsible data use as we understand it is not only about adhering to the legal framework but also about focussing on key ethical principles and considering quality and security criteria prepared in accordance with the latest developments in technology. In our opinion, this also includes high data quality, high standards of data management, careful documentation and transparent data analysis.

When it comes to using data, not everything that is technically possible is also ethically justifiable or politically desirable. Opportunities connected with processing large volumes of data, predicting and controlling behaviour and influencing preferences through → profiling and scoring must be scrutinised and, if necessary, restricted. Data use must not be allowed to result in social or political polarisation. Data law and ethical principles cannot stop this, but they are important for protecting basic rights and for responsible data use.

The COVID-19 pandemic has shown that it is possible to employ effective digital instruments in alignment with European values. A high level of data protection can even become a driving force for innovation and be crucial to the success of a digital technology because it increases trust in that innovation or technology. Greater data use may also be required for ethical reasons, for example in health research. Questions of data ethics should be discussed again and again by the whole of society and considered within the framework of legislation. This is something that is made particularly clear in the report by the Data Ethics Commission.

And finally, we must also always be aware of the fact that the complexity of reality – for example with political and social issues – cannot always be captured in full by data and data analysis. The significance of the results of data use depends to a large extent on the quantity and quality of the data and also the technology employed. Misinterpretations can also arise through the biased interests of those providing the data, using the data and programming the corresponding algorithms.

Creating trust in data use

All stakeholders in the data society are responsible for establishing and nurturing trust. We want to create a digital future that people can rely on. In doing so, our objective is to protect people through legal regulations and technical measures and enable them to act in an informed manner: with self-determination and skill, independence and security.

The more fast-moving, more complex and therefore also less transparent technological processes become, especially for the individual, the more important trust becomes as a means of orientation. For this purpose, responsible data use requires a high level of information security, which means legal framework conditions must be adhered to and enforced and all stakeholders must take responsibility.

Trust in framework conditions, infrastructures and stakeholders is the basis on which data that can be shared is actually shared. And trust in the data and its source is the basis on which data that is shared is actually used. If you do not trust the source of the data, you won't trust the data itself either, and won't use or learn from it.

This trust is fragile, however. It can be permanently broken, especially if personal data is misused or its security is not guaranteed. It can also be broken when data is not used for the common good. Trust in structures and stakeholders needs to be secured and reinforced.

We need to set our course towards our future data society together with science, industry and civil society. Creating a modern data society in Germany requires all social stakeholders to do their bit. It is essential to enforce framework regulations and adapt to digital challenges as well as create trust so that citizens and civil organisations can use the opportunities digitalisation offers and companies can boost their competitive strength with innovative data-based business models. We, the Federal Government, must also reposition ourselves, future-proof our data infrastructure, enhance our data skills and review our own self-image.

Areas of action of the Data Strategy of the Federal German Government

The Data Strategy covers four areas of action:

Firstly, we will improve **data provision** and secure **data access** at infrastructural level.

Secondly, we will promote responsible **data use** and tap potential for innovation.

Thirdly, we want to improve → **data skills** and establish a new data culture in Germany.

Fourthly, we will make the **Federal Government a world leader of the new data culture** so that it can fulfil its special role in this field.

Europe and the world

The objective of the Data Strategy here is not only to point us in the right direction in terms of our data policy, but also to contribute to the European vision of the data age that we are developing with our European partners. In this vision, ensuring justified access to and better use of data for the good of the many and protecting the rights and data of each and every individual are not contradictory but are inseparably connected.

Many of our measures are already closely linked to the efforts of the European Commission and its Data Strategy. With all newly proposed measures, we will consider from the outset how they can be connected to other European member states. Only then can we create synergies and contribute to Europe‘s digital sovereignty. At the same time, we want to support our international partners with establishing and protecting their own digital sovereignty. This also involves cooperation with developing countries and emerging markets. A key factor here is understanding that data can also be for the common good so that the great potential of data can be harnessed for economic and social development around the globe.

We will also work to ensure that the European Union remains the world’s most open region for trade and investment in the digital age, supporting international cooperation on ambitious obligations relating to the free movement of data and countering digital protectionism.

Financing

If measures listed here or future measures connected with them involve financial costs or the need for additional personnel which is not provided for in the financial planning up to 2024 or covered by funds from the Federal Government‘s stimulus package, these measures may only be implemented – provided they are the responsibility of the Federal Government – if they are counter-financed or compensated directly, in full and on a long-term basis within the individual plans concerned or in the given area of policy-making.

Further development

We are certain that the measures in the Data Strategy will enable us to assert our European values, our ideas of data protection and sovereignty in the age of the global movement and networking of data and that our way of handling data can be an example to others.

We will monitor progress made on implementing the Data Strategy by conducting, among other things, prompt and effective evaluations.

I. The foundations: creating effective and sustainable data infrastructures

Effectively and sustainably designed data infrastructures are a necessary prerequisite for innovation in the → data economy. They form the technical basis of components and services on which data is made available and software and services can be provided. Covering data transfer networks and common (technical) standards, they extend right down to the level of hardware, e.g. servers in computer centres.

With ever faster growing volumes, data is increasingly processed locally where it is generated (→ edge computing). This may be on a smartphone or sensor network, for example. Local and central approaches are intertwined these days. This increasing complexity in combination with the effects of consumption of energy and resources on the environment and climate means that there is also a growing need for common standards and innovative solutions.

These standards are of key significance. We must ensure that we, in Germany and in Europe, are involved in defining them. After all, those who set the standards not only facilitate innovation and new value creation but also strengthen their own → digital sovereignty. Added to this is the fact that data is only readily shared and used by stakeholders in a → data ecosystem if the data infrastructure is safe and trustworthy and the security of the data is guaranteed, especially if data protection and IT security are technically incorporated into the products and processes from the outset. Likewise, setting standards is also associated with ensuring the necessary data quality (e.g. in terms of integrity, comprehensiveness and validity as well as appropriate test and training data). If these attributes are called into question, it results in one of the biggest obstacles to → data sharing, corresponding trust in the data and therefore also to trust in innovative data use.

This is why we also want to lead a broader social debate on existing and future instruments and measures to create more sustainable data infrastructures.

1. Interlinking and expanding data infrastructures

Where do we stand?

A large number of public and private data infrastructures have been established over the past few years in Germany, each with their own standards and framework conditions for users. A wide range of projects is underway in science and industry. The landscape is, however, very fragmented and continually changing.

This is why the → National Research Data Infrastructure (NFDI) was set up in the science sector: applications were received from 142 research institutes in the first round of applications from the fields of life sciences, natural sciences, social sciences, behavioural sciences, economics and engineering, among others. There is also a local network of 34 accredited → research data centres. These serve to improve access for the science sector to → microdata from research or official statistics.

A large number of company-owned solutions and sector-specific initiatives exist in industry. Start-ups, small and medium-sized enterprises and major companies all work together in a global network of partners on data platforms.

What do we want to achieve?

Implementing innovative data projects is to be made easier in Germany. Innovation and value creation are to be facilitated by a secure, trustworthy and sustainable data infrastructure. For this purpose, the Federal Government aims to provide incentives for consolidating, expanding and connecting existing infrastructures, including data preparation and the standardised creation of metadata. Data records are to be made usable through (semantic) connections with the aid of → linked data and application programming interfaces for the application of artificial intelligence. We want to achieve economies of scale and network effects to make investments in newer technologies like supercomputing and quantum computing worthwhile and make German and European → data ecosystems more attractive to more users. We hope to expand data infrastructures to make them interoperable, energy-saving, resource-efficient and local. In future, various stakeholders will be able to add their data safely and access data resources saved by others in the same place. In other words, they will become part of a data ecosystem.

The Federal Government will implement measures to improve responsible and sustainable use of data and initiate the setting of standards for data infrastructures.

How do we want to achieve this? Our key measures[1]:

- We will make decisive progress on the cross-sector project → GAIA-X. GAIA-X is a project that aims to link up local infrastructure services (particularly cloud and edge solutions) to form a user-friendly system. The goal is to create a trustworthy, open and transparent ecosystem in which data and services can be made available, combined and shared safely. Industry and science will be able to share their data for use/reuse in this ecosystem without losing control over who, where, why and how often their data is used. In this way, there will be a considerable increase in the willingness to share data. The objective is to link up existing infrastructures via open source applications and interoperable standards in the form of a common reference architecture without first expanding own computer capacities. The European GAIA-X AISBL organisation will not only provide a secure and sovereign data infrastructure but also create the basis for an entire infrastructure and data ecosystem that encourages trustworthy data sharing and thereby promotes innovative, data-based business models. (BMWi/BMBF)

- We will push ahead with the expansion of the National Research Data Infrastructure (NFDI). This will be supplemented by a Research Data action plan, which combines activities on improving the use and usability of research data, for example for researching the universe and matter in major research infrastructures and aims to promote cultural change in science in favour of strengthening data sharing and reuse. (BMBF)

- The European Open Science Cloud (EOSC) is moving into the implementation phase and is creating a Europe-wide, trustworthy, virtual networked environment in which research findings can be stored, shared and reused digitally. We will continue to push ahead with establishing this environment in Germany. (BMBF)

1 Several other measures can be found in the table in Appendix 1.

- We are committed to the development of universal standards of data quality, metadata and the interpretability of data in the NFDI. In particular, interoperability with data in the European Open Science Cloud (EOSC) and consideration of standards for the digital representation of measurement data established by the Meter Convention (International Committee for Weights and Measures, CIPM) will play a role in this. (BMWi/BMBF)

- We will push ahead with the research and development of innovative digital technologies and data infrastructures, methods and tools and further expand Germany's technological sovereignty. For this purpose, we will create the conditions for safe, trustworthy and effective data technologies, applications and infrastructures through the strategic funding of technological development. In the new framework programme on microelectronics, we will promote electronics for energy-saving information and communication technology as well as data processing. (BMBF)

- Within the Green ICT research initiative we will promote electronics for energy-saving information and communication technology as well as data processing. (BMBF)

1.2 High performance computing, quantum computing and storage media

Where do we stand?

The research infrastructure in Germany forms the basis of a new generation of data processing.

High performance computing is an important and necessary prerequisite for research and parts of industry in Germany to be competitive on a global scale. It represents an infrastructural basis for (future) applications of artificial intelligence, complex climate models or simulations (including for corporate processes and production processes, in medicine, physics and mechanical engineering as well as in risk provisioning and disaster prevention). Germany is among the world leaders in developing algorithms and applications for high performance computing. In terms of the performance of installed supercomputers, Germany is among the top 3 in Europe, but is currently not one of the providers of the ten highest performing computer systems in the world.[2]

Quantum computing can be used to complete certain tasks, especially complex simulations, which traditional computers are not efficient enough to perform. In January 2020, the Federal Government published a strategic initiative on building an efficient ecosystem for quantum computing (→ digital ecosystem). We are also setting up three new institutes of the German Aerospace Center (DLR) in the field of **quantum technology**. A centre for quantum technology is currently under construction at the National Metrology Institute of Germany (PTB). This centre is simultaneously part of the regional initiative "Quantum Valley Lower Saxony". Quantum communications is being researched in a project with the Fraunhofer-Gesellschaft (QuNET). On the basis of the Federal Government's stimulus package, investigations are currently underway on how to progress with the construction of at least two platforms for quantum computing and how Germany can become a competitive economic and technological world leader in the relevant fields of quantum technology.

2 Japan, the USA and China are the current top three: https://www.top500.org/ (accessed on 21.08.2020).

In addition to quantum computing, researchers around the globe are looking for new ways to process and store giant volumes of data. These include → neuromorphic chips and improvements for → CPUs and special processors like → GPUs. Institutes and start-ups in Germany are also conducting research into this area of high technology. Research and industry are among those tackling the challenge of backing up and archiving large volumes of data by developing DNA data memories and using glass plates as a storage medium.

What do we want to achieve?

We want Germany to become a world leader in high performance computing. With the further expansion of the Gauss Centre for Supercomputing (GCS), total operating performance is to be increased initially to over 100 → petaflops over the next two years. Together with other European countries, we also want to close the gap on the world leaders Japan, the USA and China, through the European Partnership on High Performance Computing (EuroHPC) by creating → exascale computers. In addition to creating central → exascale supercomputers for periods of peak demand, capacities will be expanded to Germany-wide use by university staff and students within the framework of the "National High Performance Computing" programme of the Federal Government and federal states.

In future, Germany and the EU must have storage and processing capacities to match increasing volumes of data. For this reason, the Federal Government wants to invest in research into new computer architectures, especially for → quantum computers but also for neuromorphic computer systems and GPU or other AI chips, making sure that German sovereignty is reinforced from the outset. We want to be world leaders in the development of → neuromorphic chips.

How do we want to achieve this? Our key measures:

- We have set up a programme for high performance computing. It includes measurable objectives to push ahead with expanding, operating and connecting computer infrastructures for exascale supercomputers and high performance computers, including within the European framework. Among other things, expansion activities at various levels are to be interlinked and progress is to be made on industrial application, flanked by research approaches into developing efficient and effective hardware and software for future computer systems and applications. The necessary increases in funds for this form part of the German implementation plan for the EU recovery plan, the German Recovery and Resilience Plan (DARP). (BMBF)

- With the consistent implementation of the Federal Government's framework programme "Quantum technologies – from basic research to market", we will ensure Germany's quantum capacities are built up. We will promote the transfer of quantum technology from basic research to market. The focus here is on quantum computing, quantum communication and quantum sensor technology. Implementation will be based on the results of the roadmap for a national initiative on quantum computing, which was presented in January 2021. (BMBF/BMWi)

- We are researching secure data exchange with the pilot quantum communication network. (BMBF)

II. Increasing innovative and responsible data use

We will set the framework conditions for society, industry, public administration and science to use and share more data responsibly and sustainably, for tapping the potential of data as a core component of digital innovation and at the same time for preventing consequences of data misuse, such as the enforcement of social controls, discrimination and the exclusion of economic or social participation by citizens.

We will also incorporate the recommendations of the Digital Council, the Data Ethics Commission and the Commission of Experts on Competition Law 4.0.

2.1 Regulation: improving framework conditions

Standardised regulation on handling data is not possible due to the large number of different data sources, stakeholders and forms of use. Regulation needs to be differentiated, requirements-based, taking into account the various interests and assets to be protected. In a federal state like Germany, however, this results in a large number of laws on data handling, which in many cases has caused significant legal uncertainty among practitioners. It makes sense to further reduce this legal uncertainty, especially through non-legislative measures, in order to establish standardised data protection practices.

2.1.1 Framework conditions for personal data

Where do we stand?

→ **Personal data** is specially protected by the EU Charter of Fundamental Rights as this data portrays the personality of an individual right down to the most private areas of his/her life. As part of the general right of personality, informational self-determination is a protected basic right under constitutional law. For this reason, with its General Data Protection Regulation (GDPR) of 2016, the European Union revised its data protection provisions and created an EU-wide high standard of data protection adapted to the age of digitalisation. This was a pioneering decision. The GDPR now also serves as a model for (new) data protection laws in countries outside the EU. At Federal Government and state level, the GDPR has been supplemented by sector-specific data protection laws. In this way, the particular features of the German federal state could be addressed. In addition, the large number of special laws and other regulations govern various administrative procedures, data processing tasks and procedures by public administration, industry and civil society.

Due to the complexity of the specifying data protection law, however, personal data is in many cases only processed to a limited degree and data-based projects are not implemented through fear of sanctions in Germany.

Another reason for not using data or preventing → data access by third parties is that data controllers are often not clear about whether the data in question is personal or if any personal reference has been removed through complete anonymisation. This only exists if any personal reference in the data is removed in such a way that it cannot be restored or can only be restored with a disproportionate amount of time, cost and effort.

The GDPR also establishes the obligation for data protection in technical design. The potential inherent in this has not yet been fully used in practice by companies and research.

Scientific institutions are also affected. If data protection provisions are interpreted in contradictory ways it can restrict the combining of data from different sources that is useful for research. Technical developments regularly bring up new legal questions on this.

Data protection is supervised in Germany by the Federal Commissioner for Data Protection and Freedom of Information (responsible for, among other things, federal authorities, financial authorities in terms of personal data processing in the application of the German Fiscal Code and telecommunication companies and postal service providers) and 17 federal state officers for data protection[3], who supervise state-specific compliance with data protection law in the public and private sphere. Together they form the Conference of the Independent Data Protection Authorities of the Federal Government and the Länder (DSK), which is designed to promote standardisation of the legal interpretation of the supervisory authorities. Nevertheless, the legal interpretation may still be divergent. We will check whether and in what form improvements are needed in the coordination of standardised implementation of data protection law.

Different approaches to data protection by different supervisory authorities within the EU can also highlight challenges associated with establishing a harmonised application of law and more European → data sovereignty.

3 The Free State of Bavaria has two data protection supervisory authorities, one for the public sector and one for the private sector.

What do we want to achieve?

Legal certainty

We want to reinforce responsible handling of personal data in Germany and ensure the enforcement of applicable data protection law. This includes a regulation to ensure the principle of informational self-determination over personal data in all social spheres. This regulation takes into account other assets protected by basic law such as the protection of life and health and scientific freedom.

Legal certainty for business models of the digital economy is also boosted when official authorities relating to the European single market are organised as effectively as possible.

We want to make regulations in **data protection law** more standardised and less contradictory in collaboration with all those responsible, while at the same time maintaining the existing level of data protection.

This includes the possible introduction of responsible data protection supervision for cross-state research projects similar to that of existing regulations for health data protection.

We are also investigating whether and how data protection supervision can be improved in the private sphere.

In the federal states, we will promote making data protection law more standardised across federal state borders, while maintaining the existing level of data protection, especially in research. We are endeavouring to achieve harmonisation in European data protection through the ePrivacy Regulation, which is designed to improve the particularly important protection of the private sphere in electronic communication.

However, there are also areas in which personal data is used without sufficient legitimacy under data protection law. We want to develop more solutions to protect consumers against this.

In addition, we must make this complex area of law accessible through new forms of preparation, cross-state standardised aids for interpretation and **more non-legislative measures** for non-legal specialists.

Technical solutions can be particularly suitable for this purpose. Applying a standardised legal interpretation in practice is also important for ensuring valid social data protection and employee data protection, especially with respect to health data. Finally, we will provide more information to a wider audience on decision-making rights under data protection law and promote projects that may be helpful for this.

The protection of personal data must be considered from the outset, in other words, in the development of products and services. Technical norms or standards can assist with this. In addition, public procurement guidelines are to be adapted accordingly.

In order to safeguard data protection law and protect the interests of **consumers**, we want to establish data management systems or **Personal Information Management Systems** (PIMS) (see Chapter 2.3).

Digitalisation and increasing use of new technologies like artificial intelligence in the world of work are resulting in more personal data being collected and processed. Employee data protection plays a fundamental role in protecting employee data, reinforcing their trust in new technologies like big data and artificial intelligence and thereby clearing the path to a data economy. Explicit, manageable regulations on employee data protection also ensure greater legal certainty for companies and can therefore offer competitive advantages on the international market.

Anonymisation and technical data protection

When looking for data services, users often cannot find German or European solutions with a strong infrastructure that access and store data and provide data analysis as a service. There are also very few solutions on the market which protect the private sphere. It is precisely this challenge that we will address, at the same time reinforcing solutions that conform to data protection.

When data is collected, concepts of reuse are sometimes overlooked, especially in the case of research data. Alongside legal safeguards, technical solutions that guarantee data protection can be helpful here. For this reason, we aim to make Germany a world leader in research on the technical depersonalisation of data through a combination of institutional, organisational and legal measures. Improving technical solutions for the → anonymisation of data in → real time is of great importance when it comes to intensifying data exchange and data reuse. Systems that include data protection through technical design and pre-settings should be prioritised in research funding and access to data. Technical protocols and standards for anonymisation can be implemented and scaled, for example, by → data trustees. Research findings in the field of anonymisation are therefore to be made available as free-to-use open source solutions to all stakeholders in the data ecosystem.

How do we want to achieve this? Our key measures:

Legal certainty

- The standardised legal interpretation and application of the data protection provisions in the private sector has played a decisive part in the effectiveness and success of data protection reforms over the last few years. We are committed to close cooperation between the data protection supervisory authorities of the Federal Government and the federal states in all data protection issues of national importance. We are investigating measures that can contribute to this. This currently forms part of the evaluation of the Federal Data Protection Act (BDSG). (BMI)

- In order to speed up and simplify multi-centric cross-state research projects on healthcare provision, a regulation was created in Section 287a of the Fifth Book of the Social Code (SGB V) governing the standardised application of federal law and a responsible supervisory authority was established following the example of the GDPR. (BMG/BMBF)

- We will define data protection law for telemedia and telecommunication services in a Telecommunication and Telemedia Data Protection Act (TTDSG), which will re-regulate the responsibilities of supervisory authorities in this field and therefore provide greater legal certainty. (BMWi)

- Diverging regulations based on data protection law at federal state level sometimes make it more difficult to use personal data for research, for instance in the education sector. We want to improve opportunities for data use for research purposes. To do so, we will promote a harmonisation of legal foundations in federal state law to the federal states and investigate where it also makes sense to base data protection supervision in other areas of research on the concentration effect of Section 287a of the Fifth Book of the Social Code (SGB V). (BMBF/BMWi/BMI)

- The interconnectability of research data on households and companies from different sources will be standardised by the interplay between different areas of legal regulation (social law, statistical law, data protection law). We want to find more standardised research-friendly solutions without lowering standards of data protection and statistical law. (BMBF/BMWi)

- By continuing with the round table on data protection we are creating an information and exchange service for interested groups on current topics of data protection such as the international movement of data. (BMI/BMWi)

- We will make it easier for data subjects to exercise their → data sovereignty themselves using technical solutions. We have also commissioned research into a solution for innovative data protection consent management. (BMJV)

- We are committed to effectively protecting the private sphere and personal data in electronic communications in alignment with the fundamental rights set out in the Basic Law as well as the provisions of the EU Charter of Fundamental Rights. For this reason, we are pushing ahead with the ePrivacy Regulation in order to attain a high level of protection and confidentiality for communication data under this regulation and, at the same time, ensure the necessary scope for innovation and digital business models. (BMWi)

- We are also committed to achieving a standardised understanding of data protection at European level. Companies operating in the European Union are to find the same conditions in

all EU member states, particularly in terms of enforcing data protection law. (BMI)

- We will work to draw up codes of conduct in accordance with Article 40 of the GDPR for secondary data use in healthcare as well as consolidate the group of experts on secondary use of health data in order to increase legal certainty and ensure that secondary data within European health data can be used in compliance with the GDPR. (BMG, BMAS)

- Research and science are vital when it comes to facilitating better use of data stocks beyond individual interests for the common good and prosperity for all and to minimise risks. To date, however, access to important data stocks and data links has been very limited in these fields. In future we will review new draft legislation to see what scope it offers for the creation of research-friendly, barrier-free access rules (known as research clauses) for independent scientific research. (BMBF, all federal ministries)

Anonymisation and technical data protection

- We will set up a research network on anonymisation in order to promote technical data protection. Beyond research alone, this will strengthen research transfer through support from public administration and industry on questions of anonymisation and data depersonalisation and thus create incentives for → data sharing. With the consolidation of expertise in one network and the establishment of a specific research profile we will strengthen research in this area for the long term and work towards securing a prominent international position. (BMBF)

- We will promote anonymisation procedures and methods. (BMBF)

- We want to support the intensification of → data sharing through more efficient monitoring of data protection and cybersecurity. An important contribution to this can be made by public testing and certification laboratories which perform technical testing to determine the data protection compliance of data-based products and services. We will review the establishment of a network of testing and certification laboratories. (BMI)

- We will continue to exchange ideas with business associations and supervisory authorities on data protection-compliant AI and blockchain solutions and thus create greater security for innovative business models. (BMWi)

- In order to create incentives for reusing research data and to promote the willingness to → share data, a funding programme is to be created that provides open-topic funding for narrowly defined research projects based on the use of existing research data records. In other words, these projects will not involve any independent data collection, but will facilitate innovative research questions and links. (BMBF)

2.1.2 Framework conditions for non-personal data

Where do we stand?

When it comes to handling **non-personal data**, there is still a lot of legal uncertainty and a great amount of unused potential. Access to and handling of non-personal data are primarily contractually agreed between the stakeholders. Companies can have a considerable **commercial interest in the exclusive use of their own data or in restricting its use** in such a way that third-party access to this data is either denied or its use is only provided via services. Controlling

access to and use of data can offer companies competitive advantages and business opportunities. Security factors can also play a legitimate role here. Exclusive access to data can also, however, prevent competition and innovative opportunities and favour the creation of monopolies.

Added to this is the fact that companies are uncertain about how much anonymisation of personal data is enough and how far data generated by industrial machines offers insight into business and trade secrets and restricts the companies' own competitive position. Many stakeholders do not know the benefits of data and so do not see this as a necessary point of negotiation when entering into contracts. Access to this data is then kept exclusive to a very small number of stakeholders. Currently, a lot of data is not used or only used for limited purposes by product manufacturers. Purchasers of goods, lessees and other entitled owners of goods often do not receive the data that "their" products generate. Alongside the sales market this is increasingly affecting what are known as aftermarkets, i.e. markets that are established after a product is purchased, such as within the framework of servicing, repairs and retrofitting. There is great potential for value creation for the German economy in this area.

Access to data is both directly and indirectly regulated partly through **copyright law**: the processing of publicly accessible data online through text and data mining where the content to be analysed (e.g. text or photographs) was copyright protected has been subject to legal uncertainty to date. In addition, databases are copyright protected in accordance with Directive 96/9/EC on the legal protection of databases, if their creation, review or presentation involved a significant investment.

Data is also protected by law in other contexts. The protection of **trade secrets** means that companies are not required to disclose their technical or commercial foundations. Violations against prohibited actions, i.e. unauthorised access to trade secrets or their unauthorised use or disclosure, justify various claims of the holder of the trade secret against the violator.

If other conditions are met alongside the violation against prohibited actions, this will also be considered a criminal act (Section 23 of the GeschGehG, German Trade Secrets Law).

The handling of data is also regulated in part under **IT security law**. This is distributed over a large number of legislative acts and is hardly systematised at all. This fact and the sometimes non-standardised wording of the regulations can lead to uncertainties for those required to translate these regulations into practice.

What do we want to achieve?

It is important to tap the potential of third-party access to **non-personal data**. In doing so, we must take into account the legitimate interests of the producers of this data and the product manufacturers. We must also weigh up public interests such as the protection of natural resources and health. Data use has positive aspects such as acquisition of knowledge through research, but there is also the question of the sustainable use of resources. For this reason, we need to create suitable incentives for accessing data. Technical standards and open source protocols play a key role here. Not only can they standardise data collection, they can also promote data management as a whole by defining data access as well as → data interoperability and → data portability. Standardised and interoperable formats are not only of assistance to data controllers, they also improve German and European → digital sovereignty.

In future we will review new draft legislation also in terms of non-personal data, to see what scope it offers for the creation of research-friendly, barrier-free access rules (known as research clauses) for independent scientific research.

Exclusive data access can prevent competition and innovation if competitors are not able to replicate this data. On the other hand, it can also serve as an incentive for companies to create new investments, business models and value creation. It makes sense to resolve this conflict of objectives and strengthen cooperation in industry, science and civil society in the interest of common value creation. We are promoting a culture of willing and responsible data sharing for the benefit of everyone in society. It is therefore important to design the whole data ecosystem in such a way that more data is used and shared willingly. We support the creation of **data pools and data partnerships** (see also Chapters 2.2 and 2.3). At European level, we are committed to performing a critical review of Directive 96/9/EC on the legal protection of databases.

Competition law must also be adapted in line with the data economy so that it is better at recording and ending the misuse of market power. We have also responded to this with our revision of the Act against Restraints of Competition (GWB): the GWB Digitalisation Act. Effects of this are yet to be demonstrated in practice. This will address the issue of data access, in particular, by focussing more on access to data when determining improper and market-dominant behaviour, including restricted data access rights and adaptation of the essential facilities doctrine. Due to the rapid development of digital markets, preventive measures in competition policy will become more important in the future.

The Federal Government will reduce improper exclusive access to data, counter data monopolies and pay greater attention to data silos.

Studies show that there are data-driven markets in which it is practically impossible for competitors with significantly less data (or access to it) to catch up with the market leader over the medium term. This results in fewer incentives for innovation than is desirable and can also have negative effects on consumers (e.g. through links to adjoining markets or potential for misuse). For this reason, scientific circles have been discussing possible options for a data sharing obligation for companies for some time. The Federal Government will continue to pursue this discussion and review whether a requirement to share certain data needs to be established in particularly data-driven markets and how this could be implemented, within the framework of competition law or sector-specific regulation. It must always involve taking full account of property rights, in particular trade secrets, protection of intellectual property and protection of personal data.

In the European context, the Digital Markets Act (DMA) will take on the function of gatekeeper and address the issue of improper behaviour by major online platforms through directly applicable, general regulations on behaviour. Consideration is being given to making it an obligation of these digital platforms to provide platform users with access to their own data under certain conditions. For example, it would be prohibited to refuse appropriate data protection-compliant and non-discriminatory access to relevant, even exclusive data that cannot be generated or collected by the platform users themselves except at a disproportionately high cost or effort.

We also want to promote a better empirical (qualitative and quantitative) understanding of data markets in Germany and the EU.

We welcome and are actively following the current debate by experts on questions of fair access to and use of data. It increases our awareness of the great significance of sovereign and self-determined handling of data for innovative business models, functioning competition, the common good and social participation. Market structures that oppose innovations and self-determined and fair participation are therefore problematic. We are expressly against the creation of "data ownership". At the same time, we will look at how the enforcement of existing rights can be reinforced and endeavour to establish an appropriate legal framework that facilitates access to non-personal data and fair participation in data use.

How do we want to achieve this?
Our key measures:

- With our revision of the Act against Restraints of Competition, we will update the provisions on misuse under competition law through the GWB Digitalisation Act. This includes being better at capturing misuse of market power, especially by online platforms. In this way, it will be easier for competition authorities to put a stop to misuse of market power in this area. A competition law-based right to data access will be regulated under certain circumstances in which access to data is especially important from the perspective of competition. Legal certainty for partnerships will also be enhanced. (BMWi)

- We will support the Digital Markets Act (DMA). In doing so, digital platforms will be prohibited from restricting access to data under certain circumstances. (BMWi)

- With a study on the economic and competition law-related framework conditions for primary and secondary data markets in Germany and the EU, we are improving the scientific basis for possible further legislative measures. (BMWi)

- We are checking whether it is necessary to establish a requirement to share certain data in particularly data-driven markets. (BMWi, BMAS)

- Taking into account legitimate interests of the producers of this data and manufacturers of corresponding machines and systems, we want to improve access to data, speed up innovations and develop opportunities for stakeholders in competition in aftermarkets, among other areas. We are therefore drawing up shared conditions for the use of non-personal data in agriculture. The relevant ministries are checking any supplementary measures in case the general regulatory framework is not adequate for specific sectors. (BMEL/BMWi, relevant federal ministries)

- With the implementation of the Directive (EU) 2019/790 (DSM-RL), we will create legal certainty in copyright law in handling text and → data mining, besides scientific analyses. (BMJV)

- We want to strengthen the data-based transformation of the world of work for small and medium-sized enterprises (SMEs) through research and development with our campaign "The Future of Work". In doing so, we will promote technological and social innovations that serve to implement new strategies and tools for work structure, organisational design and, in particular, knowledge management. The focus here is on issues of acceptance, employee qualifications, data security and employee data protection, among other things. (BMBF)

- Within the EU legal framework for the governance of common European data spaces, we will work towards creating incentives for data sharing within and beyond the bounds of data spaces. This also includes incentives for sharing data with our neighbouring continent of Africa and other regions around the world. (BMWi)

- We will continue our dialogue with all relevant stakeholders to strengthen data markets, data partnerships and the setting of standards. In order to establish this dialogue at European level, we will promote the innovation board agreed in the coalition agreement. This will also function as a contact point for advice on data protection issues concerning industry (especially start-ups and larger companies) in terms of digital innovations at EU level. (BMWi)

2.1.3 Strengthening data and IT security

Where do we stand?

Alongside corresponding rights for individuals and transparency in handling data, it is crucial to ensure structural **data and IT security** for all parties involved. Without this security there can be no trust in data use and digitalised processes.

Stakeholders must be able to move around safely in the data ecosystem and be able to maintain control of their data, make independent decisions in the data ecosystem and have corresponding options open to them. More and more applications are now cloud-based. There is less visibility for Europe's existing small **cloud providers**. Sometimes it is not possible to switch to these providers with certain – especially market-dominant – applications and operating systems, as these software products are often only provided in connection with their own cloud solution (see 1.1).

Some major non-European cloud providers store their customers' data in their countries of origin. This can be associated with negative consequences for those affected. In some cases, it also contradicts European data protection law in accordance with the current case law of the European Court of Justice.

At the same time, the international movement of data is vital to German and European companies in terms of their competitive strength and innovative, data-based, global business operations. European companies operating in certain non-EU states are increasingly subject to unfair disadvantages – in particular, data localisations – and digital restrictions. These cause unnecessary costs and inhibit growth and innovation. Small and medium-sized enterprises (SMEs) find it particularly hard to perform globally networked business operations and participate in internationally networked value creation chains under these conditions.

What do we want to achieve?

Against the backdrop of the case law of the European Court of Justice on the privacy shield, international cloud providers in Europe must be reorganised. To strengthen the → data sovereignty of European consumers and companies, we will look for technical, legal and institutional solutions to make it easier to switch cloud service providers, which is a laborious task, and to minimise → lock-in effects. We want to create a trustworthy ecosystem in which industry, science and society can share their data for controlled (re)use. The European GAIA-X project will be able to offer solutions for this. It is based on European values, open source applications and → interoperable standards (see 1.1).

The Federal Government is committed to an open approach to the international movement of data based on European values.

German and European companies will benefit from being able to offer their services worldwide and at the same time being free to choose their storage location. We are still working at an international level for the free movement of data as forced data localisation causes unnecessary costs for com-

panies. As far as personal data is concerned, of course, provisions of European and national data protection law must be taken into account.

We also need better European regulation for **strengthening data and IT security**. This is the only way to make full use of the opportunities of digitalisation and enable companies to boost their competitive strength through innovative, data-based business models. It makes sense to implement these provisions technically through norms and standards.

In addition, data sovereignty and data security need to be considered beyond Europe's boundaries. With regard to our neighbouring continent of Africa, in particular, strategic data sponsorships can be created that enable European and African tech companies to access relevant digital markets and enforce European standards on an international basis.

How do we want to achieve this? Our key measures:

Cloud computing services

- We will work at European level to ensure that the rights of companies and consumers vis-à-vis cloud computing services are strengthened and that options to make it easier for users to switch cloud providers (→ data portability/ porting) are reviewed in the upcoming legislative procedure, if need be, through technical provisions. (BMWi)

- We want to strengthen European cloud service providers and thereby improve secure and competitive data storage within Europe. (BMWi)

International data flows

- At European level, we will work to ensure that the European Union is and remains the world's most open region for trade and investment in the digital age. We will support the European Union in leading the way in international partnership towards ambitious requirements for free cross-border movement of data that will provide our companies with effective protection from unfair restrictions and maintain the EU standard of protection for personal data under the GDPR. (BMWi)

Data and information security

- We will implement important measures to support IT security and cybersecurity in our IT Security Act 2.0. This is the only way to make full use of the opportunities of digitalisation and achieve improvements in federal public administration, industry and society. (BMI)

- Beyond the bounds of this legal framework, we have begun evaluating and updating the Cybersecurity Strategy, which will determine the basis of cybersecurity over the next decade. (BMI)

- We will continue and increase funding for IT security research through a follow-up programme to the current research framework programme "Self-determined and secure in the digital world 2015–2020". (BMBF)

- We will continue strengthening and expanding research on and development of quicker, more secure and more reliable communication technologies of the future through the new "Communication systems" specialist programme. (BMBF)

- We will coordinate a cross-departmental steering group in cooperation with the global standardisation bodies that are responsible for producing standardisations for data processing and IT security. (BKAmt)

2.2 Creating new data spaces

Where do we stand?

Innovative data-based and responsible business models are important for the German market to remain competitive and create employment in a changing society. They are also vital for shaping a community which seizes the opportunities of data use for the common good. Funding innovative, data-based research projects and facilitating the transfer of fundamental findings to industry are very important to Germany as a centre for business.

Data spaces are key elements here. They provide users with shared trustworthy places for transactions in which data can be provided, analysed and managed in collaboration. Contrary to what the term suggests, data in data spaces does not have to be consolidated centrally. There are lots of ways in which data spaces can be designed both technically and legally.

Data-based innovation is also possible where data is shared and used by (business) sectors and research fields. For this reason, data spaces should be structured in a way that ensures this openness is maintained beyond the bounds of individual sectors – where this can be done securely and in compliance with data protection law.

The European Data Strategy sets out plans to establish Common data spaces for industry, the Green Deal, mobility, healthcare, finance, energy, agriculture, public administration, research and expertise (see 3.1). These sectoral data spaces do not yet exist at European or German level. Data handling and data exchange are still heavily characterised by segregated island solutions and historic differences in data culture.

What do we want to achieve?

We welcome the establishment of innovative data spaces and data-based business models as well as research projects that address social challenges in particular, with the aim of developing responsible solutions for these issues. We are also working on developing and promoting innovative data spaces for stakeholders in civil society and those working for the public interest. It is primarily companies, organisations and corresponding research fields that are tasked with developing sector-specific data spaces. Science and research can be found in all sector-specific data spaces. Within the framework of this Strategy, we will set up funding programmes for developing innovative data-based business models as well as establish targeted support for trialling innovations in real laboratories and review additional legal scope for real laboratories. In addition, interdisciplinary measures will focus on handling research data openly and responsibly. There needs to be a stronger transfer of findings from science to practice.

Together with our European partners and our own national measures, we will bring trustworthy **European data spaces** to life. For this purpose, we plan to implement the following measures:

Social and economic risks are increasing due to the climatic disaster. **Sustainable protection of the climate and environment** (Green Deal data space) requires the collection and systematic processing of corresponding climate and environmental data and implications on health in decision-making processes, including within the Federal Government, in order to make Europe the first climate-neutral continent by 2050 and to preserve its biodiversity and quality of life. This includes opportunities for preventive measures in the context of environmental and natural risk scenarios (e. g. heatwaves, drought, widespread fires and floods).

In order to develop the life-saving potential of data, we will create the conditions under which **health data** can be collected and used systematically and in compliance with informational self-determination. Health data enables the healthcare system and researchers to make medical progress and provide better preventive measures and treatment of patients (health data space). It is therefore important to continue promoting the use of health data for the benefit of patients and in compliance with the valid data protection regulations in healthcare provision and research and continue pursuing the goal of digitalisation of the healthcare system.

Germany wants to become a world leader in autonomous driving and in the mobility transition. For this reason, a user-friendly, innovative and comprehensive data network of **mobility data** is to be created at national level. Especially against the backdrop of electric mobility, it also makes sense to include data on consumer behaviour (mobility data space).

Access to and use of **agricultural data** means agriculture can be more efficient, more climate friendly and more environmentally friendly.

This not only applies to Germany but is extremely relevant across the globe (data space for agriculture, forestry and the timber industry).

Greater (re)use of **industrial and production data** provides opportunities for new business models and can promote the establishment of aftermarkets (see 2.1.3).

Access to and use of **energy data** for and by producers (provision and potential of, in particular, renewable energies, energy supply networks) and consumers (in particular, energy consumption by computer centres, industrial plants, households and devices as well as energy-saving measures, such as in renovating buildings to make them more energy efficient) will facilitate a flexible, well-designed and cost-effective transition to a climate-neutral energy infrastructure as well as form the basis for concrete measures for a targeted and tailored expansion of the energy infrastructure (energy data space).

We will also continue being actively involved in the establishment of the Common European finance data space and the data space for public administration.

The data space for public administration will contribute to improving data maintenance and data management as well as data minimisation. Data relating to public administration should be available for use (subject to statutory framework conditions) across departments and authorities (see the Federal Government's data pool initiative 4.4). In a first step towards achieving this, the quality and content of existing data stocks will be analysed and the metadata will be presented in a transparent manner in a data atlas of public administration. For this reason, we are also endeavouring to establish better links, for example, between monitoring health and monitoring the environment. This is so that environmental factors that are relevant to health can be observed, adverse effects can be assigned and then incorporated into a health data space within the framework of an integrated national monitoring system based on existing structures, such as the German Environmental Survey (GerES).

We also want to tap the potential of data spaces in what is known as the third sector, which focuses on the common good. We want to assist with connecting existing data stocks and, by doing so, make them useful for training AI algorithms, for example. Unless there are compelling reasons to the contrary, it is important to us that these data spaces are open data spaces and not closed silos.

We support the establishment of shared open tools as well as open (standard) licences for data.

How do we want to achieve this? Our key measures:

Promoting innovative and responsible data use initiatives

- An open innovation and data culture is achieved through agile processes and scope for experimentation. For this purpose, we will provide support for temporary trialling of innovations in real laboratories as test rooms for innovation and regulation. (BMWi)

- We are supporting the development of options for action through our research funding on ethical, legal and social aspects (ELSA) of the digitalisation of → big data and artificial intelligence in health research and healthcare provision. (BMBF)

- With our "Smart data management" research programme, we are funding 20 projects developing new data products and digital systems that can form the basis of innovative data services and data-based business models. (BMWi)

- We will set up a GAIA-X funding competition for the implementation of examples of applications and establishment of data spaces in the GAIA-X infrastructure and thereby lay the foundations for a digital ecosystem that provides incentives for data sharing – beyond the bounds of data silos. (BMWi)

- With the new research programme on "The future of value creation: research for production, services and work", we are supporting research and development into the impacts and requirements of the platform and data economy and Industry 4.0. The focus here is on the ability of small and medium-sized enterprises to interpret data and transfer it to their business models. (BMBF)

- We are bringing experts from science, industry, politics and society together on platforms to discuss the opportunities, challenges and framework conditions of new technologies. The Industry 4.0 platform is focusing on the digital and data-based transformation of production and is developing solutions on, among other things, the use of data for networking value creation systems as well as new services and business models. The Learning Systems platform is looking at the development and applications of learning systems and methods of artificial intelligence. (BMBF/BMWi)

- Together with the EU Commission and AU Commission, we would like to promote responsible data use and value creation in Africa and create African-European data spaces. We began work on this within the framework of Germany's Presidency of the Council of the European Union with what is known as the EU-AU Data Flagship. (BMZ)

Green Deal data space

- The establishment and operation of a central, national portal for data and information on environmental protection and nature conservation, working title: environmental protection and nature conservation system in Germany (UNIS-D), will provide comprehensive access to all information available in this field from the Federal Government, federal states and local authorities as well as, in the future, from science, industry and citizens. On the basis of a high performance computing infrastructure, intelligent research and visualisation tools will be made available that serve the needs of users and cover information requirements of everyone from interested non-specialists to expert scientists. (BMU)

- Monitoring of biodiversity throughout Germany will be expanded and secured for the long term through the establishment of the Centre for Biodiversity Monitoring. (BMU)

- We are promoting new approaches to intelligent use and networking of ecosystem data and process data in the environmental industry through our "Digital GreenTech" initiative. (BMBF)

- We will continue to support the German Marine Research Alliance in order to reinforce the strategic capability of marine research institutions in Germany in the field of data management and digitalisation (e.g. improved systematic data recording and data analysis on marine expeditions). (BMBF)

- We will build on our research into a new generation of climate information services and local climate modelling to create opportunities for connecting climate data to a broad range of local environmental aspects. Development will be based from the outset on the real needs and requirements of the users so that the data and tools actually contribute to progress on handling environmental and climate issues at local level. (BMBF)

- We aim to use our initiative on sustainable data infrastructure to create transparency on the impact that data infrastructures have on the environment and climate and establish corresponding targeted measures, including metrics, transparency and flagging of energy consumption by computer centres, as well as corresponding funding measures, setting minimum standards, sustainability criteria of technologies (e.g. blockchain), and "green coding". (BMU)

Health data space

- We are piloting a systematic data-based measurement of the performance and efficiency of the German healthcare system using suitable indicators and databases. An instrument like this will offer significant opportunities for continuously monitoring the healthcare system, identifying its strengths and weaknesses and thereby creating the foundations for evidence-based decision-making by policy makers. (BMG)

- The establishment of the research data centre will create a protected and trustworthy data space where authorised institutions can use the billing data of individuals with statutory health insurance for the purpose of research into preventive measures and healthcare provision as well as to aid the management of the healthcare system. From 2023 onwards, data from electronic patient records will be made available to the research data centre for certain research purposes on the basis of informed consent by citizens. This data will be pseudonymised in accordance with Section 363 of the Fifth Book of the Social Code (SGB V). (BMG)

- Through our medical computing initiative we have created a structure that trials the cross-site use of health data for research at university medical centres and incorporates the findings into designing the interface between electronic patient records and health research. Partners from non-university healthcare practices will also participate via the digital progress hubs for health. (BMBF)

- We will merge data from state cancer registers to make this data more usable for health research and healthcare provision on a national level. Only → data pools that are of adequate size and diversity to cover the data-based

cross-section of our society can prevent research leading to non-transferable findings based on a database that is limited in various respects. (BMG)

- With our genomDE initiative, we are planning to introduce medical genome sequencing in standard care, starting with cancer and rare diseases. Designated centres will collect and analyse clinical, phenotypic and genomic data for the purpose of providing individualised patient healthcare. (BMG)

- Within the framework of the "Data for health" innovation initiative, we have presented a schedule for the further development of research with health-related data and we will update this together. (BMBF, BMG, BMWi)

- By regulating the release of health data, patients will be given the opportunity as from 2023 to voluntarily release the treatment data stored in their electronic patient records to the research data centre for research purposes and for the further development of the healthcare system. Independently of this, patients will also have the opportunity to consent to making the data in their electronic patient records (for example, through broad consent) available on an individual and direct basis for medical research. (BMG)

- We are reviewing the introduction of a central national drinking water database. We want to consolidate data from federal and state environment and health departments as well as from water supply companies and ensure barrier-free and open online access to this information. (BMG)

- We aim to pilot nationally standardised electronic death certificates to create the most effective and up-to-date statistics on causes of death with high quality results. (BMG)

- Within the framework of the "Digital innovations to improve patient-centred care in healthcare" funding area, we are supporting projects developing strategies for better data use in research and healthcare provision. (BMG)

- We are expressly supporting the establishment of the Common European health data space and making secondary use of health data easier in the EU by participating in, among other things, the joint action "Towards the European Health Data Space" and the creation of specific codes of conduct by stakeholders. (BMG)

Mobility data space

- Trust in secure data handling and, in particular, the reinforcement of user sovereignty are key elements in promoting innovative business models for mobility. Within the framework of the concerted action for mobility with the support of the National Academy of Science and Engineering Technical Sciences (Acatech), we are creating a mobility data space for sovereign and differentiated data handling as the foundation of modern mobility, based on trust and European rules. (BMVi)

- In order to make the Federal Government a world leader in responsible and open provision and use of mobility data, we will comprehensively improve and expand the National Access Point (NAP) to traffic and mobility data by the end of 2021. Existing BMVi data portals for mobility (mCLOUD, MDM) are already being consolidated into a new mobility data portal. Important technical components for the mobility data space are already being made available through the mobility data portal. (BMVI)

- In order to retain our international competitive strength in the application of artificial in-

telligence, access to data and computing power are crucial for data analysis. For this reason, we have drawn up the "Digitalisation and artificial intelligence in mobility" action plan. This brings together measures to design modern, clean, efficient, sustainable and affordable mobility, including by creating a comprehensive and reliable database. (BMVI)

- We are also using funding programmes to promote numerous data-related innovations, including within the framework of the data-based mFUND, the strategy of automated and networked driving, "Innovative port technologies", "Digitalisation of local transport systems" and a "Funding call for drones and flying taxis". (BMVI)

- We want to continue defining and expanding the legal framework conditions for the provision of mobility data. (BMVI)

Data space for agriculture, forestry and the timber industry

- We are reviewing in what form a national digital data platform for the agricultural sector can be provided and what variations of technical and legal solutions for such a platform are the most advisable. (BMEL)

- We are calculating greenhouse gas emissions produced by the sectors of agriculture, land use and land-use change and forestry using detailed data at company level. This is essential to meet EU and international obligations on climate reporting, and is compiled by the BMU. This data can also assist with developing efficient strategies for reducing greenhouse gas emissions in agriculture. (BMEL)

- We are expanding both the data platforms on the cultivation and use of renewable resources in Germany and the directory of products and providers for the bioeconomy. (BMEL)

- As regards the timber industry and international timber trade, we are continuing to work on the ongoing "Databases for the identification of different types of wood" project, expanding databases for the computer-assisted identification of different types of wood and reference points for the identification of solid wood, wood-based materials and paper products (fibre atlas). (BMEL)

- The soil survey conducted by the Thünen Institute is a national inventory of agricultural soil. Based on more than 3,000 samples, the carbon content of the soil was examined at national level, taking into account the different locations and factors of soil use. (BMEL)

- In close collaboration with the European Commission, we are working on drawing up rules and guidelines on the shared use of agricultural data at EU level. (BMEL)

- Within the framework of our partnerships with developing countries and emerging markets, we will examine the extent to which the potential of satellite remote sensing can be tapped for agriculture and across different sectors. This includes, for example, the use of open data and artificial intelligence for better monitoring of harvests and yields. (BMEL/BMZ)

2.3 Data trustees and new forms of cooperation

Where do we stand?

Non-personal data is still not used or shared enough in Germany. Innovative data partnerships can be specifically promoted by new stakeholders in the data ecosystem, including, for example, data trustees. Many **companies** state that they perform data exchanges, but they usually only mean within their network of customers or suppliers. Companies primarily share data with their customers (83 percent), suppliers (53 percent), much more rarely with other companies in the same sector or in different sectors (21 percent), let alone with competitors (15 percent).[4] Small and medium-sized enterprises (SMEs) are shown to be even more hesitant in this respect than large companies: depending on the study, 50 to 80 percent of large companies participate in cross-company data exchange, while the percentage for SMEs is lower. Only around 41 percent of the companies surveyed in Germany currently expect that they will exchange more data with external partners in future.[5]

By contrast, great progress has already been made regarding the use of shared platforms for data exchange in **science**.

In the online consultation for the Data Strategy, 82 percent of surveyed scientific institutions stated that they use platforms for → data sharing, compared with just 58 percent of all surveyed.

There have hardly been any data partnerships between **stakeholders in government and industry** to date, although the Federal Government has data stocks that could serve as the basis of innovations in industry. At the same time, company data could help the Federal Government fulfil its obligation to provide public services and protect public resources.

Trustworthy intermediaries can make an important contribution to ensuring access to data and data exchange and reinforcing a decentralised, sovereign data economy. **These include, for example, → data trustees**. Data trustees can simplify and facilitate data sharing through various structures, such as by providing data infrastructures and ensuring compliance with current data protection law or performing anonymisation procedures. → Data trustees can also consolidate expertise in → anonymisation, → pseudonymisation as well as in creating → synthetic data records. They also ensure the quality of the data records, manage access rights and guarantee compliance with universal standards. Finally, data trustees can also operate in the interests and for the protection of consumers, including in relation to personal data. These data trustees can safeguard consumer interests and assist consumers with exercising and asserting their decision-making rights under data protection law and their rights as data subjects (e.g. information, amendment, consent, erasure, objection).

These different forms of data trustees have not yet become established in our data ecosystem to any scalable extent, however.

4 T. Fedkenhauer, Y. Fritzsche-Sterr, L. Nagel, A. Pauer, A. Resetko (2017), Datenaustausch als wesentlicher Bestandteil der Digitalisierung, PwC, https://www.pwc.de/de/newsletter/it-security/studie-datenaustausch-digitalisierung.pdf (accessed on 26/01/2021).

5 Fraunhofer Institute for Software and Systems Engineering ISST (2019), Data Economy – Status Quo der deutschen Wirtschaft & Handlungsfelder in der Data Economy, p. 19.

What do we want to achieve?

In order to establish a culture of sustainable → data sharing and data use, we will facilitate a **wide range of models** of → data trustees and shared resources and, by doing so, promote an open culture of innovation that uses data sharing as an opportunity for innovation and value creation. In this respect, → data trustees are not a miracle cure, but we need to promote them in a targeted and strategic manner. A key priority for us is to ensure that the establishment of → data trustees does not create added bureaucracy and that data exchange is not made more difficult. Instead, it must be done in a way that facilitates rapid and secure data exchange.

Data trustees can be employed and designed in various ways. They can operate in all sectors and across different sectors of **industry**. They can be organised as **private, charitable, cooperative or even state-run** entities. Pilot projects are currently looking into the legal form of a cooperative to support data partnerships between companies.

There are various types of data partnerships. All require participants to have mutual trust in the quality and integrity of the data. We want → data quality metrics which show the various levels of anonymisation to be guaranteed by trustworthy data trustees. For this reason, we regard the establishment of → synthetisation and verification servers as an approach to ensuring trustworthy data cooperation.

We are reviewing the creation of a concrete legal framework for data management systems or **Personal Information Management Systems** (PIMS) to safeguard data protection law and protect the interests of **consumers**. In doing so, we plan to build on proposals made by the Data Ethics Commission. An important criterion here is to ensure that these data management systems operate exclusively in the interests of the data subject and act according to the provisions of data protection law. In the case of private data trustee models, the operators must not be permitted to benefit from the commercial use of the data. All operator models must comply with the principles of independence, neutrality and the required trust of the users.

→ **Research data centres** as data trustees can facilitate data exchange among and between research institutes and with state-run establishments. They have already solved issues of data access in many areas, including to sensitive data, both technically and legally. They can therefore serve as a model of best practice for other sectors. The research data centres of the Federal Government's and federal states' statistical offices must be considerably better equipped to provide the latest scientific data.

Data trustees also have the potential at national and European level to reduce strong tendencies towards concentration and the creation of monopolies in data-dependent markets, for example, by allowing competitors to train their algorithms in shielded data pools with data-powerful companies.

Thoughts about this are still in their very early stages, but we plan to give them further consideration.

In the context of the European regulation on data governance at EU level, we are committed to ensuring that future data trustee models, regardless of what form they take and especially those with a business-to-business function, must meet certain pre-defined quality criteria, for example, in terms of transparency and neutrality of interest of the trustees' activities, in order to be permitted to operate within the EU and in Germany.

We are also working on preparing criteria for a non-bureaucratic accreditation or certification process for data trustees designed to prevent data misuse.

Data can also be created, managed and made openly available by a group of institutions and individuals as common goods. Large volumes of data can be created quickly via platforms. These are regarded as robust and long-lasting because they involve many stakeholders in the data ecosystem. They also facilitate rapid, decentralised innovation based on free → data sharing. We want to tap this potential for SMEs and research institutes as well as state-run establishments with regard to their obligation to provide public services. By doing so, we will also be able to create models of cooperation with other regions of the world and, for example, provide open training data for artificial intelligence for developing countries and then further develop this data together.

How do we want to achieve this? Our key measures:

- In order to promote a wide range of data trustee models, we are starting an ideas contest for data trustee models as well as other models for data sharing and establishing a funding programme for the development and trialling of innovative data trustees. (BMBF)

- At national level, we are reviewing the introduction of a regulation on data management systems/"Personal Information Management Systems" (PIMS) that will make it easier for consumers to exercise their data protection rights. (BMWi)

- We want to establish data trustees in the data ecosystem by, among other things, defining concrete requirements and quality criteria that particularly ensure the neutrality and economic independence of the data trustees through legislative processes at EU level (Data Governance Act). (BMWi)

- We will continue expanding and supporting funding for scientific research data centres in collaboration with the federal states. (BMBF)

- We will review the framework conditions for collective exercising of interests, e.g. in the context of operational co-determination, and develop strategies accordingly. (BMAS)

- We will trial data sharing as a global public good and common good with Africa and Asia (e.g. open training data for artificial intelligence in the field of local languages, geodata, etc.). By doing so, we aim to achieve global sustainable development goals more rapidly. (BMZ)

2.4 Ensuring participation: reinforcing the interests of citizens in the data economy

With all measures relating to handling data, the basic rights of users must be guaranteed in terms of protection of their general right of personality, consideration of their private life and their informational self-determination, such as regarding trade and fiscal secrets protected by professional and entrepreneurial freedom, and protection against discrimination.

Where do we stand?

Over the last few years, alongside major opportunities for responsible data use promoting cohesion in society, value creation in industry and the acquisition of knowledge in science, we have also increasingly experienced the risks and political, social and individual consequences of unethical data use. Defining these challenges and the shared task of overcoming them is a prerequisite for achieving broad social acceptance of innovative data use for the common good and thus for realising the opportunities data use provides.

Discrimination founded on data-based decisions, which are therefore supposedly objective decisions, is real – especially if models reinforce existing discriminatory aspects. Discrimination founded on personal data with the aid of statistical models can even affect citizens who have not made that data available.

In addition, large data collections and, in particular, combined data sources can be used to – possibly illegally – create detailed profiles on movements and personality.

Smartphones and digital services, especially social media, play a key role in this. They comprehensively analyse their users' preferences and use this data to keep their users' attention on their platforms, sell advertising space and display third-party advertising. User attention is a key object of economic interest. Children and young people, in particular, can easily become dependent without realising it.

Users can sometimes neither understand the services and other mechanisms offered to them for free nor distance themselves from them without also largely withdrawing from participating in social life. These questionable services are also designed in such a way that makes it difficult to stop using them. Users are manipulated by → addictive designs or → dark patterns, often to the advantage of these business models.

Data-based manipulation can also lead to the influencing of political elections contrary to the principle of democracy. The distribution of disinformation can also have negative effects on the community and the functioning of democracy. "Deep fakes", in which the lines between reality and computer-generated information are blurred, can be particularly dangerous.

Ultimately, data can only be "retrieved" with great difficulty once third-parties have acquired copies.

The state is also responsible for ensuring that companies do not create structures that are incompatible with a free society through illegally collecting and using comprehensive data. Even if → profiling and scoring serves to improve digital services and personalise products, they can still be used to influence the preferences or (purchasing) behaviour of customers. Product personalisation and price differentiation do not always work to the customers' advantage. It is the Fed-

eral Government's responsibility to protect the basic rights of citizens and the basic principles of the free rule of law effectively against infringements resulting from data misuse.

What do we want to achieve?

The increasingly complex structure of digital products and services results in many **consumers** feeling overwhelmed in an increasingly networked environment. Companies should design all their digital processes and services so that they are user-friendly, fair and transparent. Important mechanisms to protect citizens are provided under data protection law and its effective enforcement (see 2.1.1) as well as regulations on consumer protection and protection of minors in the media.

Alongside the responsibility of companies to design their products and services so that they are user-friendly, individuals' scope to act and subjective rights need to be reinforced in order to ensure that data is handled responsibly. Consumers should be given a better overview of how companies deal with their personal data.

We will add contractual regulations to the German Civil Code (BGB) to strengthen the position of consumers in cases where the provision of digital products is not paid for but where consumers provide or undertake to provide personal data. We will work towards ensuring that digital goods and services for consumers are user-friendly from the outset (by design and by default).

The decision-making patterns of data-based systems can feature systematic distortions based on the depiction of social prejudices, inadequate representation of certain groups, other poor data quality or inconsiderate use of information generated by these systems. These all lead to discriminatory or unfair decision-making. Profiling and scoring also need to be taken into account because they can also lead to → discrimination.

The accessibility of more and more data about individual citizens facilitates the "measurement" of citizens. Individuals can be measured by their counterparts. As a result, individuals have to expect that decisions made by their counterparts, e.g. when concluding contracts, will be increasingly based on information about them that was not previously accessible. This creates, among other things, new opportunities for product and price differentiation based on individual preferences or individual willingness to pay. These are accompanied by welfare and distribution effects as consumers are excluded from certain products. We currently know too little about the consequences of this. This is something we want to change.

Social participation by all citizens must continue to be safeguarded. It is not possible to collect, prepare or analyse data without associations and categorisations. These are required to simplify complexity. The risk with these types of procedures is that individuals or groups of individuals can be overlooked or incorrectly associated. This can result in → discrimination and exclusion from economic or social participation. For this reason, ensuring the inclusive consideration of all people is a continuous task to be performed across all sectors of the data society.

When implementing our measures, we will consider the needs of people with disabilities from the outset in order to enable barrier-free use of data for all users.

The Federal Government is committed to increasing transparency of advertising with political objectives within the framework of the European Democracy Action Plan.

How do we want to achieve this? Our key measures:

- With the implementation of EU directive 2019/770 on digital content, we will add contractual regulations to the German Civil Code (BGB) to give individuals more rights when "paying with data". (BMJV)

- Better research needs to be conducted on the distribution of data-driven product and price differentiations in private industry and the resulting welfare and distribution effects. A research project aims to expand on existing expertise in this subject and any resulting requirements for action in social policy will be reviewed. (BMAS)

- We will examine whether discrimination based on algorithm-based decisions can be countered by establishing requirements for the training data used or by resolving deficiencies in legal enforcement, for example. (BMJV)

- We will review how discrimination against people resulting from the analysis of aggregated/anonymous/synthetic data can be prevented and to what extent effective security mechanisms can be developed in relevant legislation. (BMFSFJ)

III. Improving data skills and establishing a data culture

Knowing what data is, understanding the consequences of your own handling of data, being able to predict the possible consequences of carelessly handling data, being able to critically scrutinise data-based reporting, understanding what rules apply to handling personal and non-personal data and how you can secure your data: these are all important skills for self-determined action in the digital age. As is having a fundamental understanding of what an increasingly data-based economy means, e.g. of how value can be created or intangible value generated from data and what role data can and should play in our increasingly data-assisted daily life and society. In the narrower sense, we understand data skills as the ability to collect, manage, analyse and use data both individually and in organisations, with sovereignty and consideration, and participate in social debate about handling data.

Alongside the creation and enforcement of reliable, comprehensible and transparent regulations and secure infrastructures, all citizens should gain basic skills in this field so that they are able to participate and have sovereignty over their own data. Further skills should be learned through relevant vocational training, degree programmes and advanced specialist training. In addition, we need enough experts with training in the specialist skills required for an internationally successful data ecosystem.

We regard data culture as an open understanding of data as a resource for a knowledge-based society and participation by the whole of society. This understanding implies that knowledge is acquired from data, but that this knowledge can also be critically scrutinised. An active data culture enables us to make evidence-based decisions that reflect European values.

3.1 Skilled society: self-determined and informed

Where do we stand?

Many citizens associate a great level of uncertainty with the topic of data, especially in the context of what are sometimes very complex explanations in data protection statements and general terms and conditions of business.

Most citizens previously acquired their digital skills primarily through their own trial and error or with help from family and friends. Very few gained relevant skills through basic and advanced training. This particularly affects older people who were not taught at work or school, but rely on informal educational courses, e.g. adult evening classes, educational opportunities provided by senior citizen offices, multi-generational homes and the German National Association of Senior Citizens‘ Organisations (BAGSO), among others. No general surveys on data have been conducted to date, but many general training courses on digitalisation include components on handling data.

What do we want to achieve?

In particular, we want to support informed and sovereign handling of data by citizens of all age groups through various formal and informal educational opportunities. By doing so, we want to facilitate participation and awaken interest in developing data-driven business models. We also want to promote the collection of open data by citizens, encourage active discussion on data use within the framework of citizen-led science projects and train citizens to become experts. We want to strengthen the population‘s data skills as well as conduct a comprehensive survey of these

skills in order to make excellent learning opportunities available to everyone according to their needs. In order to create and further develop relevant learning opportunities, courses and training, we need to implement comprehensive long-term monitoring of the population's data skills.

How do we want to achieve this? Our key measures:

- We will establish a national digital educational campaign to expand and consolidate teaching and learning provision on the key topics of digitalisation. (BMBF)

- With our flagship initiative for secure digital rooms for education, we are promoting the development of open standards, infrastructures and governance models for user-centred, self-determined and data protection-compliant exchange and the networking of digital teaching and learning platforms as well as digital certificates of education for all areas of education. We will expand the initiative into an overall strategy for digital educational architecture and data space for expertise. (BMBF)

- As part of the national digital educational campaign, we will develop an education data space that includes a skill data space. This will form part of the more comprehensive digital space for education. (BMBF)

- Within the framework of the digital educational campaign, we want to gradually set up a platform for education that will facilitate networking between the federal states' existing systems with the goal of providing educational content across all educational sectors. The national digital educational campaign is based on ongoing BMBF initiatives, for example, the INVITE innovation contest (digital platform for further vocational training). INVITE promotes projects that network existing further education platforms, enhance the quality of these platforms, for example by recommending personalised training opportunities, and develop further education opportunities that facilitate adaptive learning using AI. (BMBF)

- We want to record the German population's current level of data skills by establishing continuous and comprehensive long-term data skill monitoring. This survey of data skills is to be integrated into the National Educational Panel Study (NEPS) based at the Leibniz Institute for Educational Trajectories (LIfBi). (BMBF)

- Within the framework of the "Digital Germany" project, we are promoting comprehensive monitoring of the population's digital skills with a particular focus on data and AI. (BMFSFJ)

- We are also committed to ensuring that the topic of data skills is paid greater attention in national comparative studies such as the International Computer and Information Literacy Study (ICILS) and the Programme for the International Assessment of Adult Competencies (PIAAC) and that the Digital Economy and Society Index (DESI) is expanded to include specific questions on data skills. (BMBF/BMWi)

- Within the framework of the digital educational campaign currently being planned, we are supporting the design and realisation of digital learning opportunities in "data skills" for the broad public (likely to start in early 2021). (BMBF)

- We are further developing the Federal Employment Agency's existing wide range of online-based information services for basic and further vocational training, including KURSNET, berufenet, self-discovery tools and the free e-learning platform Lernbörse, to broaden access to the many further training opportunities availa-

ble and eligible for funding in the field of IT. In connection with this and within the framework of the National Skills Strategy, we are working on developing a central online access portal for vocational further training that will provide greater transparency, make user-focused training opportunities accessible and contribute significantly to increasing participation in further training in Germany. This will also form part of the national digital educational campaign. (BMAS)

- A roadmap for data skills and data culture will bring all stakeholders from science, industry, politics, public administration and society together to draw up concrete objectives, measures and development ideas through a co-creative process to improve data skills and establish a data culture.
(BMBF)

- We are promoting citizen research with the goal of anchoring citizen-led science in the scientific system for the long term, promoting handling of data by citizens, encouraging the collection of open data in civil society and improving access to research for more widespread knowledge. (BMBF)

- We intend to make another funding announcement for projects conducting research into essential skills for self-determined action in digital, communication and information-based environments. (BMBF)

- We are using the new digital learning platform atingi to provide training in data use skills for everyone around the world. As just one example, courses are offered on how to use open data sources for new types of applications in artificial intelligence in developing countries. (BMZ)

3.2 Improving data skills in education and vocational training

Where do we stand?

In **school education** → data skills have not yet been added systematically to the curriculum or anchored in the federal states' framework syllabuses. Data skills have neither been integrated as a single subject (media skills) nor a component of other subjects. This also applies to digital skills in general, although the first steps have been taken here in connection with the Digital Pact for Schools. The strategy on "Education in the Digital World" by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (Kultusministerkonferenz, KMK) sets out a framework of skills containing elements to reinforce data skills on, among other things, personal data protection, data analysis and data storage. One of the key comments resulting from the online consultation conducted for the Data Strategy was the lack of and need for comprehensive teaching of data skills in school education as a whole.

Since then a whole series of digital learning opportunities have been initiated by various providers, including on data skills, which teachers and parents can use independently. For the most part, however, these services are not quality-controlled so it is not possible to identify which content and applications are recommended.

As regards basic and further training of teachers as possible facilitators of data skills in schools, it should also be stated that data skills have not yet been systematically or comprehensively integrated into teacher training. There are, however, in-

dividual projects, including interdisciplinary and college-based projects, which serve as role models for adding data skills to university curricula.

In the context of **university education** in general, there are no comprehensive subject-specific courses on data skills available to students from all disciplines, including teacher training programmes. No such courses are provided across the board for doctoral researchers at university research training groups either. There are, however, individual subjects in which work is already done on a data-intensive basis. Some universities are already implementing their own excellent approaches and projects in which separate courses on data skills are provided or relevant project-based content is integrated into existing courses.

What do we want to achieve?

All **pupils** should learn how to collect, process, critically assess and use data. Data skills should be anchored in state syllabuses and prepared in an age-appropriate format. It is important for pupils to learn these skills at an early age as most pupils start to handle data early on (for example, by putting their own personal data on social media or posting on open data platforms). They also need to make conscious decisions about this and learn how to be responsible with their own data. Teaching data skills should not just be restricted to a specific new school subject, but should be integrated into a wide range of subjects via practice-based exercises.

Our aim is to ensure that everyone who completes a **vocational training or a degree course** is also taught data skills to a particular minimum standard.

How do we want to achieve this? Our key measures:

- There are around 330 training regulations under the Vocational Training Act (BBiG)/Crafts Code (HwO) that are subject to a continuous process of updating and quality assurance based closely on the requirements of the working world. The need for specific data skills for each vocation is also subject to review and demand-based regulation. (BMWi/BMBF)

- In order to teach sustainable skills for data-based empirical work, primarily to students, data literacy courses and teaching material are to be developed and made openly available to teachers and learners through the expansion of the “AI Campus” initiative. (BMBF)

- We will also set up a doctoral programme for skills development in the field of data sciences. In support of activities provided by the NFDI, we will promote projects by early career researchers that have a strong focus on data sciences linked to a specific discipline. (BMBF)

3.3 Demand for and provision of data skills in industry

Where do we stand?

Due to changed requirements in industry, more and more companies need their employees to have data skills. The number of data experts as a percentage of all employees rose slightly from 3.0 % to 3.7 % between 2013 and 2019.[6] Illustrating the shortage of skilled staff in this field, there were around 114,000 vacant positions for data experts in Germany in 2019. This number is predicted to increase to 126,000 vacancies for data experts in 2025.[7]

What do we want to achieve?

Our aim is to consistently counter the increasing shortage of skilled workers and provide basic and further training for future data experts at the highest international level. We particularly want to help SMEs access the potential of data-based value creation. For example, SMEs could benefit greatly from platform innovation, but until now it has been primarily large companies and start-ups that establish platform organisations. A lack of human resources is a core obstacle for SMEs. We will support companies in training their employees in demand-based data skills.

6 European Data Market Monitoring Tool, IDC (2019), Data set for Final Study Report 2020, https://datalandscape.eu/study-reports/final-study-report-european-data-market-monitoring-tool-key-facts-figures-first-policy (accessed on 27.11.2020).

7 European Data Market Monitoring Tool, IDC (2019), Data set for Final Study Report 2020 https://datalandscape. eu/study-reports/final-study-report-european-data- market-monitoring-tool-key-facts-figures-first-policy (accessed on 27.11.2020).

How do we want to achieve this? Our key measures:

- With the aid of the SMEs Digital initiative, we will increase awareness of the data economy among SMEs and enable them to participate in data-based industry and use of platforms. (BMWi)

- We want to support SMEs with the topics of data economy, data analysis and data-based business models through a new funding programme called “Go-Data”. This will promote services offering advice on data skills, which will help the companies benefit economically from their data assets. (BMWi)

- The purpose of “future centres” is to support and advise SMEs and employees on developing and implementing innovative approaches to independent learning and design to overcome the major processes of change and to promote their ability to perform and compete through this change. These centres were developed during implementation of measures from the Federal Government’s AI Strategy to help employees and companies work together on shaping how AI is introduced at company level. The funding programme is financed exclusively by federal funds and its aim is to enable companies and employees to help shape the digital transformation, especially in terms of AI. (BMAS)

- The funding measure “Innovative SMEs: research on production and services” will enable companies to develop new solutions for digitalisation and virtualisation of production and production systems (Industry 4.0) as well as product-based services and service systems. (BMBF)

- We are establishing effective educational guidance and supervision through company-internal mentors for further training. The aim of the

project is to train 200 company representatives in up to 100 enterprises as company-internal mentors for further training and by doing so establish employee-based, company-internal guidance on further training that will be supported by a regional network and will form a link to company-external guidance on further training. The metalworkers' union IG-Metall is responsible for implementing the project within the framework of the National Skills Strategy. (BMBF)

- With the establishment of regional competence centres for work research, points of contact will be created that examine the design potential for new technologies for the world of work and promote the transfer of research findings into company practice. The focus here is on shaping the use of data-based methods and tools of artificial intelligence (AI) in the world of work. (BMBF)

- We will review how we can support the creation of a "toolbox" for more data skills in various areas of application, e.g. for companies and civil organisations. This toolbox will be prepared centrally by a number of stakeholders within the framework of the Digital Summit and then made freely available. (BMBF)

3.4 Data skills in civil organisations

Where do we stand?

Civil organisations play an important role in improving data skills in Germany. There are numerous organisations dedicated to the transfer of data skills, e.g. through digital commitment and digital voluntary work as well as within the framework of digital participation. Numerous civil organisations are also committed to preparing data as common good and making this freely available to the public. Overall, however, voluntary structures and corresponding government funding are all too often geared towards "analogue" work, even though this is changing now based on experiences in the COVID-19 pandemic.

At the same time, civil organisations also face the challenge of having to fulfil all the legal requirements of data controllers.

What do we want to achieve?

Our aim is to continue developing the data skills of civil organisations. We want to assist civil organisations, clubs and associations with the secure and data protection-compliant employment of data-based processes. We also want to promote civil organisations that are dedicated to improving the population's data skills and that prepare non-personal data records as common goods and make them freely available to the public. We want to expand the field of citizen-led science, open up further data sources for stakeholders performing data work in aid of the common good and to encourage these stakeholders to collect their own open data.

How do we want to achieve this?
Our key measures:

- We will work with the Civic Data Lab on creating iterative, collaborative data exchange structures in non-profit sectors and those for the common good. The Civic Data Lab assists project sponsors with collecting, preparing and analysing data as well as with training in essential skills. (BMFSFJ)

- We will continue to use non-financial assistance within the framework of statutory regulations to promote and support civil organisations which train citizens in data skills. (BMI)

- With the "Securing the future of non-statutory welfare through digitalisation" funding programme, we will support leading non-statutory welfare associations in utilising the potential of digitalisation and in developing and trialling innovative solutions for social work. In particular, this includes improving digital and data skills as well as raising awareness of data use. (BMFSFJ)

- The service centre "Digitalisation and education for senior citizens" run by the Federal Association of Senior Citizens' Organisations (BAGSO) is conducting the "Promoting digital sovereignty of senior citizens with AI technologies" project up until the end of 2021. Older people are to be introduced to AI technologies to reinforce their digital sovereignty. This is designed to use AI to facilitate access to existing educational opportunities for older people by expanding the existing database of events at wissensdurstig.de to become the central platform for educational opportunities for older people in Germany. (BMFSFJ)

IV. Making the Federal Government a world leader in data use

As a result of → digitalisation, government procedures and processes also have to be reconsidered and refocussed. The Federal Government needs to be more agile, more transparent and more responsive. Citizens expect digital government services to have easy, barrier-free access. They also demand greater participation and transparency in political processes.

In order to act in a forward-looking and evidence-based manner, public administrations require data from various fields, sometimes data that is only valid for the short term, in order to make decisions, review their effects and change them if need be. Governance and administration in → real time requires real-time data. This is linked to the challenge of ensuring a high level of data quality for good governance and administration. Data only becomes available if the Federal Government itself uses the data much more intensively than in the past. Ideally, with reference to existing best practice models, resources and networks, we need to create new processes, standards, roles and institutions that facilitate data-based and evidence-based governance for the good of society.

Our attention must be targeted, therefore, at establishing and developing our data resources and skills. Authorities should be able to work with a much more interdisciplinary and cross-departmental focus and with the latest technologies (e.g. with open source tools). This includes work on setting standards and norms. The safeguarding of data quality and thus also incentives for responsible and mutual data sharing between the Federal Government, industry and society can be supported in this way. Potential for responsible data use should also be investigated in the context of more efficient and more citizen-friendly provision of access to the law or justice.

Wherever possible, the Federal Government must see citizens, civil society and companies more as partners for data cooperation in future. The state must also claim the information it needs for evidence-based governance from industry.

4.1 Sustainable improvement of data infrastructure in federal authorities

Where do we stand?

A powerful information network of public administrations (IVÖV) is currently being set up and in future it will link up all areas of public administration. It is not only since the COVID-19 pandemic that we have learned that data exchange and collaborative work are essential for our society and public administration. The Federal Government‘s cloud, planned for this purpose, is still under construction. As a platform, it is a necessary foundation for data-based work, but it is not enough on its own. We lack the crucial structures for optimising data collection, management, maintenance and use. There is as of yet no shared internal → data pool in public administration where different authorities can compile and use data in a standardised, consistent format. There is not even an overview of which data is available, in which format and at which authority (“data map”), neither for ministries nor for the federal administration as a whole. Data exchange between the Federal Government, the states and local authorities currently only takes place selectively and sometimes only by request.

In the field of geodata, Spatial Data Infrastructure Germany (GDI-DE) has established a technical and organisational structure to boost data provision at all levels (government, states and local authorities). The Federal Government and the federal states have been consolidating spatial information according to universal standards in a register of geodata infrastructure since 2003 in accordance with the resolution by the Head of the Federal Chancellery and the heads of the state and senate chancelleries of the federal states.

What do we want to achieve?

Public administrations require comprehensive knowledge of who has what data, what access rights are associated with that and who maintains this data. The first steps are being taken in this direction through modernisation of the register.

At infrastructure level, what is most needed is fundamental consolidation and modernisation; implementation of this needs to be speeded up. Cross-authority instruments and their organisational implementation are also required in order to anchor data-based action in public administration for the long term. In order to achieve this, we need to strengthen relevant cooperation with federal states as essential data providers in public administration.

We regard the creation of standardised or at least compatible interfaces between authorities at federal, state and local level as particularly important in this context. In this respect, we will refer to documentation on specifications of the Open API initiative.

The technological base platform "PLAIN" (Platform Analysis and Information System), which was developed for the PREVIEW project in the Federal Foreign Office can be reused in full by other projects. We have established an effective data infrastructure in which more than 40 data sources on peace, conflict, climate, migration, government, health and others are maintained, continuously updated, curated and made available.

Geoinformation and earth observation data are an important strategic component of this and, thanks to their interdisciplinary function, they form the basis of a shared view of the current situation, therefore linking cross-departmental crisis teams and enabling all actions to be coordinated.

How do we want to achieve this? Our key measures:

- We will develop a "Data atlas of the federal administration". In the first stage, the data stock of federal administration will be analysed and reviewed to determine whether they are accurate, up-to-date or redundant and a strategy will be drawn up on how these data stocks should be presented. (BMI/BMF)

- We will create a shared, internal, virtual → data pool for federal authorities in which various authorities can compile and exchange relevant data in a universal, standardised format for data-based government action. We will check the use and roll-out of existing standards to prevent duplication. Data quality criteria (including clarity, consistency, integrity) will be guaranteed by the establishment of shared → data governance and its technical implementation. Dashboards can be created on this basis. These should be aligned with existing projects, e. g. the Federal Foreign Office's PREVIEW project. (AA/BMI/BMVg/BKAmt)

- The federal authorities have the opportunity to use a secured and standardised development platform on the Federal Government's cloud.

This type of platform forms part of the tech stack of IT consolidation. The platform brings inter-coordinated tools and services together to form an ecosystem of software development and can be used by developers to programme new specialist processes. (BMI/BKAmt)

- By establishing a competence centre for "AI in public administration" we will consolidate skills in AI and make this available centrally to federal administration. All federal authorities will thus have access to central expertise in all areas of data analysis and artificial intelligence and at the same time an expert point of contact will be established for industry. (BMI/BMF)

- Until now, open source solutions have only been used sporadically in public administration. Establishing organisational and structural foundations in the short term will ensure long-term availability of alternative and future-proof open source applications. For this purpose, we will set up an office responsible for public administration (working title "Centre for digital sovereignty"). (BMI)

- Through a strategic dependency analysis of databases, we will analyse the existing data infrastructure to identify dependencies and their impact (e.g. influence on the government's ability to guarantee → data security). We will also assess potential alternative approaches. Based on the findings of the study, we will examine the necessary adjustments and further developments as well as trial alternative data management systems – especially in the open source environment. (BMI)

- We will push ahead with the networking and expansion of effective data infrastructures through targeted cooperation with the federal states. (all federal ministries)

- We will use the projects linked to the "PLAIN" platform, such as PREVIEW or the planned standard platform for open source data analysis, in particular, social media monitoring, where technically and legally possible, to generate, prepare and curate internationally high-quality data on foreign policy-related topics, also with the aid of non-governmental stakeholders, and make this data available to the Federal Government. We will provide long-term funding for this task. The data and analysis platform will continue to help make conflicts and other trends visible, enable crisis situations to be identified in their early stages and provide data-based support for the Federal Government's foreign policy actions. (AA)

- PREVIEW, the data and analysis platform for early recognition of crises and information management, will continue to help make conflicts and other trends visible, enable crisis situations to be identified in their early stages and provide data-based support for the Federal Government's foreign policy actions. (AA/BMVg)

- As a technical toolbox, the planned standard platform for the analysis of publicly available data from social and digital media will assist with the assessment of the discourse process in, among other things, social networks and digital media, aid the analysis of third-party narratives (campaign dynamics and disinformation analysis) by network analyses and support strategic communication by the Federal Government. It will also facilitate political decision-making. (AA)

- Using the United Nations and World Bank Group system, we will continue working intensively on AI-driven forecast models and innovative approaches to using large data records in the context of foreign policy, especially in early recognition of crisis situations. (AA)

- Tackling crises within the framework of national risk and crisis management for the protection of German nationals abroad (NatRKM) requires a federal crisis prevention information system that can be used across departments, either desk-based or mobile, and can easily be expanded (KVInfoSysBund). This will take into account increased demand from departments for a comprehensive system of information and data exchange as well as modern forms of communication to support joint processes in tackling crisis situations abroad. (BMVg)

4.2 Publicly funded data records and open government data

Where do we stand?

Germany only has an average ranking in various internationally comparable open data indices (e.g. the EU Commission's Open Data Maturity Index).

On the basis of the EU directive on open data and reuse of public-sector information adopted in 2019 (PSI Directive), public-sector data should be more usable than it has been before. We also want to identify high-value data records that offer particular socio-economic benefits to make these available in future for free and in real time.

The GovData.de platform of the Federal Government and federal states, which provides an overview of existing open data, is not being developed ambitiously enough. Federal, state and local → metadata is compiled here and so far there are only around 38,000 data records. Alongside the Federal Government, only twelve states are involved GovData.de. Many of the highest federal authorities and federal state administrations are only involved to a very limited degree in providing metadata records for GovData. Only isolated independent open data portals exist at federal state level. From a total of around 11,000 local authorities, there are only approximately 90 local open data portals, although they generate the most data. The first open data portals at federal state level are now beginning to collect local authority data. Specialist information systems, e.g. for environmental data, are also highly fragmented due to the distribution of expertise. As a result of this, a lot of public data is only available in different formats or is very hard to find.

The European Earth observation programme Copernicus as the world's most effective infrastructure for the provision of global environmental information assists decision-makers in politics, public administration, science and industry in issues relating to the environment and security with current information from satellite data. Each month more than 1.5 petabytes of sentinel data are supplied to users. Current trends suggest that this figure will increase.

What do we want to achieve?

For industry, civil society as well as for citizens, public administration needs to become a visible, agile and effective stakeholder in the data ecosystem. In order to achieve this, the Federal Government must firstly modernise its internal processes and secondly improve its provision of data for the public.

In terms of → open data, participants of the online consultation regard investment in both personnel (76 percent) and technical capacities (75 percent) as necessary for the success of → open government data. Those surveyed in the online consultation also thought that better coordination between the Federal Government,

federal states and local authorities is very important in terms of the provision of public data. We want to promote this through institutional, organisational and budgetary or investment measures. This also includes the provision of → high-value data records. The Data Catalogue Application Profile (DCAT-AP) already provides a universal standard for metadata.

The Federal Government wants to be a driving force for more responsible data use and data provision and speed up the transformation to a strong open data culture in which it leads the way as a role model. In this context, taking → FAIR principles into consideration will contribute to sustainable data management in public administration.

The ubiquity and interdisciplinary function of spatial data, i.e. geoinformation, makes this data particularly valuable if it can be used by everyone as base data. Geoinformation and Earth observation data are essential when it comes to finding solutions to social challenges such as climate change and environmental protection, sustainable supplies of raw materials, the energy transition and internal and external security, and thus establishing a cornerstone of a digital value creation chain. We will push ahead with this partnership in data preparation and use for the Federal Government through, among other things, use of the technology and architecture of the base platform PLAIN as well as the PREVIEW project.

Data from sensitive government departments must be considered separately here. In particular, security-related data must not be made available.

Better access to the data records of public administration under applicable law has been a key priority for the research sector for years. → Public administration research data centres can have a high leverage effect in this respect, also in terms of the preparation of data records. Thanks to their up-to-date research results, they contribute to improving steps taken in public administration as well as government decision-making.

Extended and improved provision of freely available legal information (federal laws, administrative regulations and case law) also makes a significant contribution to the availability of public data.

With its "Green Deal", the European Commission has defined environmental protection as a key focus of the European Union and its member states. The Federal Government wants to improve access to environmental information in order to contribute to transparency on the current state and development of the climate, environment and nature as well as promote innovations for sustainable developments in environmental policy and encourage individual environmentally-conscious behaviour.

How do we want to achieve this? Our key measures:

- We are creating an open data strategy for the Federal Government that will be introduced to the Federal Cabinet in the first half of 2021. The aim of this strategy is to provide open data on public administration and improve its potential for reuse for various purposes. The open data strategy will be accompanied by comprehensive measures focussing on standardising and improving data connections as well as on boosting data quality and topicality. (BMI)

- A culture of open data is also to be established and made a permanent fixture in public authorities. For the purpose of implementing this measure, the Competence Centre for Open Data (CCOD) will be supported in its role as the central, pro-active advice centre for the Federal Go-

vernment, comparable federal state agencies and relevant community stakeholders. We will examine the extent to which steps toward institutionalisation, in particular, in the areas of networking, provision of information and applied research, if necessary, in line with international role models (e.g. the UK's Open Data Institute, ODI UK) can make an effective contribution to the open data ecosystem in Germany. (BMI)

- Within this legislative period, we will introduce a new act on data use to enforce the EU directive on open data and the PSI directive and propose a second open data act to expand framework conditions for the provision of open federal administration data and fundamentally improve use of public-sector data for industry, science and civil society. (BMWi/BMI)

- We will actively contribute to defining high-value public-sector data records in order to provide data records with great potential for significant socio-economic value creation under ideal conditions (free, machine-readable and in real time). We are committed to providing high-value data records for compliance with FAIR principles and want to expand the provision of metadata, in particular, for the purpose of better searchability. In close cooperation with the federal states, we will look at conversion requirements in greater detail and promote the potential of free and machine-readable provision of high-value data records in real time. (BMWi)

- We will develop an innovative legal information portal for the Federal Government that offers standardised online access to freely available legal information provided by the Federal Government (federal laws, administrative regulations and case law) and thus improve the scope, quality and researchability of legal information. At the same time, the legal information portal will facilitate data copying by commercial and non-commercial reusers via an interface. The legal information including all metadata will be provided as open data. (BMJV)

- Through the "IT support for open data" initiative, which forms part of the Federal Government's IT framework strategy, we will provide federal administrations with needs-based IT solutions for the provision of open data, in particular through the expansion of the GovData platform. The objective is to minimise the costs incurred by federal authorities in the implementation of Section 12a of the E-Government Act (EGovG) as well as improve the availability and searchability of open data and metadata. (BMI)

- In order to guarantee more transparency and scientific traceability, scientific studies and evaluation reports and, if possible, the data on which they are based are to be made accessible to the public. The BMWi is already taking a leading role in this respect by publishing evaluations on funding measures and regulatory projects on a new website.
(BMWi, all federal ministries and BKM)

- We are establishing a digital data portal for the Federal Statistical Office called "Dashboard Deutschland", which takes into account the dynamic information requirements of civil society, industry and science. (BMI)

- We have set up a system of federal electronic statistics on contract awards (VgS) for the Federal Statistical Office, which began operating on 1 October 2020 and will, in future, provide the first transparent data on awarded public contracts via the Federal Statistical Office's GENESIS database. (BMWi)

- We will increase the digitalisation of library and archive stocks and film databases and further

develop accompanying specialist information systems so that this data is increasingly available on a virtual basis, meaning that information from archives and libraries is searchable and all information is easily retrievable and barrier-free. By doing so, we want to boost the open data culture. (BKM)

- We will continuously improve the use of the growing abundance of Earth observation data to tackle global challenges and will increasingly use methods of artificial intelligence for this purpose. With Earth observation data, we will enable innovative companies to access new markets and create future-proof jobs in Germany and Europe. (BMVI)

- We will improve the Federal Agency for Cartography and Geodesy's Geoportal.de as the central point of access to the national → geodata of Spatial Data Infrastructure Germany (GDI-DE) and make data more easily searchable with the assistance of a data editing department. This will provide machine-readable formats and adequate metadata. (BMI)

- Embedded in the Geological Data Act is the comprehensive obligation to safeguard geological data for the purpose of the maintenance, long-term readability and availability of this data for all existing and future geological actions of the Federal Government and the federal states. The public provision of geological data is an essential element of this act. It sets out provisions on staggered publication for the various categories of geological data so that alongside commercially collected geological data, it is primarily the large volume of geological legacy data via Geoportal.de that is made available to the public. (BMWi)

- We will set up a web portal for interdisciplinary research using the various data stocks of the Federal Institute for Geosciences and Natural Resources (BGR). The portal will form the central point of access to BGR data and ensures that BGR data can be found via Geoportal.de. INSPIRE-compliant drill data will also be provided here in a shared source format. Visualisations of 3D underground models will also be centrally accessible here in future. (BMWi)

- Within the framework of a new governmental agricultural data platform, data that is required to meet statutory conditions will be collected, generated and provided directly by governmental bodies. (BMEL)

- Within the framework of the Earth Observation for Sustainable Development (EO4SD) programme, we want to improve use of the European Space Agency's free satellite images and services. (BMZ)

- We are developing an international platform with standardised and specified ICT components as a global public good. We are also setting up a working group to prepare the core standards that will apply to all components. These standards will relate to the data and interoperability requirements that are needed for all components. (BMZ)

4.3 Better data use for more efficient and more citizen-friendly administrative practices

Where do we stand?

Efficient government use of existing data to design citizen-friendly administrative practices and more effective supervision in Germany's authorities has been highly heterogeneous to date. There is potential for reducing the burden on public administration, increasing its efficiency and making (administrative) services more effective through data protection-compliant modernisation, digitalisation and interlinking of registers. There have also been very few data partnerships between government and industry or civil society. The online consultation showed that, according to participants, government authorities should be more involved as stakeholders in the data ecosystem.

Access restrictions under competition law are another example of an obstacle here. For instance, data that is collected within the framework of spatial planning processes can only be made available in connection with the particular planning procedure and is only accessible to the public for a short period of time. Planning procedures in close temporal and spatial proximity cannot access this data to speed up the process.

What do we want to achieve?

The Federal Government is to become an innovative stakeholder in the data ecosystem. More data-based partnerships between government and industry need to be established. This will make federal administration more transparent and encourage open data thinking so that industry can develop new business models. In order to improve the Federal Government's ability to fulfil its obligation to provide public services as well as protect public goods, in particular natural resources and health, companies need to provide the government with access to their quality-assured data records (e.g. relating to the condition and capacity of existing infrastructures or in connection with environmental data) in return, if possible in real time. This will empower civil society in the data economy and facilitate better social cohesion. This privately collected or generated non-personal data will help the Federal Government implement adequate measures, especially those for ensuring climate protection, providing better healthcare, creating new infrastructures and expanding existing ones.

How do we want to achieve this? Our key measures:

- In order to improve the coordination of data policy issues, the Federal Government will set up an inter-ministerial working group on "Data policy" to be led by the Federal Chancellery. This working group will consider fundamental issues of data policy and, if necessary, invite experts in to discuss current and legislative topics and dossiers relating to data policy. (BKAmt, all federal ministries and BKM)

- Updating registers is an important task for modern public administrations. With the cross-register identification of individuals, the administrative burden on citizens and companies is lessened by the fact that they will not have to re-enter personal data at public offices if it is already available there. Their tax identification number will serve as their standardised identification. (BMI)

- In connection with this, we will establish a data cockpit to ensure transparency on data exchange between public offices. This will be digital and therefore more user-friendly for citizens. The data cockpit will also help to increase acceptance for this type of data exchange, e. g. for online applications. (BMI)

- By establishing data partnerships we will be able to fulfil our government obligation to provide public services in a more targeted manner. For this purpose, we will examine which data collected and generated by non-public offices (in particular environmental data and infrastructural data, e. g. on road conditions, air quality, etc.) is relevant to our obligation to provide public services and to which level of → data quality. We will also consider the extent to which secure access to this → machine-readable data needs to be created for public offices. (BMEL/BMU)

- There is currently no overview of which data is maintained in which format and at which office by public institutions. We will therefore perform an inventory of public data stocks and create as comprehensive an overview as possible on the public administration data information platform (VIP). In the context of future-proof public administration, VIP also serves as a tool for assessing the impact of legislation. (BMI)

- A base register for company master data is to be created in connection with a standardised federal identification number for companies. This will reduce company reporting requirements by preventing duplicate enquiries. (BMWi)

- Data analysis is more difficult if data is derived from different sources and is prepared and presented in different ways. This affects all users of this data in public administration, industry, science and civil society. We will set up a data transparency office at the Federal Statistical Office to support the empirical foundation of administrative actions in technical, methodological and procedural terms and establish a solid basis for short-term political decision-making requirements. This will identify inconsistencies and highlight possible actions based on needs through the application of internationally recognised data standards and methods. Another objective is to establish a platform for metadata descriptions that is as comprehensive as possible so that it forms the basis for implementing the “once only” approach and reducing inefficiencies. (BMI).

- We will use tax enforcement data to prepare and apply new methods for handling, assessing and presenting information within the framework of the tax analysis system project. (BMF)

- We will gradually equip all legislative experts with the ability to enact digital-compatible laws. In the meantime, we will perform digital feasibility checks on new draft laws. (BMI)

- We will improve regulation through intelligent data use. Within the framework of new regulatory projects, relevant ministries will check which data is relevant to which regulatory project, whether this data is available or can be collected and what results can be derived from this data for the regulatory project. (BMJV/BMBF/all federal ministries and BKM)

- Citizens should have access at any time to information on their individual entitlements in statutory, company and private pension schemes. For this purpose, we will develop and test a digital overview of pensions, starting in 2021. This is likely to be operational by the end of 2024. Information on individual statutory, company and private pension schemes will be accessible

on a portal. Users will be able to see the current level of their entitlements as well as the level they will reach on retirement from the various sources and whether further provisions are required. (BMAS)

- In the context of employer reporting obligations, employers often request information from various social insurance providers. Supporting AI systems will be used to generate automated responses and offer standardised information on similar cases, taking into account and based on applicable statutory regulations under the Social Code (SGB), shared principles of data exchange, by-laws of individual health insurance providers and current case law. A preliminary study will highlight the technical, organisational and legal framework conditions of using AI. (BMAS)

- We want to see the EU Commission adopt and further develop the initiative for a shared European identity ecosystem that we established in 2020 within the framework of Germany's Presidency of the Council of the European Union. (BMI/BMWi)

- The DataCipation project is advising the African Union (AU) on establishing an interactive information platform for improving dialogue between citizens and political representatives of the AU and its member states. (BMZ)

4.4 Instruments for improving data skills in the federal authorities

Where do we stand?

A cultural transition has only just begun in many public authorities in terms of how existing data can be used within those authorities' individual departments and what opportunities there are, including for government action, in targeted analysis or visualisation of data analysis. To a large degree, public administration also lacks positions for data content work. There are currently only very few federal ministries that have a dedicated and visible data team (responsible for data science and/or data governance) that consolidates expertise and provides a data analysis service for those public authorities.

Non-personal data is currently only collected and processed in individual departments. Information on existing data remains dormant in "departmental silos". There is a general lack of a cross-departmental overview of existing data by way of a modern knowledge management system. There is also a lack of institutional exchange between those entrusted with future-proof data work in federal administration. Most downstream ministries and federal authorities have no data laboratories to allow for experimental data work.

Training for current administrative personnel in data skills, particularly including data analysis and its visualisation, is still under internal development.

In 2021, the Federal Academy of Public Administration (BAköV) will be running a further training programme entitled "Data literacy – data skills in

public administrations", among other initiatives. Its aim is to convey a fundamental understanding of data analysis and visualisation of data analysis and create the expertise on which modern data administration is to be based. Experts already working in public administration will also be offered further specialist training.

Related to this is the fact that → data governance, i.e. standardised processes and the distribution of roles for data content work, only exists in federal administration in isolated cases. The increasing complexity of cases and their regulation or corresponding funding measures mean that improvements in the design and classification of internal assessment documents are also required, e.g. through visualisation of data analysis.

What do we want to achieve?

In order to facilitate the effective use of public data records for civil society, industry and science (see 4.1), public administration must develop a better understanding of the importance of data for external data users as a whole. This is the only way in which other stakeholders can become reliable and skilled partners. A first important step in this direction is to prepare a data skills map in federal administrative organisations with the aim of initiating the targeted development towards achieving a data-based administrative culture.

We want to improve the data skills of federal administration. New positions, responsibilities and units need to be created in every federal ministry for more data-based work. Although every government authority has its own official data protection officer, hardly any have a → **chief data scientist** or chief data officer responsible for data governance and able to assist with the development of further uses of data within the authority. A chief data scientist can promote better use of data in the highest federal authorities and thus increase the availability of open data. A detailed analysis of the actual state or situation should be considered particularly important in this regard. This is the only way to identify existing shortfalls and create the necessary measures to improve the quality of data use and establish relevant specific departmental tasks for the long term.

The Federal Ministry of Defence already has a chief data officer and a team of experts tasked with establishing internal data governance. The Federal Foreign Office has central data science competence centres with its PLAIN platform, the PREVIEW project carried out on this platform and projects currently being set up, e.g. the planned standard platform for open source data analysis, in particular social media monitoring. Expanding on this to establish a chief data scientist role is possible. Projects established on the PLAIN platform involve specific expertise and analysis skills. This should serve as a template for cross-departmental data infrastructure towards expanding a data analysis platform that is accessible to the whole of the Federal Government and must therefore be staffed with corresponding personnel. This will ensure that data is actively incorporated into political governance. Existing infrastructures must be integrated in a suitable form to prevent duplicate actions.

We want to make government action and communication more effective, more evidence-based, more transparent and more sustainable through better data-based foundations. In order to achieve this, the relevant decision-makers in various political fields need valid, robust data provided in real time in their decision-making processes (e.g. via → dashboards). There will be greater use of available data for strategic, proactive and empirical government action and communication. The evaluation of public measures is a key instrument of social and economic value creation.

How do we want to achieve this? Our key measures:

- All the highest federal authorities are to conduct a detailed status analysis of measures already taken to improve data skills. The focus here should be on existing structures. These measures are to be scrutinised and if necessary, further developed in the chosen direction. (BKAmt, all federal ministries and BKM)

- We want all federal ministries to establish their own position for a chief data scientist or a similar role (e. g. chief data officer). The chief data scientist and the data protection officer work together. A chief data scientist would work with a core team of data analysts who could be recruited from within the public administration. Team members should have proven skills in data science and statistics. (BKAmt, all federal ministries)

- We want all federal ministries and/or their downstream authorities to establish their own internal **data laboratories**.
AA, BMBF, BMU, BMVg and BMZ are the leading authorities here. (AA/BMI/BMBF/BMU/ BMVg/ BMZ/BKAmt).

- The Federal Foreign Office has application-based data centres or data science competence centres for foreign policy data work, where expertise is consolidated. These competence centres, both existing and currently being set up, will be expanded and staffed with trained personnel as a priority. The technical foundation provided by PLAIN can serve as a blueprint and infrastructure as a service provider (IaaS) for the Federal Government as a whole. (AA)

- The Federal Ministry of Education and Research (BMBF) will establish a data laboratory designed primarily to support evidence-based policy-making on education, research and innovation. This data laboratory is to be set up as an independent specialist competence centre that will consolidate expertise on data collection and analysis as well as on the systematic evaluation of political innovation measures. (BMBF)

- The Federal Environment Agency is setting up an "Application laboratory for → artificial intelligence and big data" with the aim of developing data-based applications for achieving sustainable development goals and thus reinforcing cooperation between the Federal Government and the federal states on environmental issues. By systematically using AI processes for improved monitoring of environmental conditions (among other things, based on in situ, sensor and remote sensing data), progress is to be made on drafting environmental measures and their implementation is to be supported through environmental administration by the Federal Government and federal states. (BMU)

- The Federal Ministry of Defence is establishing its own system of data governance, which will strengthen value-based handling of data in the organisation and facilitate a data-centred organisational culture. (BMVg)

- Through its digilab, the Federal Ministry for Economic Co-operation and Development (BMZ) wants to make German development cooperation more digital and efficient in the context of data use, among other things. The objective here is to use agile methods like design thinking to create a more effective, efficient and modern structure for development cooperation. (BMZ)

- The federal ministries will set up or expand → **research data centres** in downstream departments or institutions, if this seems necessary in the context of expertise. These function as con-

tacts for data protection-compliant use of available non-categorised → raw data. The leading authorities here are BMAS, BMEL, BMG, BMU and BMZ. They will agree on setting standards. (All federal ministries)

- The research data centre of the Federal Institute for Occupational Safety and Health (BAuA) is to be expanded to improve access to data on occupational safety and health and humane working environments collected as part of scientific work. (BMAS)

- The Data Service Center (DSC) of GIZ, the German society for international cooperation, is to be established as a contact for data use and enable data-based cooperation and evidence-based evaluation of political measures. (BMZ)

- By early 2021, the Federal Academy of Public Administration (BAköV) will complete its development of a digital academy that will combine all the further training courses available in support of digitalisation. These will include further training measures (face-to-face lectures and digital learning formats) on data-based administrative practices to improve data skills in federal administration. In 2021, BAköV will further develop its existing practice-based and needs-based further training data skills strategy for different target groups, based on various skills requirements in federal administration, and it will also make training available for data officers according to available resources. In developing its strategy, its Scientific Committee will consult a team of experts from science, industry, politics and society. The strategy is to be integrated into the federal authorities' personnel development strategies. (BMI)

We are reviewing the creation of a data skills map, focussing on the departments' own human resources in the fields of data governance, data management and data analysis. Building on this, the relevant departments' personnel management processes should facilitate targeted data use according to specialist skills. (BKAmt)

Table of all measures of the Data Strategy

Table of all measures of the Data Strategy

Chapter No.	*Project title*	*Responsible*
I. The foundations: creating effective and sustainable data infrastructures		
1.1 Interlinking and expanding data infrastructures		
1.1	***GAIA-X: building a federated data infrastructure as a cradle for a vital, European ecosystem***	***BMWi/BMBF***
	The aim of GAIA-X is to establish a trustworthy, sovereign digital infrastructure for Europe, which will form the basis of new data-driven services and applications.	Ongoing
1.1	***National Research Data Infrastructure (NFDI)***	***BMBF***
	The NFDI provides access to local, project-based or temporarily stored scientific and research data stocks in Germany. The NFDI will set data management standards and make research data usable and reusable for the long term as a comprehensive research data management system.	Ongoing
1.1	***European Open Science Cloud (EOSC)***	***BMBF***
	The aim of the EOSC is to create a trustworthy, interconnected, Europe-wide environment in which research results (publications, data, software) can be stored and shared. For this purpose, the EOSC relies on cooperation with European initiatives, such as the NFDI in Germany in particular.	Ongoing
1.1	***Standards for data quality – interoperability for the European Open Science Cloud (EOSC)***	***BMWi/BMBF***
	We are committed to the development of universal standards of data quality, metadata and the interpretability of data in the NFDI. Interoperability with data in the EOSC and consideration of standards for the digital representation of measurement data established by the Meter Convention (CIPM) will play a role in this.	Planned
1.1	***Researching and developing innovative, trustworthy digital technologies and data infrastructures – research framework programme by the Federal Government for microelectronics***	***BMBF***
	A follow-up programme is being prepared to promote research on microelectronics. The BMBF's aim here is to support research and development for a new quality of electronics in the context of sustainable digitalisation.	Ongoing

1.1	***Electronics for Green ICT and energy-saving data technologies: Green ICT competence centre, Green ICT innovation contest, energy-saving super computers & data centres***	***BMBF***
	Through its strategic funding of technological development in hardware and software, the BMBF is creating the preconditions for secure, trustworthy and effective data technologies, applications and infrastructures.	Ongoing
1.1	***BMBF Research Data action plan***	***BMBF***
	The action plan makes the potential of research data broadly usable and provides the stimulus for a self-determined data culture. It combines activities and projects with the aim of creating a culture of research data sharing and reuse.	Planned
1.1	***FNS Cloud (Food Nutrition Security) project***	***BMEL***
	The Federal Institute for Risk Assessment (BfR) is also involved in the FNS Cloud, which is an EU-funded research project on infrastructure to provide data in the field of healthcare-related consumer protection/food safety.	Planned
1.2	**High performance computing, quantum computing and storage media**	
1.2	***Programme on high performance computing***	***BMBF***
	Demand for computing capacities in science and industry is growing strongly, which is why the BMBF has established a programme on high performance computing in Germany that has measurable targets.	Ongoing
1.2	***A Federal Government framework programme "Quantum technologies – from basic research to market"***	***BMBF/BMWi***
	The aim of the framework programme is to enable German institutes and companies to be significantly involved in shaping what is known as the second quantum revolution and play a leading role in the transfer from research to application and onto the market.	Ongoing
1.2	***Roadmap for a national initiative on quantum computing***	***BMBF/BMWi***
	The aim of the roadmap for a national initiative on quantum computing is to make Germany a competitive technological and economic world leader in this field.	Planned

1.2	***Pilot quantum communication network***	***BMBF***
	In the QuNET project, a tap-proof test track for quantum communication is currently being established between two federal institutions. This will assess how quantum communication can contribute to making confidential data more secure.	Ongoing
1.2	***National High Performance Computing at Universities (NHR)***	***BMBF***
	The NHR comprises a network of funded high performance computing centres. The network aims to provide comprehensive and needs-based high performance computing capacities for scientific research at universities, among other things.	Planned
II. Increasing innovative and responsible data use		
2.1 Regulation: improving framework conditions		
2.1.1 Framework conditions for personal data		
Legal certainty		
2.1.1	***Collaboration between data protection supervisory authorities***	***BMI***
	We are committed to close cooperation between the data protection supervisory authorities of the Federal Government and the federal states in all data protection issues of national importance. We are investigating measures that can contribute to this. This currently forms part of the evaluation of the Federal Data Protection Act (BDSG).	Ongoing
2.1.1	***Leading data protection supervision in cross-state projects in healthcare provision and health research***	***BMG/BMBF***
	In order to speed up and simplify multi-centric, cross-state projects in healthcare provision and health research, a regulation was created in Section 287a of the Fifth Book of the Social Code (SGB V) governing the application of federal law (Section 27 BDSG) and a responsible supervisory authority was established following the example of the GDPR.	Completed
2.1.1	***Telecommunication and Telemedia Data Protection Act (TTDSG)***	***BMWi***
	We will define data protection law for telemedia and telecommunication services in a telecommunication and telemedia data protection act (Telekommunikations-Telemedien-Datenschutz-Gesetz – TTDSG), which will clarify the responsibilities of supervisory authorities in this field and therefore provide for greater legal certainty.	Ongoing

2.1.1	***Promoting harmonisation of legal foundations in federal state law***	***BMBF/BMWi/ BMI***
	Diverging regulations based on data protection law at federal state level sometimes make it more difficult to use personal data for research, for instance in the education sector. In order to improve opportunities for data use for research purposes, we will promote a harmonisation of legal foundations in federal state law to the federal states.	Ongoing
2.1.1	***Linking up research data – more standardised solutions***	***BMBF/BMWi***
	We want to find research-friendly solutions to boost the interconnectability of research data on households and companies. This connected data from different sources will be standardised by different areas of legal regulation (social law, statistical law, data protection law).	Planned
2.1.1	***Round table on data protection***	***BMI/BMWi***
	By continuing with the round table on data protection, we are creating an information and exchange service for interested circles on current topics of data protection (such as the international movement of data).	Ongoing
2.1.1	***Project: "Innovative Data Protection Consent Management"***	***BMJV***
	This research project analyses consent models in an online context and collects data on consumer expectations through representative online surveys. Recommendations on securing legally compliant and consumer-friendly consent are being developed in the form of best practice models.	Ongoing
2.1.1	***ePrivacy Regulation***	***BMWi***
	We aim to achieve harmonisation in European data protection with the ePrivacy Regulation, which is designed to improve the particularly important protection of the private sphere in electronic communications.	Ongoing
2.1.1	***Standardised enforcement of data protection law within the EU***	***BMI***
	A standardised understanding of data protection should be developed at European level so that companies operating in the European Union find the same conditions in all EU member states. This applies in particular to the enforcement of data protection law.	Ongoing

2.1.1	***Facilitating secondary use of health data in the EU through European codes of conduct***	***BMG/BMAS***
	Standardised understanding is to facilitate cross-border data use in research projects involving health data. In order to create the legal clarity required here, EU-wide codes of conduct on the secondary use of health data are to be drawn up in accordance with Article 40 of the GDPR.	Ongoing
2.1.1	***Meaning of research clauses***	***BMBF, all federal ministries***
	In future we will review new draft legislation to see what scope it offers for the creation of research-friendly, barrier-free access rules (what are known as research clauses) for independent scientific research.	Planned
Anonymisation and technical data protection		
2.1.1	***Anonymisation research network***	***BMBF***
	We will establish an interdisciplinary research network on the topic of anonymisation. This network will strengthen research in this field in Germany. It will also provide knowledge transfer and consultation services for public administration and industry.	Planned
2.1.1	***Research funding: anonymisation procedures and methods***	***BMBF***
	We will promote research in Germany in the field of privacy in machine learning and, in particular, artificial intelligence and quantum computing. We will also promote research into privacy metrics and privacy guarantees.	Planned
2.1.1	***Trial establishment of a network of testing and certification laboratories***	***BMI***
	An important contribution to the enforcement of data protection law can be made by testing and certification laboratories that perform technical testing to determine the data protection compliance of data-based products and services. For this reason, we are reviewing the establishment of this type of network.	Planned
2.1.1	***Exchange with business associations and supervisory authorities on data protection-compliant AI and blockchain solutions***	***BMWi***
	We will continue to exchange ideas with business associations and supervisory authorities on data protection-compliant AI and blockchain solutions and thus create greater security for innovative business models.	Ongoing

2.1.1	***Funding provision for the reuse of existing research data records***	***BMBF***
	With this project, open-topic funding will be provided for narrowly defined research projects based on the use of existing research data records. In other words, these projects will not involve any independent data collection, but will facilitate innovative research questions and links.	Planned
2.1.2 Framework conditions for non-personal data		
2.1.2	***GWB Digitalisation Act***	***BMWi***
	With our GWB Digitalisation Act, we are creating a pro-active and digital competition law 4.0 and a regulatory framework in line with the digitalisation requirements of industry.	Ongoing
2.1.2	***Support for the Digital Markets Act (DMA)***	***BMWi***
	We will support the Digital Markets Act (DMA). In doing so, digital platforms will be prohibited from restricting access to data under certain circumstances.	Ongoing
2.1.2	***Study on the framework conditions surrounding economics and competition law for data markets***	***BMWi***
	For this study, funding will be provided for a research project on competition law-related framework conditions for data markets, including data trustee strategies and interoperability solutions.	Planned
2.1.2	***Review of separate measures on data-driven markets***	***BMWi/BMAS***
	Review on whether it is necessary to establish a requirement to share certain data in particularly data-driven markets.	Planned
2.1.2	***Shared conditions for the use of non-personal data***	***BMEL/BMWi***
	This project is preparing shared conditions of use (general terms and conditions) in collaboration with stakeholders for the use of non-personal data in agriculture, among other things.	Ongoing
2.1.2	***Regulating text and data mining under copyright law***	***BMJV***
	In the implementation of Article 4 of the Digital Single Market Directive, a new authorisation for non-targeted text and data mining for all will be adopted under copyright law.	Ongoing

2.1.2	***Funding campaign "Future of Work: SMEs – innovative and social".***	***BMBF***
	The aim of the funding campaign "Future of Work: SMEs – innovative and social" is to reinforce the data-driven transformation of the world of work for small and medium-sized enterprises (SMEs) through work in research and development.	Planned
2.1.2	***Legal framework for the Data Governance Act governing common European data spaces***	***BMWi***
	In the 4th quarter of 2020, the EU Commission presented a legal framework for the governance of Common European data spaces . The Federal Government is committed to facilitating the interoperability and usability of data within this legal framework.	Ongoing
2.1.2	***Innovation board***	***BMWi***
	We will promote the innovation board agreed in the coalition agreement. This will also function as a contact point for advice on data protection issues concerning industry (especially start-ups and larger companies) in terms of digital innovations at EU level.	Planned
2.1.2	***Research project on AI training and test data quality for applications in the social and work context***	***BMAS***
	The project is designed to address technical, legal, ethical and regulatory aspects of training data quality and test data quality in the social and work context. The objective is to develop practical criteria and strategies with a focus on freedom from discrimination, diversity and reducing the number of faulty decisions made based on data models.	Planned
2.1.3 Strengthening data and IT security		
Cloud computing services		
2.1.3	***Reinforcing the rights of companies and consumers towards cloud computing services***	***BMWi***
	We will work at European level to ensure that the rights of companies and consumers towards cloud computing services are strengthened and that switching cloud providers is also facilitated through technical provisions in the upcoming legislative procedure.	Planned
2.1.3	***Strengthening European cloud service providers***	***BMWi***
	We want to strengthen European cloud service providers and thereby improve secure and competitive data storage within Europe.	Planned

International data flows		
2.1.3	***Protecting German companies against unfair restrictions***	***BMWi***
	We will support the EU in establishing ambitious obligations relating to the free movement of data across borders, which will protect German companies from unfair restrictions and ensure personal data protection is maintained.	Ongoing
Data and information security		
2.1.3	***Promoting IT security and cybersecurity through the IT Security Act 2.0***	***BMI***
	We will review which further measures (including regulatory ones) are important in promoting IT security and cybersecurity and will implement them through our IT Security Act 2.0.	Ongoing
2.1.3	***Evaluating and updating the Cybersecurity Strategy***	***BMI***
	Beyond the bounds of this legal framework, we have begun evaluating and updating the Cybersecurity Strategy, which will determine the basis of cybersecurity over the next decade.	Ongoing
2.1.3	***Follow-up programme to "Self-determined and secure in the digital world 2015–2020"***	***BMBF***
	We will continue and increase funding for IT security research through a follow-up programme to the current research framework programme "Self-determined and secure in the digital world 2015–2020".	Planned
2.1.3	***A Federal Government research framework programme for IT security and specialist programme for communication systems***	***BMBF***
	With our IT security programme and specialist programme for communication systems, we will promote research into and development of innovative technologies and secure and trustworthy data infrastructures and forms of communication.	Planned
2.1.3	***Cross-departmental steering group "Global standardisation bodies"***	***BKAmt***
	We will coordinate a cross-departmental steering group in cooperation with the global standardisation bodies that are responsible for producing standards for data processing and IT security.	Planned

2.2 Creating new data spaces		
Promoting innovative and responsible data use initiatives		
2.2	***Data protection law-compliant support for trialling innovations in real laboratories***	***BMWi***
	We will provide support for temporary trialling of innovations in real laboratories as test rooms for innovation and regulation.	Planned
2.2	***Promoting research into the ethical, legal and social aspects of digitalisation, big data and artificial intelligence in health research and healthcare***	***BMBF***
	We are supporting the development of options for action through our research funding on ethical, legal and social aspects (ELSA) of the digitalisation of health research and healthcare provision.	Ongoing
2.2	***"Smart data management" research programme***	***BMWi***
	With our "Smart data management" research programme, we are funding projects from various sectors which develop new data products and systems that will form the basis of new data services and data-based business models.	Ongoing
2.2	***GAIA-X funding competition***	***BMWi***
	We will set up a GAIA-X funding competition for the implementation of examples of applications and establishment of data spaces in the GAIA-X infrastructure, which will form the foundation of a digital ecosystem.	Planned
2.2	***Research programme on "The future of value creation: research for production, services and work"***	***BMBF***
	With the new research programme on "The future of value creation: research for production, services and work", we will support research and development into the effects of the platform and data economy, as well as Industry 4.0.	Planned
2.2	***Industry 4.0 – collaboration in dynamic value creation networks***	***BMBF/BMWi***
	The aim of the initiative is to promote innovative Industry 4.0 solutions, in particular with regard to collaboration between companies and their customers and suppliers. Company-internal and cross-company data-driven processes are to be developed for this purpose.	Ongoing

2.2	***EU-AU Data Flagship***	***BMZ***
	Together with the EU Commission and AU Commission, we would like to promote responsible data use and value creation in Africa and create African-European data spaces. We began work on this within the framework of Germany's Presidency of the Council of the European Union with the EU-AU Data Flagship.	Ongoing
2.2	***Learning production technologies – the use of artificial intelligence in production***	***BMBF***
	This initiative is designed to demonstrate and speed up access to the potential of AI in production and thereby improve the performance and functionality of machines and production resources and tools in industry.	Ongoing
2.2	***Internet-based services for complex products, production processes and plants***	***BMBF***
	This initiative is designed to promote the development and testing of innovative, data-based services and business models derived from linking up the entire value creation chain.	Ongoing
2.2	***Advanced systems engineering: mastering the complexity of socio-technical systems***	***BMBF***
	The aim of this initiative is to develop innovative solutions for SMEs in particular, to handle the increasing complexity of products, services and production systems.	Ongoing
Data spaces for the environment		
2.2	***UNIS-D environmental protection and nature conservation system in Germany***	***BMU***
	UNIS-D (working title) will use intelligent research and visualisation tools to provide comprehensive access to all information on environmental protection and nature conservation from the Federal Government, federal states and local authorities as well as, in the future, from science, industry and citizens.	Planned
2.2	***Centre for Biodiversity Monitoring***	***BMU***
	Monitoring of biodiversity will be expanded and secured for the long term at national level. The monitoring methods will be further developed and supplemented by innovative approaches and technologies. The establishment of an information management system is also planned.	Ongoing

2.2	***"Digital GreenTech" – environmental technology meets digitalisation***	***BMBF***
	The "Digital GreenTech" initiative promotes new approaches to intelligent use and networking of e.g. ecosystem data and process data in the environmental industry. The focus here is on areas of application such as the recycling industry, water management and sustainable land management.	Ongoing
2.2	***German Marine Research Alliance – improving data analysis and use in marine, coastal and polar research***	***BMBF***
	We will continue to support the German Marine Research Alliance in order to reinforce the strategic capability of marine research institutions in Germany in the field of data management and digitalisation.	Ongoing
2.2	***Planning the future with intelligent information on the climate and environment: component 3 of the "Local climate and environmental models for future cities and regions" flagship initiative***	***BMBF***
	We will build on our research into a new generation of climate information services and local climate modelling to create opportunities for connecting climate data to a broad range of local environmental aspects.	Planned
2.2	***Sustainable data infrastructure initiative***	***BMU***
	We aim to use our initiative on sustainable data infrastructure to create transparency on the impact that data infrastructures have on the environment and climate and establish corresponding targeted measures, including metrics, transparency and flagging of energy consumption by computer centres, as well as corresponding funding measures, setting minimum standards, sustainability criteria of technologies (e.g. blockchain), and "green coding".	Planned
Health Data space		
2.2	***Piloting the systematic measurement of the performance and efficiency of the German healthcare system***	***BMG***
	The aim of this project is to pilot a systematic, data-based measurement of the performance and efficiency of the German healthcare system. Particular attention will be paid to the objective comparability of indicators..	Planned

2.2	***Establishing a research data centre for health data***	***BMG***
	In order to make the billing data of individuals with statutory health insurance and, from 2023, voluntarily released treatment data stored in their electronic patient records much more rapidly available than before in a trusted space for, among other things, research into healthcare provision, the data processing centre at German Institute of Medical Documentation and Information (DIMDI) will be developed into a research data centre at the Federal Institute for Drugs and Medical Devices (BfArM).	Ongoing
2.2	***Medical computing initiative***	***BMBF***
	The aim of the medical computing initiative is to improve research and patient care through cross-departmental networking of data on research and healthcare provision. Data integration centres are being established for this purpose.	Ongoing
2.2	***Digital progress hubs for health***	***BMBF***
	Starting with the university medical centres participating in the medical computing initiative, the digital progress hubs for health are investigating how hospitals, GP surgeries, research institutes and health insurance companies can work together on establishing digital approaches to healthcare provision.	Ongoing
2.2	***Making data from the state cancer registers more usable throughout the nation***	***BMG***
	The aim of this project is to consolidate data from federal state cancer registers and make this more usable at national level. A comprehensive database for research, reporting, regulation and quality assurance is to be created through a data network and partnership between participating stakeholders.	Ongoing
2.2	***genomDE initiative***	***BMG***
	The aim of the genomDE initiative is to introduce genome sequencing in standard care for cancer and rare diseases. Designated centres will collect and analyse clinical, phenotypic and genomic data for the purpose of providing individualised healthcare.	Ongoing
2.2	***“Data for health” innovation initiative***	***BMBF/BMG/ BMWi***
	Presented within the framework of the “Data for health” innovation initiative is a roadmap for better patient care through health research and digitalisation that consolidates the activities of participating departments in order to promote data-assisted health research.	Ongoing

2.2	***Provision of health data from electronic patient records***	***BMG***
	With the release of data under the Patient Data Protection Act (PDSG), patients will be given the opportunity as from 2023 to voluntarily release the treatment data stored in their electronic patient records to the research data centre or give their consent to make it available for research purposes.	Ongoing
2.2	***Drinking water database***	***BMG***
	We are reviewing the introduction of a central national drinking water database. We want to consolidate data from federal and state environment and health departments as well as from water supply companies and ensure open online access to this information.	Planned
2.2	***Piloting of nationally standardised electronic death certificates***	***BMG***
	This project is piloting the introduction of electronic death certificates in Germany. An electronic chain of communication is to be set up from GP surgeries to statistical offices, which prepare statistics on causes of deaths.	Ongoing
2.2	***"Digital innovations to improve patient-centred care in healthcare" funding area***	***BMG***
	Within the framework of the "Digital innovations to improve patient-centred care in healthcare" funding area, we are supporting projects developing strategies for better data use in research and healthcare provision.	Ongoing
2.2	***Facilitating secondary use of health data in the EU (Joint Action TEHDAS)***	***BMG***
	The aim of the European Joint Action "Towards the European Health Data Space" (JA TEHDAS) is to prepare governance models for the establishment of an EU health data space. This includes proposals for data quality, infrastructure and the creation of required capacities in EU member states.	Ongoing
Mobility Data space		
2.2	***Mobility data space***	***BMVi***
	Within the framework of the concerted action for mobility and with the support of the National Academy of Science and Engineering Technical Sciences (Acatech), we are creating a mobility data space for sovereign and differentiated data handling as the foundation of modern mobility, based on trust and European rules.	Ongoing

2.2	***Mobility data portal/National Access Point (NAP)***	***BMVi***
	With the mobility data marketplace and mCLOUD, two portals are being merged to form one central, effective and user-friendly access point for mobility data.	Ongoing
2.2	***"Digitalisation and artificial intelligence in mobility" action plan***	***BMVi***
	The "Digitalisation and artificial intelligence in mobility" action plan consolidates measures to design modern, clean, efficient, sustainable and affordable mobility. We aim to retain our international competitive strength by implementing this plan.	Ongoing
2.2	***mFUND funding programme***	***BMVi***
	We are supporting the development of innovative digital applications in the mobility sector through our mFUND initiative. mFUND forms an ecosystem for data-driven innovations in Mobility 4.0.	Ongoing
2.2	***Legal framework conditions for the provision of mobility data***	***BMVi***
	We want to continue defining and expanding the legal framework conditions for the provision of mobility data.	Ongoing
2.2	***Funding campaign for digital test fields in ports***	***BMVi***
	This funding campaign is designed to support the establishment of digital infrastructures at German sea ports and inland ports.	Planned
2.2	***Creation of a national data platform for the Maritime Safety and Security Centre (MSSC)***	***BMVi***
	In order to facilitate a smooth exchange of information, partners to the MSSC are to use a shared MSSC national data platform, e.g. to display conditions using data from various sources (such as weather, water current and track data) or detect anomalies.	Planned
2.2	***Roadmap for "Digital networking in public transport"***	***BMVi***
	The "Digital networking in public transport" roadmap was prepared in collaboration with various stakeholders and adopted on 21 June 2016. It is currently being updated with the stakeholders' assistance	Ongoing
Data space for agriculture, forestry and the timber industry		
2.2	***Review of platform use by the agricultural sector***	***BMEL***
	We are reviewing whether state-run digital data platforms can form the basis of a data space for agriculture and which technical and legal solutions there are for these types of platforms.	Ongoing

2.2	***"Greenhouse gas emissions" project – data products from inventories of emissions in agriculture and LULUCF***	***BMEL***
	This project calculates greenhouse gas emissions produced by agriculture and forestry at company level, as required for EU and international climate reporting.	Ongoing
2.2	***Purchase of renewable resources***	***BMEL***
	We are expanding both the data platforms on the cultivation and use of renewable resources in Germany and the directory of products and providers for the bioeconomy.	Ongoing
2.2	***"Databases for the identification of different types of wood" project***	***BMEL***
	In the "Databases for the identification of different types of wood" project, we will expand databases for the computer-assisted identification of solid wood, wood-based materials and paper products for the timber industry.	Ongoing
2.2	***Soil inventory – publication of data from agricultural soil inventory***	***BMEL***
	The soil survey conducted by the Thünen Institute is a national inventory of agricultural soil. It includes more than 3,000 soil samples which were taken to analyse the carbon content of the soil, among other things.	Planned
2.2	***Guidelines for shared use of agricultural data at EU level***	***BMEL***
	In close collaboration with the European Commission, we are working on drawing up rules and guidelines on the shared use of agricultural data at EU level.	Ongoing
2.2	***Potential of satellite remote sensing in the agricultural sector***	***BMEL/BMZ***
	Within the framework of our partnerships with developing countries and emerging markets, we will examine the extent to which the potential of satellite remote sensing can be tapped for agriculture and across different sectors.	Planned
2.2	***NRstat***	***BMEL***
	The collection and analysis of statistical data on the cultivation and processing of renewable resources facilitates continuous, annual reporting on cultivation and processing of these resources.	Ongoing

2.2	***"Smarte.Land.Regionen" model project***	***BMEL***
	Within the framework of the "Smarte.Land.Regionen" model project, seven German districts are receiving funding to optimise the digital transformation of public service provision in rural areas in structural, technological and social terms.	Ongoing
2.2	***RADAR research project***	***BMBF***
	The RADAR research project is developing a software system that can analyse large volumes of data in order to detect relevant signals, trends and technologies as well as revolutionary changes in the corporate environment in real time.	Ongoing
2.2	***ErUM-Data action plan (working title: "From big data to smart data: digitalisation of fundamental research in the natural sciences")***	***BMBF***
	This action plan focuses on creating links between relevant stakeholders and structures, systematic skills development, exchange and knowledge transfer to/from fundamental research in the natural sciences.	Ongoing
2.3 Stakeholders: data trustees and new forms of cooperation		
2.3	***Ideas contest for data trustee models***	***BMBF***
	The aim of this project is to promote a range of data trustee projects and initiatives using various systems of financial and non-financial incentives for data sharing.	Planned
2.3	***Personal Information Management Systems (PIMS)***	***BMWi***
	At national level, we are reviewing a regulation on "Personal Information Management Systems" (PIMS) that will make it easier for consumers to exercise their data protection rights.	Ongoing
2.3	***Data Governance Act – legal certainty and quality criteria for data trustees***	***BMWi***
	By creating a legal framework for the governance of data spaces, we are committed to establishing a system of accreditation or certification of trustees under the Data Governance Act.	Ongoing
2.3	***Funding research data centres***	***BMBF***
	We will continue expanding and supporting funding for scientific research data centres in collaboration with the federal states.	Ongoing

2.3	***Framework conditions for the collective exercising of interests***	***BMAS***
	We will review the framework conditions for collective exercising of interests, e.g. in the context of operational co-determination, and develop strategies accordingly.	Planned
2.3	***Data as a global public good with Africa and Asia***	***BMZ***
	We will trial data sharing as a global public good and common good with Africa and Asia (e.g. open training data for artificial intelligence in the field of local languages, geodata, etc.). By doing so, we aim to achieve global sustainable development goals more rapidly.	Planned
2.3	***Funding campaign for data trustee models***	***BMBF***
	The aim of the funding campaign for data trustee models is to promote innovative data trustee models. The funding is targeted at pilot projects, use cases and real laboratories for trialling and providing scientific support for data trustee models.	Planned
2.3	***Silicon Economy Logistics Ecosystem, SELE***	***BMVi***
	The SELE project is developing a federal and decentralised platform ecosystem as an open source service for the logistics sector with the aim of pushing ahead with digitalisation in goods transport.	Ongoing
2.4 Combating risks: reinforcing the interests of citizens in the data economy		
2.4	***Implementation of the EU directive on digital content ("paying with data")***	***BMJV***
	The EU directive 2019/770 on contractual aspects of the provision of digital content and services sets out a harmonisation of contractual conditions regarding digital products (such as e-books, mobile applications and social networks).	Ongoing
2.4	***Data-driven product and price differentiation***	***BMAS***
	Better research needs to be conducted on the distribution of data-driven product and price differentiations in private industry and their welfare and distribution effects. A research project will be established to develop existing expertise and review requirements for action.	Planned
2.4	***Requirements for training data***	***BMJV***
	We will examine whether discrimination based on algorithm-based decisions can be countered by establishing requirements for the training data used.	Planned

2.4	***Preventing people being discriminated against as a result of the analysis of aggregated/anonymous/synthetic data***	***BMFSFJ/ADS***
	We will review how discrimination against people resulting from the analysis of aggregated/anonymous/synthetic data can be prevented and to what extent effective security mechanisms can be developed in relevant legislation.	Planned
2.4	***"Digital Compass Plus" project***	***BMJV***
	The aim of the "Digital Compass Plus" project is to create and expand new digital compass locations at regional network points that provide information and opportunities for dialogue to improve senior citizens' quality of life, self-determination and participation through digitalisation.	Ongoing
2.4	***"Data Check for Smartphone Apps" project***	***BMJV***
	We are promoting the "Data Check for Smartphone Apps" consumer information project. The main aim of the project is to add an app testing platform with information on data protection and data security for consumers to the website mobilsicher.de.	Ongoing
2.4	***Data sovereignty and empowerment of consumers – data protection when using voice assistants (CheckMyVA)***	***BMJV***
	The aim of this project is to enhance the data sovereignty of users of voice assistants. For this purpose, a platform is to be created that helps users exercise their consumer rights.	Ongoing
III. Improving data skills and establishing a data culture		
3.1 Skilled society: informed and self-determined handling of data in all sections of society		
3.1	***National digital educational campaign***	***BMBF***
	The aim of the national digital educational campaign is to expand and consolidate teaching and learning provision on the key topics of digitalisation.	Planned
3.1	***Flagship initiative for secure digital rooms for education***	***BMBF***
	With our flagship initiative for secure digital rooms for education, we are promoting the development of open standards, infrastructures and governance models for user-focused, data protection-compliant exchange and the networking of digital teaching and learning platforms.	Ongoing

3.1	***National digital educational campaign***	***BMBF***
	As part of the national digital educational campaign, we will develop a data space for education that includes a skill data space. This skill data space will form part of the more comprehensive digital space for education.	Planned
3.1	***Educational platform for high-quality digital teaching content***	***BMBF***
	Step-by-step establishment of a platform for education that will facilitate networking between the federal states' existing systems with the goal of providing educational content across all educational sectors.	Planned
3.1	***INVITE innovation contest (digital platform for vocational further training)***	***BMBF***
	The aim of the INVITE innovation contest (digital platform for vocational further training) is to link up existing databases and platforms, promote platform-based innovations and develop AI-assisted teaching and learning provision, among other things.	Ongoing
3.1	***Creation of continuous long-term monitoring of data skills***	***BMBF***
	We will establish continuous and comprehensive long-term monitoring of the German population's data skills. For this purpose, the survey of data skills could be integrated into the National Educational Panel Study (NEPS) based at the Leibniz Institute for Educational Trajectories (LIfBi).	Planned
3.1	***Digital Germany monitoring***	***BMFSFJ***
	The project "Digital Germany – monitoring the German population's digital skills" will initiate a monitoring system in the third quarter of 2020, interlinking results of quantitative and qualitative studies and providing updated topic-specific findings on an annual basis.	Planned
3.1	***Commitment to greater consideration of data skills and supplement to indices***	***BMWi/BMBF***
	The aim of this initiative is to promote greater consideration of data skills in the International Computer and Information Literacy Study (ICILS) and the Programme for the International Assessment of Adult Competencies (PIAAC) and to add specific data skill indicators to the Digital Economy and Society Index (DESI).	Planned

3.1	***Digital further training in "data skills"***	***BMBF***
	Within the framework of the digital educational campaign currently being planned, and in collaboration with the German Adult Education Association (DVV), we are promoting the establishment of digital further training in "data skills" for the German population.	Ongoing
3.1	***Expansion of digital information services for further vocational training/development of a further training portal***	***BMAS***
	The Federal Employment Agency's existing wide range of on-line-based information services for basic and further vocational training, including KURSNET, berufenet, self-discovery tools and the free e-learning platform Lernbörse, are being further developed (among other things, via a central online access portal for further training).	Ongoing
3.1	***Roadmap for "Data skills and data culture"***	***BMBF***
	The aim of the roadmap is to develop a shared process for improving data skills in all areas of education. Various shareholders will take part in a number of workshops where they will draw up goals for improving data skills.	Planned
3.1	***Funding citizen research***	***BMBF***
	We are promoting citizen research with the goal of anchoring citizen-led science in the scientific system for the long term, promoting handling of data by citizens and improving access to research for more widespread knowledge.	Ongoing
3.1	***Self-determined action in digital, communication and information-based environments***	***BMBF***
	We intend to make another funding announcement for projects conducting research into essential skills for self-determined action in digital, communication and information-based environments.	Planned
3.1	***Global project Africa Cloud with the learning platform atingi***	***BMZ***
	atingi is the new digital learning platform of the Federal Ministry for Economic Co-operation and Development (BMZ). The platform enables people in the Global South to access high-quality digital learning content at any time and free of charge.	Ongoing

3.1	***innOsci – Forum für offene Innovationskultur***	***BMBF***
	innOsci is a platform for learning and dialogue and an experimental space for strategically opening up science and research and for creating a new and open innovation culture – especially with regard to data handling. innOsci prepares and tests approaches to solutions.	Ongoing
3.1	***"Architectures, institutions and rooms for the data society" innovation process***	***BMBF***
	The "New sources for new knowledge" mission of the Federal Ministry of Education and Research's High-Tech Strategy is to use data for empirical government action. We will systematically enhance the interoperability of government databases in particular for this purpose.	Planned
3.1	***"Human-technology-interaction for digital sovereignty" (DISO) funding measure***	***BMBF***
	The aim of the "Human-technology-interaction for digital sovereignty" funding measure is to make it easier for users to understand data generation and data use through new forms of interaction between people and technology.	Ongoing
3.1	***Artificial intelligence (AI) for everyone – FAIR Forward: AI training data as a global public good with Africa and Asia***	***BMZ***
	The German development and cooperation initiative "Artificial intelligence (AI) for everyone – FAIR Forward" actively involves the Global South. It is a global measure by the Federal Government and one of its objectives is to develop AI skills in Africa and Asia.	Ongoing
3.1	***Forum for privacy and self-determined living in the digital world***	***BMBF***
	Starting with technical, legal and other humanities-based approaches, Forum Privatheit (forum for privacy) has been working on promoting a sound, up-to-date, interdisciplinary understanding of the role of privacy since 2014.	Ongoing
3.1	***Platform for privacy***	***BMBF***
	Forum Privatheit (forum for privacy), which has become established as a sound voice on aspects of privacy and self-determination in the digital world, is supplemented by Plattform Privatheit (platform for privacy).	Planned

3.1	***Funding measure: "Agile research – self-assessment and digital self-determination"***	***BMBF***
	Funding is provided for research on and development of methods and technologies as well as analysis of social framework conditions for data disclosure in the context of self-assessment.	Ongoing
3.2 Improving data skills in education and vocational training		
3.2	***Updating basic and further training regulations***	***BMBF/BMWi***
	There are around 330 training regulations under the Vocational Training Act (BBiG)/Crafts Code (HwO) that are subject to a continuous process of updating and quality assurance. The new "digitalised world of work" element to standard job profiles will anchor a minimum standard for data skills in all dual apprenticeships in future.	Ongoing
3.2	***Teaching sustainable skills for data-based empirical work***	***BMBF***
	Students will learn skills relevant to data-based empirical work through expansion of the "AI Campus" initiative. Data literacy courses and teaching material are to be developed and made available to teachers and learners through this project.	Planned
3.2	***Doctoral programme for skills development in the field of data sciences***	***BMBF***
	The doctoral programme for skills development in the field of data sciences will promote open-topic projects by young researchers with a strong empirical focus linked to a specific discipline.	Planned
3.3 Demand for and provision of data skills in industry		
3.3	***SMEs Digital initiative***	***BMWi***
	The SMEs Digital initiative will enable small and medium-sized enterprises to participate in the data-driven industry. Centres of excellence located throughout Germany will help with expertise, demonstrations, networks for exchanging experiences and practical examples.	Planned
3.3	***"Go-Data" funding programme***	***BMWi***
	We want to support SMEs with the topics of data economy, data analysis and data-based business models through a new programme called "Go-Data".	Planned

3.3	***"Future centres" (AI) federal programme***	***BMAS***
	"Future centres" support SMEs and employees with the development and implementation of innovative approaches to independent learning and design in order to manage processes of major change.	Ongoing
3.3	***"Innovative SMEs: research on production and services" funding measure***	***BMBF***
	This funding measure will enable companies to develop new solutions for digitalisation and virtualisation of production and production systems (Industry 4.0) as well as product-based services and service systems.	Planned
3.3	***Establishment of educational support and guidance through company-internal mentors for further training***	***BMBF***
	This project will create sustainable educational support and guidance through company-internal mentors for further training, for example, through 200 company representatives in up to 100 enterprises	Planned
3.3	***Establishment of "Regional competence centres for work research"***	***BMBF***
	The "Regional competence centres for work research" should establish points of contact that examine the design potential for new technologies for the world of work and promote the transfer of research findings into company practice.	Planned
3.3	***Creation of a "toolbox" for more data skills in various areas of application at the Digital Summit***	***BMBF***
	We will fund the creation of a "toolbox" for more data skills in various areas of application, e.g. for companies and civil organisations. This will be made freely available.	Planned
3.4 Data skills in civil organisations		
3.4	***Civic Data Lab***	***BMFSFJ***
	With our Civic Data Lab, we are creating an integrated platform for data provision in non-profit sectors and those for the common good. Its support is based on providing relevant data and assistance with its collection, preparation and analysis.	Ongoing

3.4	***Promoting and providing non-financial support to civil organisations***	***BMI***
	The Federal Ministry of the Interior, Building and Community (BMI) will continue funding and supporting civil organisations that teach data skills to German citizens.	Ongoing
3.4	***"Securing the future of non-statutory welfare through digitalisation" funding programme***	***BMFSFJ***
	With this funding programme, we will support leading non-statutory welfare associations in utilising the potential of digitalisation and in developing and trialling innovative solutions for social work.	Ongoing
3.4	***"Promoting digital sovereignty of senior citizens with AI technologies" project***	***BMFSFJ***
	The service centre "Digitalisation and education for senior citizens" run by the Federal Association of Senior Citizens' Organisations (BAGSO) is conducting the "Promoting digital sovereignty of senior citizens with AI technologies" project up until the end of 2021 to familiarise senior citizens with AI technologies.	Ongoing
3.4	***Developing tools and services for augmented science journalism***	***BMBF***
	The Science Media Center Germany will consider how science journalism can continue providing an overview of research and scientific publications in future. The aim here is to develop collaborative digital tools, among other things.	Ongoing
IV. Making the Federal Government a world leader in data use		
4.1 Sustainable improvement of data infrastructure in federal authorities		
4.1	***Data atlas of federal administration***	***BMI/BMF***
	We will develop a "Data atlas of federal administration". In the first stage, the data stocks of federal administration will be analysed and reviewed to determine whether they are accurate, up-to-date or redundant and a strategy will be drawn up on how these data stocks should be presented.	Planned
4.1	***Shared internal data pool for federal authorities***	***AA/BMI/ BMVg/ BKAmt***
	We will create a shared internal data pool for federal authorities in which authorities can compile and exchange relevant data in a universal, standardised format for data-based government action.	Planned

4.1	***The Federal Government's Bundescloud – open source software development platform***	***BMI***
	An open source software (OSS)-based development platform, forming part of the Federal Government's Bundescloud network, will provide stakeholders from public administration, industry and science with the necessary tools for standardised and cooperative application development.	Planned
4.1	***"AI in public administration" competence centre***	***BMI/BMF***
	By establishing a competence centre for "AI in public administration" we will consolidate skills in AI and make this available centrally to federal administration. At the same time, this competence centre will serve as an expert point of contact for industry.	Planned
4.1	***Centre for digital sovereignty***	***BMI***
	Establishing organisational foundations in the short term will ensure long-term availability of alternative open source applications. We will set up an office for this purpose in federal administration (working title "Centre for digital sovereignty").	Planned
4.1	***Strategic dependency analysis of databases and assessment for public administration***	***BMI***
	This study is analysing the existing data infrastructures (focussing on database systems) to identify dependencies and their impact. Based on its findings, we are examining any necessary adjustments and further developments.	Ongoing
4.1	***Interlinking and expanding effective data infrastructures***	***All federal ministries***
	We will push ahead with the networking and expansion of effective data infrastructures through targeted cooperation with the federal states.	Ongoing
4.1	***PLAIN platform***	***AA***
	We are using the "PLAIN" platform to prepare and curate internationally high-quality data on foreign policy-related subjects and make this data available to the Federal Government.	Ongoing

4.1	***PREVIEW data and analysis platform***	***AA***
	PREVIEW, the data and analysis platform for early recognition of crises and information management, will help make conflicts and other trends visible, enable crisis situations to be identified in their early stages and provide data-based support for the Federal Government's foreign policy actions.	Ongoing
4.1	***AI-driven forecast models for early recognition of crisis situations***	***AA***
	Using the United Nations and World Bank Group system, we will continue working intensively on AI-driven forecast models and innovative approaches to using large data records in the context of foreign policy, especially in early recognition of crisis situations.	Planned
4.1	***The Federal Government's crisis prevention information system (KVInfoSysBund)***	***BMVg***
	Tackling crises within the framework of national risk and crisis management for the protection of German nationals abroad (NatRKM) requires a shared, mobile federal crisis prevention information system (KVInfoSysBund).	Planned
4.1	***Provision of a GIS-based information and planning portal (GIS planning portal)***	***BMVI***
	The aim of the GIS planning portal is to present restructured, harmonised data provision in one place for national network documentation, network planning and network expansion of public telecommunication networks.	Ongoing
4.1	***The Federal Government's Bundescloud for public administration***	***BMI***
	The project to establish the Federal Government's Bundescloud for public administration is defining and implementing multi-level shared and open standards and interfaces for the development and operation of cloud-based infrastructures.	Ongoing
4.1	***Standard platform for analysing publicly accessible data***	***AA***
	The system to be established for analysing publicly available data from social and digital media aims to assist with the assessment of discourse in, among other things, social networks and digital media. It can also support strategic communication by the Federal Government in the analysis of third-party narratives.	Planned

4.2 Publicly funded data records and open government data		
4.2	***Open data strategy***	***BMI***
	We are creating an open data strategy that will be introduced to the Federal Cabinet in the first half of 2021. The aim of this strategy is to provide open data on public administration and improve its potential for reuse for various purposes.	Ongoing
4.2	***Reinforcing the Competence Centre for Open Data (CCOD)***	***BMI***
	A culture of open data is to be established and consolidated in public authorities. To achieve this, the Competence Centre for Open Data (CCOD) will be supported as the central, pro-active advice centre for the Federal Government, comparable federal state agencies and relevant community stakeholders.	Planned
4.2	***Second Open Data Act***	***BMWi/BMI***
	Within this legislative period, we will introduce a new act on data use to enforce the EU directive on open data and the PSI directive and propose a second open data act to expand framework conditions for the provision of open federal administration data and fundamentally improve use of public-sector data for industry, science and civil society.	Ongoing
4.2	***FAIR principles for high-value data records***	***BMWi***
	We are committed to providing high-value data records for compliance with FAIR principles and want to expand the provision of metadata, in particular, for the purpose of better searchability.	Planned
4.2	***The Federal Government's legal information portal***	***BMJV***
	The aim of the Federal Government's legal information portal is to provide standardised online access to freely available legal information provided by the Federal Government (federal laws, administrative regulations and case law).	Ongoing
4.2	***"IT support for open data" initiative***	***BMI***
	Through the "IT support for open data" initiative, we will provide federal administration with needs-based IT solutions for the provision of open data through, among other things, the expansion of the GovData platform.	Ongoing

4.2	***Greater transparency through evaluation reports***	***BMWi, all ministries***
	For the purpose of transparency and scientific traceability, evaluation reports and, if possible, the data on which they are based are to be made accessible to the public. The BMWi is already taking a leading role in this respect.	Ongoing
4.2	***Dashboard Deutschland***	***BMI***
	The Federal Statistical Office is establishing a data portal which takes into account the dynamic information requirements of users. The dashboard provides access to the latest high frequency data that is not dependent on location, time or end device.	Ongoing
4.2	***Creation and operation of statistics on contract awards (VgS)***	***BMWi***
	The system of federal electronic statistics on contract awards (VgS), which began operating on 1 October 2020, will, in future, provide the first data on awarded public contracts via the Federal Statistical Office's GENESIS database.	Ongoing
4.2	***Making film heritage data accessible and simplifying film archiving***	***BKM***
	As Germany's central film archives, the Federal Archives are currently updating their film software BASYS 3-Film, which is used to manage more than 500,000 (analogue and digital) stock items.	Ongoing
4.2	***Copernicus programme***	***BMVI***
	Copernicus supports environmental, civil and population protection measures and provides reliable access to Earth observation information. The Copernicus information services are mainly based on satellite observations.	Ongoing
4.2	***Making the Geoportal.de more attractive. Identifying relevant geodata and making it easily accessible.***	***BMI***
	The Federal Agency for Cartography and Geodesy's Geoportal.de is the central, online point of access to the national geodata of Spatial Data Infrastructure Germany (GDI-DE). In future, it should receive support from a data editing department.	Ongoing

4.2	***Best practice in legislation around data provision (Geological Data Act)***	***BMWi***
	A comprehensive obligation will be embedded in the Geological Data Act to safeguard geological data for the purpose of the maintenance and availability of this data for all existing and future geological actions of the Federal Government and the federal states.	Completed
4.2	***Geoportal of the Federal Institute for Geosciences and Natural Resources (BGR)***	***BMWi***
	Setting up a web portal for interdisciplinary research using the various data stocks of the Federal Institute for Geosciences and Natural Resources (BGR). The portal will have an integrated map viewer so that maps and data can be used directly or offer access to specific applications.	Ongoing
4.2	***BoreholeML2INSPIRE – INSPIRE-compliant borehole data provision based on BoreholeML***	***BMWi***
	The aim of the BoreholeML2INSPIRE project is to transform participating federal geological services in line with the INSPIRE model for geology in accordance with Directive 2007/2/EC.	Ongoing
4.2	***Procuring software for storing and visualising 3D underground models via the Internet***	***BMWi***
	The 3D underground models created by the BGR are to be stored in a central database and presented online so that internal and external stakeholders can use the models interactively.	Ongoing
4.2	***Agricultural data platform***	***BMEL***
	Within the framework of a new governmental agricultural data platform, data that is required to meet statutory conditions will be collected, generated and provided directly by governmental bodies.	Planned
4.2	***Earth Observation for Sustainable Development (EO4SD) programme***	***BMZ***
	Within the framework of the Earth Observation for Sustainable Development (EO4SD) programme, we want to improve broad public use of the European Space Agency's free satellite images and services.	Planned

4.2	***Platform with ICT as a global public good***	***BMZ***
	We are developing an international platform with standardised and specified ICT components as a global public good. We are also setting up a working group to prepare the core standards that will apply to all components.	Ongoing
4.2	***"Architectures, institutions and rooms for the data society" innovation process***	***BMBF***
	The aim here is to use existing data for empirical government action. Workshops are to be held in which the relevant departments are able to flexibly tackle specific issues (e.g. educational data such as reports, certificates, etc.).	
4.2	***Agricultural and nutritional research data management***	***BMEL***
	Guidelines for research data (data policies) are developed within the framework of this project, agreed upon with the Federal Ministry of Food and Agriculture (BMEL) and implemented. More pilot projects are to follow.	Ongoing
4.2	***"AI" application campus***	***BMI***
	The Federal Statistical Office is pushing ahead with increasing the use of AI as it offers new opportunities for data provision, preparation and assessment. A new type of "AI" application campus will be established as a "start-up" to bring in the necessary expertise and develop applications with the aid of AI in network-based collaboration.	Planned
4.2	***"European Metrology Cloud" for the digital transformation of quality infrastructure***	***BMWi***
	The National Metrology Institute of Germany (PTB) is funding the establishment of a "European Metrology Cloud" as a GAIA-X-compatible digital infrastructure. This is founded on a trustworthy platform in each member state that supports regulatory processes and will, in future, form a central point of contact for all those involved.	Ongoing
4.2	***Research and consultation on data quality, reference data and artificial intelligence (AI) in medical engineering***	***BMWi***
	The aim of this project by the National Metrology Institute of Germany (PTB) is to develop methods for assessing reference data and algorithms for applications in medical engineering with the aid of AI.	Planned

4.2	***ZooNotify: development of a query tool for microbiological and epidemiological data on zoonotic agents in the food chain***	***BMEL***
	The interactive, web-based data query tool ZooNotify is being developed as the central source of data on zoonotic agents and their microbiological properties, including resistance to antibiotics, in the food chain at the Federal Institute for Risk Assessment (BfR).	Ongoing
4.2	***Establishing a virtual reading room***	***BKM***
	With the establishment of a virtual reading room, the Federal Archives are aiming to make their services digitally available to users. As far as possible, all functions are to be made possible online and can therefore be used anywhere and anytime.	Ongoing
4.2	***BASYS 3 eGov***	***BKM***
	BASYS 3 eGov is the application used by agencies, usually authorities, for researching and ordering documents in the interim and end archives in the Federal Government's information network (IVBB).	Ongoing
4.2	***BASYS 3 invenio***	***BKM***
	invenio is the application used within and beyond the Federal Archives for research into indexing information and for ordering archived material. The application is used by employees as well as external users of archived material.	Ongoing
4.2	***BASYS 3 Akte***	***BKM***
	The purpose of the Federal Archives' specialist archive information system, which currently comprises around 20 million data records, is to manage, assess and index archived material. This project is professionally and technically upgrading and replacing the current software, BASYS 2 Akte.	Ongoing
4.2	***Geoinformation for civil protection***	***BMI***
	The Federal Office of Civil Protection and Disaster Assistance (BBK) is enabling the Federal Government to access the potential of geo-information technology for civil protection. Its aim is to provide information for emergency planning, risk management and crisis management by the Federal Government.	Ongoing

4.2	***Coordination with open communities on the use of open licences for geodata***	***BMI***
	The geodata of public administration is increasingly provided as open data. The Federal Agency for Cartography and Geodesy (BKG) aims to identify obstacles and propose solutions for this in collaboration with representatives of open communities.	Planned
4.2	***Development of a machine-readable interface for data on approved pesticides***	***BMEL***
	The aim of this project is to establish a generally accessible, machine-readable and searchable database of approved pesticides that provides access to application-relevant data on approved pesticides through an interface (API).	Ongoing
4.2	***Amendment to the Law on the Statistics of Public Finance and Public Service Personnel (FPStatG)***	***BMF***
	EU requirements and supply obligations form the background to amending the FPStatG to correct over and under-reporting as well as clarify definitions.	Ongoing
4.2	***Coding da Vinci – the cultural hackathon***	***BKM***
	The cultural hackathon Coding da Vinci is a unique format for an event in Germany that makes the creative potential of digital cultural assets more visible and effective.	Ongoing
4.2	***Improving the quality of metadata and processing in the German Digital Library (DDB)***	***BKM***
	The quality of metadata is crucial to the functioning of a comprehensive service such as that of the German Digital Library (DDB). The aim of this project is therefore to enhance the quality of metadata in terms of its comprehensiveness, accuracy and logical consistency.	Ongoing
4.2	***User-oriented restructuring of the German Digital Library (DDB)***	***BKM***
	The “User-oriented restructuring of the portal of the German Digital Library (DDB)” project aims to design the user experience of all user groups so that it is intuitive and tailored to different needs.	Ongoing
4.2	***Data networking and analysis with Culturegraph***	***BKM***
	Culturegraph is a platform on which metadata from library networks in German-speaking regions and the German National Library (DNB) is compiled for services and projects relating to all aspects of data analysis and data networking.	Ongoing

4.2	***Provision of data and content for science, research, culture and the creative industry***	***BKM***
	The German National Library (DNB) offers access to its stock through comprehensive metadata packages (> 30 million data records) and digital collections (e.g. > 3 million freely accessible items), which are available for free reuse via the DNB website.	Ongoing
4.2	***Indexing machine: automated enrichment of metadata***	***BKM***
	The aim here is to use a modular AI-based system for the purpose of automated content indexing. In future, the generated terms will be made available as open data via the DNB's metadata services (incl. Datenshop and DNBLab).	Ongoing
4.2	***Opening the Integrated Authority File (GND) for all cultural heritage establishments and humanities research***	***BKM***
	Opening the Integrated Authority File (GND), the backbone of a semantic data network for culture and science, encourages the establishment of interdisciplinary structures, which will make standard data available to all users in a data ecosystem.	Ongoing
4.2	***Catalogue enrichment 1945–2012: digitalisation and provision of 2.7 million tables of contents from books***	***BKM***
	This major project is digitalising and enriching the tables of contents of all books from German National Library (DNB) stock dating from 1945 to 2012 with text recognition, and linking them with accompanying title data in the online catalogue.	Ongoing
4.2	***Collaboration between the German National Library and libraries of the top 9 technical universities (TU9 libraries)***	***BKM***
	The German National Library (DNB) is collaborating with the libraries at the top 9 technical universities (TU9 libraries). The purpose of this collaboration is shared networking and, in future, the provision of infrastructures, tools and services in content indexing and automated indexing processes.	Ongoing
4.2	***Licensing service for out-of-commerce works (VW-LiS)***	***BKM***
	The licensing service (VW-LiS) of the German National Library (DNB) has established itself as a national single access point for licensing out-of-commerce works to support the digitalisation projects of German cultural heritage institutions.	Ongoing

4.2	***Metadata for everyone: simplifying and standardising access to the title data and standard data of the German National Library (DNB)***	***BKM***
	Since 2015, the German National Library has made all data available free of charge and for free reuse via online interfaces (OAI, SRU) under the CCO 1.0 licence. Data referencing will be further simplified and standardised within the framework of this project.	Ongoing
4.3 Better data use for more efficient and more citizen-friendly administrative practices		
4.3	***Inter-ministerial working group on data policy***	***BKAmt, all federal ministries***
	In order to improve the coordination of data policy, the Federal Government will set up an inter-ministerial working group on "Data policy" to be led by the Federal Chancellery. This working group will discuss data policy issues.	Planned
4.3	***Updating registers***	***BMI***
	Updated registers create the basis on which public authorities can exchange the documents they need to perform their administrative services directly between themselves – where legally permitted.	Ongoing
4.3	***Data cockpit***	***BMI***
	The aim of the data cockpit is to provide digital and therefore more user-friendly transparency on the data exchange between public authorities. The data cockpit will also help to increase acceptance for this type of data exchange, e.g. for online applications. We will use a data cockpit as part of register updating to provide transparency on the data exchange between public authorities.	Ongoing
4.3	***Establishment of data partnerships to fulfil the government obligation to provide public services***	***BMEL/BMU***
	By establishing data partnerships we will be able to fulfil our government obligation to provide public services in a more targeted manner. For this purpose, we will examine which data collected and generated by non-public offices is relevant to our obligation to provide public services and to which level of data quality. We will also consider the extent to which secure access to this machine-readable data needs to be created for public offices.	Planned
4.3	***Public administration data information platform (VIP)***	***BMI***
	In this project, we will perform an inventory of public data stocks and create as comprehensive an overview as possible on the public administration data information platform (VIP).	Ongoing

4.3	***Base register for company master data***	***BMWi***
	The aim of this project is to create a base register for company master data in connection with a standardised business identification number. Company reporting requirements can be significantly reduced as a result.	Ongoing
4.3	***Data transparency office at the Federal Statistical Office***	***BMI***
	We will set up a data transparency office at the Federal Statistical Office that will identify inconsistencies in data records and highlight possible actions through the application of internationally recognised data standards and methods.	Planned
4.3	***Tax analysis system (StAS)***	***BMF***
	With the Federalism Reform II in 2009, federal states were required to make tax enforcement data available to the Federal Government in pseudonymised form. New methods for handling, assessing and presenting information are to be prepared and applied on the basis of this data.	Ongoing
4.3	***Digital feasibility check***	***BMI***
	We will gradually equip all legislative experts with the ability to enact digital-compatible laws. In the meantime, we will perform digital feasibility checks on new draft laws.	Planned
4.3	***Improving regulation through intelligent data use***	***BMJV/BMBF/all federal ministries and BKM***
	Within the framework of new regulatory projects, relevant ministries will check which data is relevant to which regulatory project, whether this data is available or can be collected and what results can be derived from this data.	Planned
4.3	***Digital overview of pensions***	***BMAS***
	Citizens should have access at any time to information on their individual entitlements in statutory, company and private pension schemes. For this purpose, we will develop a digital overview of pensions, starting in 2021, which we plan to introduce via a portal at the end of 2024.	Planned

4.3	***Preliminary study on automation of information provision***	***BMAS***
	In the context of employer reporting obligations, employers often request information from various social insurance providers. Supporting AI systems will be used to generate automated responses and offer standardised information on similar cases. This is the focus of a preliminary study.	Planned
4.3	***Initiative for a shared European identity ecosystem***	***BMI/BMWi***
	We want to see the EU Commission adopt and further develop the initiative for a shared European identity ecosystem that we established within the framework of Germany's Presidency of the Council of the European Union.	Ongoing
4.3	***DataCipation project***	***BMZ***
	The DataCipation project is advising the African Union (AU) on establishing an interactive information platform for improving dialogue between citizens and political representatives of the AU and its member states.	Ongoing
4.3	***Research and consultation on crisis management for the COVID-19 pandemic***	***BMBF***
	This project serves to enhance expertise for evidence-based policy with regard to the coronavirus pandemic. For this purpose, the project team is working on establishing new interfaces between science and politics to enhance rapid crisis management responses across different disciplines and institutions.	Ongoing
4.3	***"Data4Germany" (working title)***	***BMBF, BKAmt***
	The Federal Ministry of Education and Research (BMBF) is planning to develop and implement a joint initiative between experts and stakeholders to promote data skills, collaborative innovation formats and political/social data literacy/AI (in the digital civil society, e.g. organising the #WirVSVirus hackathon).	Ongoing
4.3	***Tax identification number as standardised identification***	***BMI***
	With the cross-register identification of individuals, personal data will only need to be recorded once and therefore data relating to citizens and companies can be used more efficiently. Their tax identification number will serve as their standardised identification.	Ongoing

4.3	***Business identification number in accordance with Section 139c of the German Fiscal Code (AO)***	***BMF***
	Data records can be linked by identification numbers. A business identification number is to be issued for each economically active natural person, legal person or association of individuals based on tax office data.	Ongoing
4.3	***Health information system (GINSY)***	***BMI***
	The health information system for Germany aims to improve the availability of health data in Germany. A minimum viable product (MVP) is to cover initial information requirements of COVID-19 decision-makers by September 2020 at the latest.	Ongoing
4.4 Instruments for improving data skills in the federal authorities		
4.4	***Status analysis of data skills and improving data skills***	***BKAmt, all federal ministries***
	All the highest federal authorities are to conduct a status analysis of measures to improve data skills. The focus here should be on existing structures. These measures are to be scrutinised and if necessary, further developed in the chosen direction.	Planned
4.4	***Chief data scientist for the Federal Chancellery and all federal ministries***	***BKAmt, all federal ministries***
	The aim here is for all federal ministries to establish their own position for chief data scientist or a similar role (e.g. chief data officer). The chief data scientist would work with a core team of data analysts.	Planned
4.4	***Establishment of data laboratories in the Federal Chancellery and at the federal ministries***	***AA/BMI/BMBF/BMU/BMVg/BMZ/BKAmt***
	We want all federal ministries and/or their downstream authorities to establish their own internal data laboratories. AA, BMBF, BMU, BMVg and BMZ are the leading authorities here.	Planned

4.4	***Data centre and data science competence centres***	***AA***
	The Federal Foreign Office (AA) is reinforcing its foreign policy data work by consolidating its data work expertise in competence centres. These competence centres, both existing and currently being set up, will be expanded and staffed with trained personnel as a priority.	Ongoing
4.4	***Data laboratory at the BMBF: evidence-based policy-making on education, research and innovation***	***BMBF***
	The Federal Ministry of Education and Research (BMBF) is to establish a data laboratory to support evidence-based policy-making on education, research and innovation. It is to be an independent specialist competence centre that will consolidate expertise on data collection and analysis as well as on the systematic evaluation of political innovation measures.	Planned
4.4	***Establishment and operation of an "Application laboratory for artificial intelligence and big data"***	***BMU***
	The aim of the "Application laboratory for AI and big data" is to improve access to the heterogeneous stock of environmental and satellite remote sensing data for specialist applications for environmental policy and to environmental administration by the Federal Government and federal states. It is also to develop application prototypes.	Planned
4.4	***Data governance of the Federal Ministry of Defence***	***BMVg***
	The Federal Ministry of Defence (BMVg) is establishing its own system of data governance, which will strengthen value-based handling of data in the organisation and facilitate a data-centred corporate culture. The strategic guidelines for this are set out in the BMVg's Data Strategy.	Ongoing
4.4	***Federal Ministry for Economic Co-operation and Development (BMZ) – digilab***	***BMZ***
	Through its digilab, the Federal Ministry for Economic Co-operation and Development (BMZ) wants to make German development cooperation more digital and efficient in the context of data use, among other things. The objective here is to use agile methods like design thinking to create a more effective, efficient and modern structure for development cooperation.	Ongoing

4.4	***Research data centres at the federal ministries***	***BMAS, BMEL, BMG, BMU and BMZ, all federal ministries***
	The federal ministries will set up or expand research data centres, either themselves or in downstream institutions, if this seems necessary in the context of expertise. These will be the points of contact for the use of (non-categorised) data. The leading authorities here (BMAS, BMEL, BMG, BMU and BMZ) will agree on setting standards.	Ongoing
4.4	***Expansion of the research data centre of the Federal Institute for Occupational Safety and Health (BAuA)***	***BMAS***
	The research data centre of the Federal Institute for Occupational Safety and Health (BAuA) is to be expanded to improve access to data on occupational health and humane working environments collected through scientific work.	Ongoing
4.4	***Data Service Centre of the German society for international cooperation (GIZ)***	***BMZ***
	The Data Service Center of GIZ, the German society for international cooperation, is to be established as a contact for data use and enable data-based cooperation and evidence-based evaluation of political measures.	Planned
4.4	***BAköV digital academy***	***BMI***
	The planned digital academy of the Federal Academy of Public Administration (BAköV) is to combine all its further training courses available in support of digitalisation process. The digital academy will function as an advice and support centre for federal administration organisations.	Ongoing
4.4	***Creation of a data skills map***	***open***
	We will create a data skills map that focuses on the federal ministries' human resources in the field of data science (data management, etc.). Based on this map, the federal ministries' human resources management should facilitate targeted data use according to specialist skills.	Planned

Glossary of terms used in the Data Strategy

The aim of this glossary is to provide easy-to-understand explanations of the terms used in the Data Strategy.

Term	*Definition*
Addictive designs	Structuring a service and web design in a way that influences and restricts the behavioural freedom of its users in terms of how they use (and stop using) that service and encourage the users to perform actions that they would not have performed otherwise, primarily through mechanisms that cause addictive behaviour.
Aggregated data	Aggregated data is when some or all individual case data is gathered and expressed in summary form or in other forms of aggregation.
Algorithm	An algorithm is a (mathematical) set of instructions for the step-by-step completion of a task.
Anonymisation	Anonymisation is the process in which data is changed so that it no longer relates to an identified or identifiable individual or in which → personal data is prepared in such a way that the data subject cannot be identified or can only be identified with a disproportionate amount of effort or by illegal means.
API	An application programming interface (API) is an interface that facilitates access to a technical system (e.g. software or a device) and determines the conditions under which the system can be used. It normally enables the standardised exchange of various data and information between systems.
Artificial intelligence	There is no universal definition of artificial intelligence (AI). AI refers to computer models used in mathematics and information technology that imitate and formally describe aspects of human intelligence (e.g. neurons in the brain and their connections). They are used to solve real application problems, e.g. text, image or language recognition.
Bias	A bias is a systematic distortion in the decision-making patterns of algorithmic systems that may be based on the depiction of social prejudices, inadequate representation of certain groups or inconsiderate use of statistical data.
Big Data	Big data is very large and complex volumes of data, often from heterogeneous data sources.
Chief Data Officer	The chief data officer is responsible for data management (e.g. creating and using data) in a company, authority or other entity. The development and implementation of internal → data governance forms part of data management.

Chief data scientist	The chief data scientist is responsible for connecting and assessing an organisation's data sources. His/her main duty is to analyse internal and external data, create → dashboards and other visualisations. Generally, s/he can also be responsible for data management, but this is not a priority. The chief data scientist works independently within an organisation. S/he works closely with the → open data officer and data protection officer.
Cloud computing	Cloud computing is the dynamic provision of IT infrastructure services via the Internet or cloud. The infrastructure comprises hardware and software resources, such as servers, memory, network components and application software.
CPU	The central processing unit (CPU) is the main computer processor. It performs calculations and controls data processing.
Critical infrastructures	Critical infrastructures are understood as establishments, facilities or parts thereof that are vital to the functioning of the community. If these are restricted or disrupted, this leads to considerable supply shortages or risks to public safety. Examples of critical infrastructures include the sectors of energy, information technology, telecommunications, transport, healthcare, water, food as well as finance and insurance.
Dark patterns	A design used for websites, digital services and user interfaces that trick or manipulate users through certain conditions or circumstances to perform a certain action – such as a purchase – or make a decision that they would not have performed or made otherwise.
Dashboard	A dashboard comprises an arrangement of several graphics and other visualisations designed to present relevant information in a compact format. Dashboards facilitate a multi-layered presentation of information in which the user can navigate interactively between individual layers.
Data	There is no standard definition of data. Data is described as, among other things, the individual values within a data record. Data is understood in literature as any type of element that can be interpreted by a computer. In principle, the term data covers any states or reproductions of facts that are stored electronically or non-electronically (surveys, calculations, measurements, texts). In this strategy, the term data is used primarily in the sense of digital data.
Data access	Data access describes the action a data user makes when they retrieve or process data that was provided by a data manager, data producer or data mediator and may be subject to specific technical, legal or organisational requirements. Data access does not necessarily mean that the data is transferred or downloaded from its current storage location.

Data cockpit	The aim of the data cockpit is to provide digital and therefore more user-friendly transparency on the data exchange between public authorities. The data cockpit will also help to increase acceptance for this type of data exchange, e.g. for online applications.
Data controllers	Data controllers are organisations or individuals authorised by laws or regulations to make decisions regarding granting access to or permitting shared use of data under their control, regardless of whether this data is collected, stored, processed or distributed by this organisation or individual or by a representative acting on their behalf.
Data economy	The term data economy is understood as a form of industry in which institutions, value creation chains, dynamics of competition and consumer behaviour on markets change through the growing use of digital technologies. The relationships between market participants (and/or institutions) are becoming increasingly data-based. This development is associated with the establishment of diverse platforms, data partnerships, data spaces and new value creation networks. In the style of the social market economy, there is also talk of a social data economy which focuses on fair social participation in creating value from data.
Data ecosystems	Data ecosystems describe the various stakeholders, services and applications (software) that use and share data for economic or social purposes. These include stakeholders from industry, science, civil society and government. The term data ecosystem is distinct from the traditional ecosystem in the context of natural sciences. In this sense, the data ecosystem is a data-based system with an innovative, technical, organisational and regulatory structure.
Data governance	Data governance describes the framework conditions (laws, directives, standards, internal regulations) and organisational structures relating to the management (administration and use) of data in public authorities, companies and other entities.
Data infrastructure	Data infrastructure can be understood as an interconnected technical infrastructure consisting of components and services that facilitates access to data as well as its storage, exchange and use.
Data intermediaries	Data intermediaries are institutions which link up access to data with the use of data by other users and act as mediators. Data intermediaries are the top category – they include institutions with trustee functions or marketplace functions as well as other methods of data mediation.
Data marketplaces	Data marketplaces are centralised or local systems that connect data supply with data demand. These marketplaces implement monetisation mechanisms, for example in the form of subscription models (in particular, access price plus volume-dependent pricing).

Data mining	Data mining is the application of statistical processes to data available in digital form, such as texts, audio recordings or images, in order to assess, extract new information and identify (new) trends from this data.
Data monopolies	Market-dominant position of companies resulting from their de facto right of disposal over very large volumes of data, primarily from digital business models. Monopolisation trends arise from economies of scale and network effects.
Data pool	Data pools are establishments used by various partners (e.g. companies) to manage their data for the purpose of shared use. Data pools can be central (= data is stored in a central location) or local (= data remains with the data provider).
Data portability	Data portability describes the option of maintaining data in a conventional, structured, → machine-readable and interoperable format or transferring this data directly to a third party.
Data protection	Data protection concerns the protection of citizens' basic rights and freedoms, in particular relating to their informational self-determination and private sphere in the context of data processing.
Data protection through technical design	This term describes the implementation of data protection principles through technical design. The basic idea here is that data protection is most effectively implemented if it is already technically integrated as from the formulation of the data processing procedure. Effective personal data protection is ensured by taking technical and organisational measures early on in the development stage.
Data quality	Data quality describes the quality of data. Depending on what the data is to be used for, high data quality is necessary if, for example, it is to be used for scientific purposes in medicine. Depending on how the data is to be applied, the necessary transparency and compliance with standards of data collection, comprehensiveness, representativeness, validity and long-term availability are also required to ensure the quality of → information structures and services.
Data quality metrics	The quality of data can be measured using various indicators (metrics). For example, → depersonalisation combines granular data into categories. This type of aggregation can be presented and measured mathematically. The extent to which these and similar interventions occur can be depicted in data quality metrics, which are part of → metadata.
Data record	A data record is a compilation of data. There are various types of data, including texts, sound recordings, images. This may be curated or available in raw form.

Data space	A data space is a shared, trustworthy space for data transactions. A data space is based on shared standards (or values, technologies, interfaces) permitting or promoting data transactions, for example.
Data science	Data science is a new scientific field that focuses on the application of new statistical procedures for working with data and information. Data is analysed here by → machine learning processes (including → artificial intelligence).
Data scientist	Data scientists analyse data so that they can derive patterns from and make predictions based on that data. They recognise the potential of various data sources in order to develop corresponding analysis procedures and data management strategies. Their necessary expertise in data analysis and integration, data management and quality, knowledge management and information provision requires skills in mathematics, statistics and information technology as well as specialist and general business skills.
Data security	Data security describes the technical and organisational measures required to ensure that the level of protection provided is appropriate to the particular requirement for protection.
Data sharing	Various stakeholders (e.g. → data trustees) forward data to third parties or use this data together on the basis of commercial or non-commercial agreements or on the basis of mandatory statutory provisions.
Data skills	Data skills or data literacy can be described as the ability to handle data in a proficient and value-driven manner in technical, economic, ethical and legal terms. Data skills are vital to and form the foundation of the digitalisation process.
Data sovereignty	The term data sovereignty extends beyond the bounds of data protection law and focuses on the autonomy of the data subjects and also of companies and their data, who/which, with technical resources and their own skills, are able to act independently and with self-determination in the data world.
Data subject	The data subject is an individual who is identified in data or identifiable from data.
Data trustees	A data trustee can be tasked with developing and implementing standardised access to data for approved agencies. Data trustees also function as advisers for users and, depending on their specialist field, offer various services such as data management for the benefit of users. Data trustees may also assert interests and rights under data protection law for a variety of consumers. They fall under the generic term of → data intermediaries.

Deep fakes	Technology that uses artificial intelligence and machine learning algorithms to create images, sound recordings or videos that are deceptively realistic but are in fact a digital fake. The deep part is derived from the sub-category of machine learning called deep learning.
Depersonalisation	Depersonalisation covers various methods and techniques for removing personal references (or references to other data subjects like companies) from data or minimising its identifiability. Depersonalisation is the generic term for → anonymisation and → pseudonymisation.
Digital ecosystem	A digital ecosystem is understood as a network of developers, providers, civil organisations and users of digital products and services in connection with transparency, broad access and lively exchange.
Digital infrastructures	Digital infrastructures are technically and organisationally networked hardware that facilitate data collection, transfer and processing. Data transmission is enabled through shared technical and/or semantic norms and standards.
Digital sovereignty	Digital sovereignty describes the ability of individuals and society to shape the digital transformation – in terms of hardware, software, services and skills – with self-determination. Having digital sovereignty means being able to decide the areas in which independence is desirable or necessary within the scope of applicable law.
Digitalisation	Digitalisation describes the social process of introducing and using digital technologies.
Discrimination	Discrimination is unfair treatment based on categorial, i.e. supposedly clear and selective, differences of individuals that puts these individuals at a disadvantage.
Dynamic data	Dynamic data is data in digital form that is updated frequently or in real time, particularly if it is volatile or quickly becomes obsolete; data generated by sensors is usually regarded as dynamic data.
Edge computing	Edge computing describes local data processing "on the edges" (e.g. on connected end devices) of a computer network. For the main part, data is processed where it is created. Edge computing is of particular relevance to real-time applications with a reaction time (latency) of a few milliseconds and to energy efficiency as large volumes of data do not have to be transferred to the cloud first before processing.
Exascale computers	Exascale computers are supercomputers. They are able to calculate at least 1018 floating point operations per second (exaflops). One exaflop is equivalent to 1000 → petaflops.
FAIR principles	The FAIR principles aim to facilitate sustainable data management, particularly in research. According to these principles, data and metadata is to be prepared in such a way that it can be reused by third parties. FAIR stands for Findable, Accessible, Interoperable, Reusable.

Geodata	Geodata is data with a direct or indirect reference to a certain location or geographical area.
GPU	The graphics processing unit (GPU) is a processor designed to compute images. GPUs are currently used to speed up high performance computers and for performing calculations in machine learning and artificial intelligence.
Health data	Health data is → personal data relating to the physical or mental health of an individual, including the performance of healthcare services, from which information about that individual's state of health can be derived. The processing of this type of data must be subject to especially stringent legal requirements. This data is different to data relating to healthcare provision that also includes non-personal data.
High-value data records	High-value data records are documents that offer important benefits for society, the environment and industry when they are reused. High-value data records are determined by a European Commission implementing act. This is based on the assessment of the data records' potential to achieve significant socio-economic or ecological advantages or create added value for a large number of users through the development of innovative services.
Industry 4.0	The term Industry 4.0 describes the digitalisation and networking of industrial production on the basis of information technologies. It facilitates, among other things, intelligent interlinking of value creation chains as well as largely independent organisation on the basis of networks of people, machines, facilities, logistics and products.
Information infrastructures	Information infrastructures are technically and organisationally networked products and services providing access to and maintenance of stocks of data, information and knowledge.
Internet of Things	The Internet of Things describes a system of devices, machines or industrial facilities that are linked up via the Internet. These can communicate with one another across the network (if the devices are clearly identified).
Interoper-ability	Interoperability is the ability of various systems, organisations and technologies to work together.
Linked data	Linked data is a way of providing (meta)data and making it easier to use. The (meta)data is assigned an address (unique resource locator, URL) so that the information can be found on the Internet. Graphs can be created from references to and between data (records) and these enable, for example, correlations to be traced and data to be integrated.
Lock-in	Lock-in describes a situation in which users or customers are tied to the services or systems of a particular provider in such a way that, because of these barriers or for technical, psychological or economic reasons, it is difficult or even impossible to switch provider.

Machine learning	Machine learning describes a statistical-mathematical process of analysing large volumes of data. This includes e. g. pattern recognition in large volumes of data (texts, videos or images). Predictions can also be made using special models (e. g. DBSCAN for cluster analysis or K Nearest Neighbor for classification of cases). In this way, machine learning does not require any manual input of knowledge or explicit programming of a solution.
Machine readability	Data that is machine-readable is structured in such a way that software applications can easily identify, recognise and extract concrete data, including individual representations of facts and their internal structure.
Metadata	Metadata is structured data that provides information about other data.
Microdata	Microdata is original data from statistical surveys that refers to one survey unit. It is the opposite of macrodata (group data, aggregated data). Macrodata can be generated from microdata through aggregation and validation.
National high performance computing	National High Performance Computing at Universities (NHR) consists of a coordinated alliance (NHR Alliance) of level 2 high performance computing centres included in the funding programme. The key aims of the funding programme include the comprehensive and needs-based provision of high performance computing capacities for scientific research at universities, reinforcement of users' methodological skills, basic and further training as well as funding and further development of scientific computing.
National Research Data Infrastructure	The aim of the National Research Data Infrastructure (NFDI) is to systematically index the data stocks of science and research and make them secure, accessible and (inter)nationally interlinked for the long term. It is currently being established in Germany as a networked structure of independent consortia through a process driven by science.
Neuromorphic chips	Neuromorphic chips are computer chips with an architecture that is based on signal processing in the human brain. Compared to traditional architectures, there is no strict separation between memory and processor. The data exchange between these components in traditional architectures, in particular AI applications, often creates a bottleneck and limits computing performance and energy efficiency. This is why neuromorphic architectures offer intelligent information processing that uses much less energy and is much quicker at the same time.
Open data	The concept of open data is generally understood as data in a machine-readable open format that is used, reused and forwarded freely by all users. Often it does not involve a one-off release of a data record but rather an ongoing process in which data is updated and users' queries relating to the data must be answered.

Open data officer	The open data officer handles, supervises and manages the release of data in an organisation (e.g. a company or public authority). His/her duties include identifying data records for release, including → depersonalisation measures, updating data records and answering questions on all aspects of open data and released data records. The open data officer works closely with the → chief data scientist and data protection officer.
Open government data	The term open government data refers to data and information that is generated by public authorities and made available as open data records → open data for further processing by third parties.
Open source	The term open source describes software with licence agreements that include the following three characteristic features and cover the ten points of the open source definition: the software (i.e. the source text) is available in a form that can be read and understood by human users. It can be copied, distributed and used as many times as the users wish, as there are often no restrictions on use or the number of times it can be installed. Users are not often required to pay the licenser for copying and distributing open source software.
Personal data	Personal data is all the information that relates to an identified or identifiable individual. An individual is regarded as identifiable if they can be identified directly or indirectly by allocating an identifier such as a name, an identification number, location data, online identification or one or several particular features expressing the physical, physiological, genetic, psychological, economic, cultural or social identity of this individual.
Petaflops	Petaflops are a measure of the processing speed of computers. One petaflop is equivalent to 1015 floating point operations per second (flops).
Profiling	Profiling is the collection and connection of personal data on people's individual, personal profiles. The purpose of these profiles is to assess, evaluate, analyse and predict certain personal aspects relating to an individual, in particular his/her work performance, credit risk, economic situation, state of health, personal preferences, character traits, behaviours or place of residence.
Pseudonymisation	Pseudonymisation is a method of processing personal data so that the personal data can no longer be allocated to a specific data subject without adding supplementary information, insofar as this supplementary information is stored separately and technical and organisational measures are taken to ensure that the personal data is not allocated to an identified or identifiable individual. An example of this is replacing names with ID numbers and removing names and numbers from an allocation table.

Quantum computers	Quantum computers base their elementary calculations on quantum-mechanical units – what are known as qubits – instead of the binary units (bits) in digital computers and process them in accordance with quantum-mechanical principles. This is expected to be a huge advantage for many applications in terms of speed.
Raw data	Raw data is obtained directly from the sources that generate the data. It is and remains unprocessed.
Real time	Real time means the continuous operational readiness of a system in which all reactions and computational steps are performed in a certain short space of time.
Research data	Research data is data in digital form that is collected or created in the course of scientific research tasks, without being scientific publications. This data is used as evidence within the research process or considered by the research community to be necessary for validating research findings.
Research data centre	A research data centre provides flexible, secure, lawful and sometimes comprehensive access to data for scientists or other authorised users. Germany currently has a decentralised network of numerous research data centres.
Scoring	Scoring is a statistical-mathematical process of allocating a value to an individual or company based on a profile. For instance, this value may provide information about the individual's credit risk, profitability or their willingness to switch to other services/competitors. Scoring facilitates categorisation and classification. A legal definition can be found in Section 31 (1) of the Federal Data Protection Act (BDSG).
Synthetic data	Synthetic data is a new "artificial" representation of an original data record generated through a certain procedure, which involves developing a model that reproduces the original data as closely as possible. The synthetic data record does not comprise data of real people but of synthetic units.
Synthetisation and verification servers	Synthetic data can be produced and managed on synthetisation servers. Verification servers can provide market participants with mathematical guarantees in data processing, e.g. concerning the extent of data noise or coarsening of data.
Tracking	Techniques for tracking and recording individual user behaviour – usually over different websites – when using networked devices, websites and digital services.

Index Federal Chancellery and Ministries

AA	German Foreign Office
BKAmt	Federal Chancellery
BKM	Federal Government Commissioner for Culture and the Media
BMAS	Federal Ministry for Employment and Social Affairs
BMBF	Federal Ministry of Education and Research
BMEL	Federal Ministry of Food and Agriculture
BMF	Federal Ministry of Finance
BMFSFJ	Federal Ministry for Family Affairs, Senior Citizens, Women and Youth
BMG	Federal Ministry for Health
BMI	Federal Ministry of the Interior, Building and Community
BMJV	Federal Ministry of Justice and for Consumer Protection
BMU	Federal Ministry for the Environment
BMVg	Federal Ministry of Defence
BMVI	Federal Ministry of Transport and digital Infrastructure
BMWi	Federal Ministry of Economic Affairs and Energy
BMZ	Federal Ministry for Economic Collaboration and Development

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