



Digital Economy and Society Index (DESI) 2022

Germany

About the DESI

Since 2014, the European Commission has monitored Member States' progress in digital and published annual Digital Economy and Society Index (DESI) reports. Each year, the reports include country profiles, which help Member States identify areas for priority action, and thematic chapters providing a EU-level analysis in the key digital policy areas. The DESI Index ranks Member States according to their level of digitalisation and analyses their relative progress over the last five years, considering their starting point.

The Commission has adjusted DESI to align it with the four cardinal points set out in the Commission proposal for a decision '[Path to the Digital Decade Policy Programme](#)' which is being negotiated by the European Parliament and the Council. The proposal sets targets at EU level to be reached by 2030 to deliver a comprehensive and sustainable digital transformation across all sectors of the economy. Of the DESI 2022 indicators, 11 measure targets set in the Digital Decade. In the future, the DESI will be aligned even more closely with the Digital Decade to ensure that all targets are discussed in the reports.

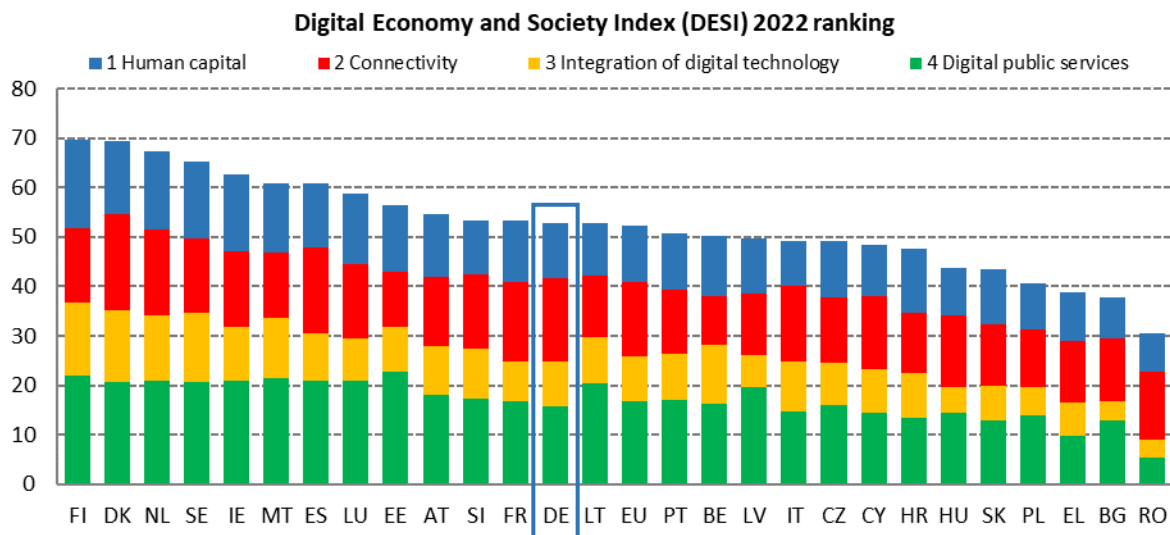
To date, digitalisation in the EU is uneven, although there are signs of convergence. While the frontrunners have remained unchanged, there is a substantial group of Member States that cluster around the EU average. Importantly, the majority of Member States that had a lower level of digitalisation 5 years ago, are progressing at a faster pace than the rest, indicating an overall convergence in digital in the EU.

Reaching the Digital Decade targets depends on a collective effort by all. Each Member State will contribute to this ambitious goal from a different starting point, determined by resources, comparative advantages and other relevant factors such as the population size, the scale of the economy and the areas of specialisation. For example, Member States with large economies or populations will need to perform well to enable Europe as a whole to reach the targets by 2030. Digital frontrunners will need to continue progressing to lead on digitalisation worldwide, while all Member States' digitalisation efforts will be driven by their economic and societal needs.

The DESI scores and rankings of previous years are re-calculated for all Member States to reflect changes in the underlying data. For further information, see the [DESI website](#).

Overview

DESI 2022	Germany		EU
	rank	score	score
	13	52.9	52.3



Germany ranks 13th of 27 EU Member States in the 2022 Digital Economy and Society Index (DESI). Germany progressed relatively well in the last five years (2017-2022).¹ As the EU's largest economy, Germany's progress with digital transformation in the coming years will be crucial, to enable the EU as a whole to reach its 2030 Digital Decade targets.

Germany shows a mixed performance on Human capital. The level of basic digital skills and basic digital content creation skills² is slightly below the EU average. However, the share of information and communications technology (ICT) specialists is above the EU average.

On Connectivity, the country performs well. Its fixed very-high-capacity network (VHCN) coverage has improved significantly. At 75%, it is now above the EU average. This counts as a major progress towards the Digital Decade target of all households covered by gigabit networks by 2030. However, Germany is still lagging behind in fibre coverage (at 15.4%, it is ranked among the last Member States in the EU), and the urban-rural digital divide persists (rural fibre coverage is 11.3%, rural VHCN is 22.5%). The country ranks 4th among EU Member States in 5G coverage with 87% of populated areas.

As regards the Integration of digital technology by enterprises, most indicators are close to the EU average. There is room for improvement, and Germany has some way to go before it meets the Digital Decade target of 90% of small and medium-sized enterprises (SMEs) reaching a basic level of digital intensity.

Performance on Digital public services is mixed. Germany scores well on open data, but interaction between the government and the public could be improved. Germany needs to continue with the

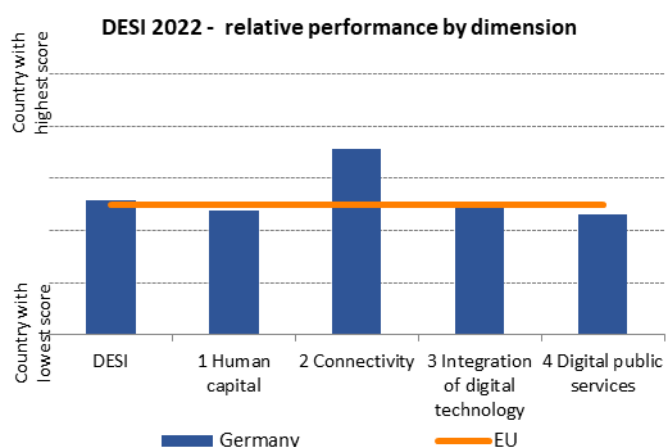
¹ Refer to section 1.3 of the DESI 2022 thematic chapter.

² Germany adapted its reporting in accordance with Eurostat methodology, therefore 2022 DESI take-up figures cannot be compared with figures from previous DESI reports. This change in methodology is unique for Germany.

work it is doing to achieve the Digital Decade target of 100% online provision of key public services for European citizens and businesses.

The new German government took office in December 2021 and set out its digital priorities in the Coalition agreement³. Digitalisation is a key priority for the new government, building on the digital dimension of the Recovery and Resilience Plan adopted by the previous government. The implementation strategy ‘Shaping Digitalization’, adopted on 15 November 2018, is a strategic umbrella covering more than 140 central digital policy projects in five fields of action: digital competence, infrastructure and equipment, innovation and digital transformation, society in the digital transformation and the modern state. By October 2021, over 90% of the implementation steps had been started, of which 44% have been completed. The interactive digital policy dashboard ‘[digital made in de](#)’, tracks progress on each measure covered by the strategy and other German digital strategies (artificial intelligence (AI), blockchain and data strategies), as well as impact indicators for digital policies. The dashboard helps to ensure transparent, verifiable and evidence-based digital policy in Germany.

The new government is working on an overarching digital strategy under which the strategies and measures of the ministries will be classified.



As a response to Russia’s invasion of Ukraine in the digital domain, Germany complies with the EU sanctions regarding RT and Sputnik. The German government is communicating actively on the war, e.g. via a theme page of the Federal Agency of Civic Education.⁴ To counter disinformation regarding the war, several German ministries provide information on disinformation and links to fact checkers on their homepages. The German government is in continued exchange with operators of platforms and social networks, in order to sensitize them to state-controlled disinformation and to ensure that the government is kept informed when measures are taken.

The Federal Ministry of the Interior and Community has set up the centralized portal ‘[Germany4Ukraine](#)’ as a secure and reliable digital source of information for people fleeing Ukraine. It bundles information for entering and getting oriented in Germany and provides an overview of the assistance available. The information is provided in Ukrainian, Russian, English and German. Cooperation with further civil and private sector actors is intensified in order to develop the platform towards a ‘one-stop-shop’ of information for those fleeing Ukraine.

In the context of the war, the potential threat represented by cyber-attacks within Germany has increased. Thus, the Federal Office for Information Security (BSI) conducts an extended cybersecurity

³ [Koalitionsvertrag 2021-2025.pdf \(spd.de\)](#), from page 15.

⁴ [Krieg in der Ukraine | bpb.de](#)

monitoring. The BSI and the competent authorities have raised the awareness of relevant German organisations, particularly critical infrastructure operators, of the heightened threat situation and made comprehensive recommendations for action.

Digital in Germany's Recovery and Resilience Plan (RRP)

Digital is the main focus for Germany's RRP. From a total budget of EUR 26.5 billion⁵, more than 50% is allocated to digitalisation⁶. The plan features two major multi-country 'important project of common European interest' (IPCEI) on digitalisation: Microelectronics and Communication Technologies, and Next Generation Cloud Infrastructure and Services (IPCEI-CIS).

Three out of the four DESI pillars are addressed in the plan, while goals relating to Connectivity, the second DESI pillar, are financed by Germany alone. Developments in 2022 relating to the digital measures in the plan are detailed below.

On Digital skills, the plan includes investments in teacher terminal equipment, an education platform, educational centres of excellence, and modernisation of the Federal Armed Forces' educational institutions. At least EUR 475 000 000 are expected to be disbursed to the teacher terminal equipment projects. Funding guidelines for education platform prototypes are expected to enter into force and the procurement process is expected to be started. The first funding guidelines for educational centres of excellence is expected to enter into force and a call for tenders is expected to be launched for an agency to implement projects for the whole programme. An analysis of the Federal Armed Forces' educational institutions is expected to be carried out and their IT needs identified.

Investments relating to the Digitalisation of enterprises and the development and integration of advanced digital technologies are included in several measures. Funding guidelines for the vehicle manufacturer/supplier investment programme were published in 2021. For the measure on building continuing education and training (CET) networks at least 200 additional businesses are expected to be actively involved in CET networks by end 2022. Research projects are supported by the Centre for Digitalisation and Technology Research of the Federal Armed Forces. All projects relating to the measure on innovative data policy are expected to have started by the end of 2022. For the cloud IPCEI, potential projects and project participants are expected to have been identified, and research, development and innovation projects should be launched by the end of 2022. For the microelectronics IPCEI, 10 grant decisions should be signed by the end of 2022.

Digitalisation of public services, accounting for more than 50% of digital investment under the plan, is supported by a number of measures in the 'Modern public administration' component. In 2021, the first pilot application was launched for the 'European identity ecosystem' measure. At least four additional application cases, each with at least 10 000 users, are expected to be fully implemented in 2022. For implementation of the Online Access Act, at least 70 public service bundles were due to be online to the general public by end 2021, and widespread digitalisation of federal administrative services as one-for-all services is expected by the end of 2022. As regards the measure on modernisation of registers, pilot projects to test pilot registers are due to be completed by the end of 2023.

⁵ This is the net amount excluding value-added tax.

⁶ Each recovery and resilience plan has to dedicate at least 20% of the plan's total allocation to digital objectives. To this end, the plans had to specify and justify to what extent each measure contributes fully (100%), partly (40%) or has no impact (0%) on digital objectives, using Annex VII of the RRF Regulation. Combining the coefficients with the cost estimates of each measure allows assessing to what degree the plan contributes to digital objectives and whether it meets the 20% target.

The Digital Pension Overview Act (*Gesetz Digitale Rentenübersicht*) came into force in 2021, supporting the digital pension overview measure. For the rail digitalisation measure, seven pilot projects were expected to be completed by the end of 2021.

Two public-health measures are relevant: as part of the measure on digital and technical strengthening of the public health service, public-health offices' progress towards digital maturity will be monitored in 2022 and, under the programme to future-proof hospitals, the Federal Office for Social Security is estimated to have received applications worth at least EUR 2.7 billion for hospital projects by the end of 2021. The 'Reducing barriers to investment' component, also features reform measures, aimed at facilitating and speeding up public investment.

1 Human capital

1 Human capital	Germany		EU
	rank	score	score
DESI 2022	16	45.0	45.7

	Germany			EU
	DESI 2020	DESI 2021	DESI 2022	DESI 2022
1a1 At least basic digital skills % individuals	NA	NA	49% 2021	54% 2021
1a2 Above basic digital skills % individuals	NA	NA	19% 2021	26% 2021
1a3 At least basic digital content creation skills⁷ % individuals	NA	NA	65% 2021	66% 2021
1b1 ICT specialists % individuals in employment aged 15-74	4.0% 2019	4.7% 2020	4.9% 2021	4.5% 2021
1b2 Female ICT specialists % ICT specialists	17% 2019	18% 2020	19% 2021	19% 2021
1b3 Enterprises providing ICT training % enterprises	32% 2019	24% 2020	24% 2020	20% 2020
1b4 ICT graduates % graduates	4.9% 2018	4.5% 2019	4.9% 2020	3.9% 2020

On Human capital, Germany ranks 16th out of 27 EU countries, below the EU average. Basic digital skills and basic digital content creation skills levels⁸ are slightly below the EU average. ICT specialists account for 4.9% of the workforce (compared to the EU average of 4.5%), and 4.9% of all graduates are ICT graduates (compared with the EU average of 3.9%). At 19%, the proportion of female ICT specialists is as high as the EU average. Among German enterprises, 24% offered specialised ICT training to their employees in 2020.

In June 2021, the first implementation report⁹ on the German national skills strategy¹⁰ was published. The report detailed progress in the 10 action fields identified in the strategy (adopted in 2019). The new German government has given a clear indication to continue with the strategy. More than three quarters of the agreed measures and initiatives were implemented or launched by June 2021 and are documented in the implementation report.

The digitalisation of education is also one of the six priority areas in the German RRP, with three measures of particular relevance here: the investment programme for teacher devices, the education platform and educational centres of excellence.

In 2021, projects worth over EUR 2 billion were approved under the Digital Pact for Schools (*DigitalPakt Schule*) for building digital infrastructure and supporting the digital transformation of schools. The federal government and the federal states agreed to allocate EUR 5 billion in federal funding to the pact between 2019 and 2024. The aim is to equip all general and vocational schools with modern digital infrastructure. In the exceptional situation caused by the Corona pandemic, the federal government and the federal states have concluded supplementary agreements to the existing

⁷ Break in series for indicators 1a1, 1a2 and 1a3. Figures are not comparable with those in earlier DESI reports.

⁸ Germany adapted its reporting in accordance with Eurostat methodology, therefore 2022 DESI take-up figures cannot be compared with figures from previous DESI reports. This change in methodology is unique for Germany.

⁹ [Umsetzungsbericht: Nationale Weiterbildungsstrategie \(bmas.de\)](https://www.bmas.de/SharedDocs/DESI/Umsetzungsbericht-Nationale-Weiterbildungsstrategie-(bmas.de).pdf?__blob=publicationFile)

¹⁰ [Nationale Weiterbildungsstrategie - BMBF](https://www.bmbwf.de/SharedDocs/DESI/Nationale-Weiterbildungsstrategie-BMBF.pdf?__blob=publicationFile)

funding guidelines. The federal states will receive additional support in the form of an ‘immediate equipment programme’ for terminal equipment in schools, an agreement to promote the administration of IT in schools, and the programme for loaning equipment to teachers. The federal government is providing EUR 500 million for each of these programmes, while the federal states are contributing at least 10%, thus leading to around EUR 7.5 billion federal funds for the Pact. In addition, the federal states are stepping up their efforts to train teachers in digital teaching and learning.

The German federal Government has set up a programme for CET Networks that provides financial support to pilot projects. The aim is to involve SMEs more in CET measures and to strengthen regional economic and innovation networks. These are networks in which several companies, regional labour market players and actors in the CET landscape cooperate. The focus here is on the identification of CET training needs in the companies as well as advice on and research into suitable training programmes or the conception of new ones in accordance with the identified needs of the companies. The first networks started in December 2020. In 2022 a total of over 50 networks are expected to receive funding.

The Federal Government initiated the innovation competition INVITE. INVITE aims at innovative solutions that – with the help of AI – enable all people to find the right continuing professional training on demand. The Federal Government has launched the ‘hubs for tomorrow’ to support companies, esp. SMEs, and employees with custom-fit counseling and innovative learning approaches. Furthermore, SMEs are supported in introducing human-centred AI-based systems together with their employees. The first ‘regional hubs for tomorrow’ started their work at the end of 2019 and several more have been established in 2021.

The Federal Ministry of the Interior and Community supports the ‘Germany secure in the network’ initiative (*Deutschland sicher im Netz e.V.*), which launched a programme in March 2022, called *DsiN-Digitalführerschein*¹¹, to raise the level of digital skills and competencies among the general public to help them become more involved in the digitalised society. The programme provides free, interactive online courses to develop digital skills for use in professional and private contexts. Certificates are issued so that participants have evidence of their digital skills to show employers.

To promote more women in science, technology, engineering and maths (STEM) professions, and as ICT specialists, in 2008 the Federal Ministry for Education and Research (BMBF) launched the ‘National pact for women in STEM’. It has more than 300 members: STEM education initiatives, universities, R&D, engineering associations, employers’ federations, job centers and industry. Since 2021, the pact is embedded into the activities of the federal STEM agency called ‘STEM connected’ (*MINT vernetzt*), funded by the BMBF, in order to boost its impact. In addition, the BMBF provides ongoing support for measures to encourage young women to study ICT sciences, which helps to increase the number of female graduates.

Germany does not have a national Digital Skills and Jobs Coalition. The country participated actively in the 2021 EU Code Week¹², organising 997 events involving 26 777 participants, of whom 42% were girls or women. Some 15% of the activities involved schools¹³.

Digital skills are the focus of several measures in Germany, including the German RRP, covering areas such as teacher training, upskilling and reskilling the workforce, CET, increasing the number of ICT specialists and narrowing the gender gap. These measures are already showing results in some of the indicators.

¹¹ [DsiN-Digitalführerschein \(DiFü\) - DiFü \(xn--dif-joa.de\)](https://xn--dif-joa.de)

¹² [EU Code Week breaks record for number of activities in 2021 with 78,000 events | Shaping Europe’s digital future \(europa.eu\)](https://europa.eu)

¹³ [4 million people created code as part of EU Code Week in 2021](https://europa.eu)

2 Connectivity

2 Connectivity	Germany		EU
	rank	score	score
DESI 2022	4	67.3	59.9

	Germany		EU	
	DESI 2020	DESI 2021	DESI 2022	DESI 2022
2a1 Overall fixed broadband take-up % households	88%	92%	82%	78%
	2019	2020	2021	2021
2a2 At least 100 Mbps fixed broadband take-up % households	21%	28%	29%	41%
	2019	2020	2021	2021
2a3 At least 1 Gbps take-up % households	0.15%	1.12%	2.46%	7.58%
	2019	2020	2021	2021
2b1 Fast broadband (NGA) coverage % households	92%	95%	96%	90%
	2019	2020	2021	2021
2b2 Fixed Very High Capacity Network (VHCN) coverage % households	33%	56%	75%	70%
	2019	2020	2021	2021
2b3 Fibre to the Premises (FTTP) coverage % households	11%	14%	15%	50%
	2019	2020	2021	2021
2c1 5G spectrum Assigned spectrum as a % of total harmonised 5G spectrum	67%	100%	100%	56%
	04/2020	09/2021	04/2022	04/2022
2c2 5G coverage¹⁴ % populated areas	NA	18%	87%	66%
		2020	2021	2021
2c3 Mobile broadband take-up % individuals	89%	89%	87%	87%
	2018	2018	2021	2021
2d1 Broadband price index Score (0-100)	75	75	80	73
	2019	2020	2021	2021

On Connectivity, Germany ranks 4th of the 27 EU countries. For fixed networks, Germany has made progress on most connectivity indicators in 2021. Germany has reached 96% coverage of fast broadband, providing a solid basis for digital participation in society and the economy. Although rural coverage has significantly improved since 2019, from 75% to 85%, well above the EU average of 67.5%, Germany still has a clear digital divide between urban and rural areas. Compared to other EU Member States, Germany performs particularly well on overall fixed broadband take-up and broadband prices. In the broadband pricing index (based on representative baskets of fixed, mobile and converged packages, adjusted for national household income levels), Germany ranks 8th in the EU.

As to preparedness for the Gigabit society, Germany has significantly improved very high-capacity network (VHCN) coverage over the last year from 55.9% in 2020 to 74.9% in 2021 and is currently above the EU average of 70.2%. However, the country is still lagging in deploying VHCN in rural areas (with a coverage of 22.5% versus 37.1% EU average) and only 15.4% of households have access to a Fibre to the Premises (FTTP) connection (compared to an EU average of 50%), which places Germany among the Member States with the second lowest fibre coverage, while the top five EU performers have a fibre coverage of 85% or more. The lack of fibre connections is accentuated in rural areas where

¹⁴ The 5G coverage indicator does not measure users' experience, which may be affected by a variety of factors such as the type of device used, environmental conditions, number of concurrent users and network capacity. 5G coverage refers to the percentage of populated areas covered by at least one operator as reported by operators and national regulatory authorities.

coverage stands at 11.3% versus an EU average of 33.8%. Further roll-out of fibre will have a crucial role to play in meeting the ‘Gigabit for everyone’ target¹⁵, as most cable networks have already been upgraded to the DOCSIS 3.1 standard allowing for gigabit capacities. Also, the quality of in-house-cablings will be critical where fibre has been rolled out to the premises or to the property, but not to the network termination points located within individual flats in multiple dwelling units or within the living areas of single dwelling units.

In total, the Federal Government provided [EUR 12 billion](#) to subsidise fibre connections. With the start of the Gigabit programme in April 2021, funding was expanded to cover also the grey NGA areas. Apart from fibre connections for households, the programme aims at the expansion of gigabit connections for socio-economic drivers such as businesses, hospitals, administrative services, transport hubs and fibre connections to schools. A separate programme, the ‘[Digital Classroom](#)’ initiative focusses on connecting schools to broadband networks. Altogether, around 11 700 schools receive funding. In addition to the general national broadband aid schemes, many German regions have separate funding schemes. A [gigabit strategy](#) to implement the objectives of the coalition agreement with regard to digital infrastructure was adopted on 13 July 2022. It includes promising goals on the availability of Fibre to the Premises (FTTP) for all German households by 2030, and of 15 million new FTTP connections by the end 2025. A revised funding programme is currently elaborated to come into effect in 2023. It takes into account, among others, the [expected more comprehensive funding possibilities](#) in the state aid framework. It takes into account, among others, the [expected more comprehensive funding possibilities](#) in the state aid framework.

On mobile connectivity, Germany performs particularly well on 5G spectrum and on 5G coverage, ranking 4th in the EU on the latter. All three incumbent operators are rolling out 5G and the new entrant is preparing to roll out its 5G network. With 87% of populated areas covered, Germany is progressing well towards nationwide 5G coverage. Notably, 49.4% of all populated rural areas have 5G coverage. Overall, [57.5%](#) of Germany’s territory was covered by 5G in January 2022. Progress in this area is important for achieving the [EU Digital Decade targets](#). [Standalone 5G](#) network introduction started in 2021, allowing for gigabit speeds and low latency. By January 2022, 5G was available from the three Mobile Network Operators (MNOs) (Deutsche Telekom, Vodafone and Telefónica) in the 3.4-3.7 GHz frequency range. By March 2022, the German regulatory authority, the *Bundesnetzagentur* (BNetzA), had granted about 200 assignments for 5G campus and industrial networks in the 3.7-3.8 GHz band and ten assignments in the 24.25-27.5 GHz band. The Federal mobile funding scheme (budget: EUR 1.1 billion) aims to ensure 5G-capable mobile sites with at least 4G-coverage in white spots that currently have no or only 2G connectivity. In 2021, the Mobile Communications Infrastructure Company (*Mobilfunkinfrastrukturgesellschaft* - MIG) has completed 111 public consultations. The evaluation showed, that more than half of the target areas will be covered on own accounts by the MNOs. The remaining areas are eligible for funding and are being prepared by the MIG (e.g. search for sites and usable land for mobile phone masts, preparation of approval procedures and identification of suitable delivery points for fibre optic connections). Some German regions run separate funding schemes.

Main market & regulatory developments

In November 2021, Deutsche Telekom announced it would be cooperating on network rollout with the financial investor ‘IFM investors’. A joint venture, ‘*GlasfaserPlus GmbH*’ is to be set up to provide four million households with fibre-to-the-home connections, targeting rural and subsidised areas. Telefónica group and the insurance company Allianz AG have created the joint venture ‘*Unsere Grüne Glasfaser*’ to invest up to EUR 5 billion to connect about 2.2 million

¹⁵ This is the EU target for 2030, please see [link](#).

households with fibre, mainly in rural and in underserved areas. In December 2021, the fibre operator Deutsche Glasfaser announced that, with backing from a consortium of creditors, it would be investing EUR 5.75 billion in a fibre roll-out to four million households.

As to market shares, Deutsche Telekom's competitors increased their market share in the broadband market by a small margin, to 61.2% at the end of 2020.

The new Telecommunications Act (*Telekommunikationsgesetz*, [TKG](#)) implements the [European Electronic Communications Code](#) and [entered into force on 1 December 2021](#). It includes notably the phasing-out of the option for landlords to charge for TV and broadband subscriptions as part of a rental contract. The option will be withdrawn by mid-2024. The regulatory authority BNetzA is putting into practice the strengthened end-user's rights for universal service. Moreover, BNetzA will set out the technical specifications for providing universal telecommunications services through an ordinance, for approval by the Federal government as well as by the German legislators (*Bundestag and Bundesrat*). BNetzA had commissioned studies to determine the bandwidth and latency needed to accommodate the minimum services defined by law. Under the TKG, providers must offer universal telecommunication services at affordable prices for consumers. The [public consultation](#) closed at the end of January 2022 and BNetzA intends to publish guidelines for determining affordable prices. Universal service is being financed through a sectoral funding mechanism whereby companies obliged to provide universal services are entitled to compensation if the net cost imposes an unreasonable burden on them.

On market regulation, in February 2021, BNetzA de-regulated the market for call origination in fixed networks¹⁶, prompted by increased competition in the market and facilitated by market players' agreement to temporarily continue providing the relevant wholesale products.

For some older types of leased lines¹⁷, Deutsche Telekom has applied to BNetzA to lift existing wholesale obligations because the technology has reached the end of its lifetime. BNetzA is examining the issue and is analysing which products could be appropriate replacements.

On 2 September 2021, the European Court of Justice (ECJ) found that the 'StreamOn' offer of Deutsche Telekom and 'Vodafone Pass' were not in line with Net Neutrality rules and violated the principle of non-discrimination for all data transmission, regardless of the service for which the transmission is used. The ECJ rulings are binding for NRAs. BEREC is currently updating its Open Internet Guidelines in the light of the ECJ decisions. BNetzA has to take utmost account of these guidelines (expected to be published by mid-June 2022) and will accordingly enforce the ECJ rulings.

Germany is preparing to monitor the level of electromagnetic fields (EMF) and is exploring approaches for monitoring the exposure of the public to such fields.

Together with the digital divide between urban and rural fixed VHCN coverage and the take up of high speed services, the main challenge for Germany is the timely rollout of fibre networks to achieve the Digital Decade targets, notably the full coverage of all German households by 2030. Increasing the capacity of the civil works sector is crucial. In particular, the workforce needs more people who are qualified to plan and manage physical works, in order to accelerate non-subsidised private roll-out and to implement the increasing number of new investment projects. Roll-out would also be facilitated by advancing the standardisation of alternative, less time-consuming digging techniques for laying fibre cables, and by faster, simpler permit granting procedures in the public sector, specifically at municipality level.

¹⁶ Market 2 of the 2007 Recommendation on Relevant Markets

¹⁷ More specifically, Synchronous Digital Hierarchy leased lines

3 Integration of digital technology

3 Integration of digital technology	Germany		EU
	rank	score	score
DESI 2022	16	35.8	36.1

	Germany			EU
	DESI 2020	DESI 2021	DESI 2022	DESI 2022
3a1 SMEs with at least a basic level of digital intensity % SMEs	NA	NA	59%	55%
			2021	2021
3b1 Electronic information sharing % enterprises	29%	29%	38%	38%
	2019	2019	2021	2021
3b2 Social media % enterprises	23%	23%	30%	29%
	2019	2019	2021	2021
3b3 Big data % enterprises	15%	18%	18%	14%
	2018	2020	2020	2020
3b4 Cloud % enterprises	NA	NA	32%	34%
			2021	2021
3b5 AI % enterprises	NA	NA	11%	8%
			2021	2021
3b6 ICT for environmental sustainability % enterprises having medium/high intensity of green action through ICT	NA	57%	57%	66%
		2021	2021	2021
3b7 e-Invoices % enterprises	17%	18%	18%	32%
	2018	2020	2020	2020
3c1 SMEs selling online % SMEs	17%	17%	19%	18%
	2019	2020	2021	2021
3c2 e-Commerce turnover % SME turnover	10%	11%	10%	12%
	2019	2020	2021	2021
3c3 Selling online cross-border % SMEs	10%	10%	10%	9%
	2019	2019	2021	2021

Germany ranks 16th in the EU on Integration of digital technology in business activities. Germany's performance for most indicators in this dimension is close to the EU average, including SMEs with at least a basic level of digital intensity and the uptake of advanced technologies by enterprises such as cloud, big data and artificial intelligence. Still, there are areas where German businesses score considerably below the EU average are e-invoices (18% compared to the EU average of 32%) and ICT for environmental sustainability (57% compared to 66%).

Germany has introduced a number of strategies, initiatives and activities to support the digital transformation of companies and the deployment and uptake of advanced technologies. Several measures are specifically tailored to SMEs. The current focus is largely on the continuation or further development of existing measures. In the coalition agreement, the newly-elected government made a pledge to create a friendlier environment for (digital) start-ups.

Recent activities have centred around advanced technologies, in particular IPCEIs on Microelectronics (see highlight box below) and on Next generation cloud infrastructure and services (IPCEI-CIS). The German RRP allocated a budget of EUR 750 million for IPCEI-CIS. This IPCEI aims to support innovative research and development as well as first industrial deployment projects for cloud infrastructure and services. Among the Member States, 12 are participating in the project.

Another significant work strand related to cloud is the Gaia-X project, aimed at setting up interconnected and trustworthy cloud and edge infrastructure. The first implementation projects are

starting: as part of the ‘Gaia-X funding competition’, 11 consortia were selected to provide safe data infrastructure in several areas including e-health, mobility and construction. Funding of around EUR 117 million will be spent up to the end of 2024. Additional projects are expected to start in 2022.

Germany adopted an artificial intelligence strategy in November 2018 (updated in 2020), with planned investments amounting to EUR 5 billion up to 2025. The focus is on: increasing computing capacity; building AI ecosystems especially for research, skills and research transfer to SMEs in particular; and attracting AI experts and talent to support the development of a competitive European AI network. As of 2022, five AI research competence centres¹⁸ have been made permanent, to establish an AI research and training network in Germany.

In the field of quantum computing, Germany has launched several business and application-oriented initiatives and projects recently. One example is the call Quantum Computing Demonstrators (*Quantencomputer-Demonstrationsaufbauten*) launched in May 2021¹⁹. It has a total budget of about EUR 300 million until 2026 and funds eight projects to realize cloud-accessible quantum computers based on different technologies. This measure is accompanied by the call Application Network for Quantum Computing which funds nine projects that develop quantum algorithms and software for use cases exploring the potential of quantum computing in different areas such as energy networks or industrial manufacturing.

Germany is participating in the European Blockchain Partnership (EBP) and the European Blockchain Services Infrastructure (EBSI). The regulatory authority (*Bundesnetzagentur*) has hosted its own EBSI node since 2020.

With the ‘SME digital’ initiative (*Mittelstand-Digital*) Germany is continuing its activities to support businesses and especially SMEs in their digital transformation. This approach consists of three strands: the SME digital centres of excellence network (*Mittelstand 4.0 Kompetenzzentren and the new Mittelstand-Digital Zentren*)²⁰, the investment support scheme Digital Now (*Digital Jetzt*)²¹ and the initiative on cybersecurity for SMEs (*IT-Sicherheit-in-der-Wirtschaft*).²²

There are currently 26 SME centres of excellence, each with a regional or industry-specific focus. The centres support SMEs free of charge in identifying and implementing suitable digital solutions. One central role of the centres’ is to provide SME staff with training on digital technologies. The Centres also identify and develop best practice projects together with SMEs to demonstrate possible digital solutions. As a part of the AI strategy of November 2018 (see above), 19 centers of excellence have extended their support with ‘AI Trainers’ (KI-Trainer).

The digital now programme (*Digital Jetzt*) has provided 2 800 SMEs with financial support for digital skills and technologies projects. From September 2020 to the end of 2021, it invested around EUR 280 million in total. Financial support was increased in 2021, bringing the total support available up to 2024 to about EUR 460 million²³.

The Cybersecurity strategy for Germany 2021²⁴ updated the strategies from 2011 and 2016. It forms the strategic framework for the federal government's action in the field of cybersecurity for the next

¹⁸ [Karliczek: Mit der Verstetigung der KI-Kompetenzzentren gehen wir den nächsten großen Schritt hin zur KI-Nation - BMBF](#)

¹⁹ [Bekanntmachung – BMBF – Förderung von Projekten zum Thema ‘Quantencomputer-Demonstrationsaufbauten’](#)

²⁰ [Mittelstand Digital - Die Zentren im Netzwerk Mittelstand-Digital unterstützen vor Ort](#)

²¹ [BMWK - „Digital Jetzt“ – Neue Förderung für die Digitalisierung des Mittelstands](#)

²² [IT Sicherheit - Startseite \(it-sicherheit-in-der-wirtschaft.de\)](#)

²³ [BMWK - „Digital Jetzt“ – Neue Förderung für die Digitalisierung des Mittelstands \(bmwi.de\)](#)

²⁴ [BMWK - IT-Sicherheit \(bmwi.de\)](#)

five years. Furthermore, the strategy is subject to continuous improvement and the goals of the new federal government are incorporated. The federal government has also launched a new research framework programme on IT security 'Digital. Secure. Sovereign.' in 2021, which will continue to systematically drive forward IT security research in Germany. The Cybersecurity for SMEs initiative (*IT-Sicherheit in der Wirtschaft*) assists SMEs in increasing IT Security, including support on individual action plans.

Digital innovation hubs are currently being selected to be part of the network of European Digital Innovation Hubs (EDIHs). 14 German European Digital Innovation Hub proposals have a successful evaluation result²⁵, two additional proposals are expected to be selected next year and four additional proposals have received a Seal of Excellence. These hubs will provide access to technical expertise and experimentation for businesses.

The funding guidelines for the 'go digital' consultancy services programme have been updated. Since January 2022, 'go digital' also supports SMEs in developing a digitalisation strategy and data skills. The funding volume for the updated programme amounts to EUR 72 million up to the end of 2024.²⁶

Germany is investing considerably in cutting-edge technologies (AI, quantum, cloud and microelectronics) and is a driver of European cooperation in this field. This is also important for reaching the Digital Decade target of 75% of enterprises using cloud, AI and big data. Further support for the digitalisation of SMEs will help them on the path to digital transformation.

Highlight 2021-2022: Important Project of Common European Interest (IPCEI) on Microelectronics and Communication Technologies led by Germany

Germany participated with France, Italy, the United Kingdom and subsequently Austria in the first IPCEI on microelectronics providing funding of up to EUR 1 billion for 18 companies.²⁷

The second IPCEI on microelectronics (included in the DE RRP) is the flagship project for the joint declaration on 'A European initiative on processors and semiconductor technologies' signed by 22 EU Member States in December 2020. It aims to strengthen the microelectronics ecosystem in Germany and Europe while focusing on the development of high-performance, energy-efficient and secure chip production. Financial support for the German semiconductor industry is also included in the coalition agreement of the new German government.

Currently, 20 Member States are actively involved in the design of the IPCEI. Germany is coordinating the process at European level, with 112 direct participants and 32 associated partners involved.

Germany selected 32 projects, with a total investment cost of around EUR 11.8 billion, for submission to the European Commission as part of the IPCEI State aid pre-notification process that started in December 2021. In the RRP, this measure has a budget of EUR 1.5 billion.

²⁵ I.e. are invited for grant agreement preparation (which is not a formal commitment for funding).

²⁶ [BMWK - „Wir müssen den deutschen Mittelstand besser bei der Digitalisierung unterstützen“ – „go-digital“ wird bis 2024 verlängert \(bmwi.de\)](#)

²⁷ [IPCEI on Microelectronics – Important Project of Common European Interest \(ipcei-me.eu\)](#)

4 Digital public services

4 Digital public services ²⁸	Germany		EU
	rank	score	score
DESI 2022	18	63.4	67.3

	Germany			EU
	DESI 2020	DESI 2021	DESI 2022	DESI 2022
4a1 e-Government users	63%	69%	55%	65%
% internet users	2019	2020	2021	2021
4a2 Pre-filled forms	NA	NA	42	64
Score (0 to 100)			2021	2021
4a3 Digital public services for citizens	NA	NA	76	75
Score (0 to 100)			2021	2021
4a4 Digital public services for businesses	NA	NA	80	82
Score (0 to 100)			2021	2021
4a5 Open data	NA	NA	89%	81%
% maximum score			2021	2021

Germany ranks 18th in the EU on Digital public services. The country is still underperforming in this area, despite several initiatives from the federal government to accelerate digitalisation in public services. The proportion of internet users using e-government services is 55%, ranking 24th, behind most EU Member States. Regarding pre-filled forms, Germany's score is 42, some way below the EU average of 64, putting it among the five worst performing EU countries. On digital public services for businesses, Germany is close to the EU average with a score of 80, whereas on digital public services for citizens it is just above the EU average with a score of 76. On the open data indicator, Germany performs relatively well, with 89%, compared with the EU average of 81%.

Germany's Online Access Act (*Onlinezugangsgesetz*), adopted in August 2017, requires all German federal and state governments to provide their services for individuals and for companies online, through public-administration websites. Implementation has two main strands, both covered by the German RRP: one for the digitalisation of federal services (*Digitalisierungsprogramm Bund*) and another for the digitalisation of services provided by federal states and municipalities (*Digitalisierungsprogramm Föderal*). In May 2022, 79 of the 575 public services were available online and another 200 were in the process of being put online. Based on the law all public services should be available online by the end of 2022²⁹. This is in line with the Digital Decade target of 100% of public services available online by 2030.

Germany offers to its citizens, Union citizens, EEA Nationals but also to foreigners with residence permit three alternative eID schemes³⁰ for facilitating their interactions with public organisations but also for private use. All of these schemes offer the possibility to use them via a smart device. In total, 53 million people in Germany (or almost 64% of the population) use at least one of these schemes,

²⁸ There is break in the series for indicators 4a2, 4a3, 4a4 and 4a5. As a result, no comparison of indicator and dimension results is possible over time.

²⁹ [Dashboard Digitale Verwaltung \(ozg-umsetzung.de\)](https://www.digitale-verwaltung.de/).

³⁰ eID schemes in Germany:

German eID based on Extended Access Controll (Online-Ausweis) with National Identity Card,
 German eID based on Extended Access Controll (Online-Ausweis) with Electronic Residence Permit,
 German eID based on Extended Access Controll (Online-Ausweis) with eID Card for Union Citizens and EEA Nationals

and these schemes are also notified to the European Commission under the eIDAS Regulation. All three types of eID are issued by the government.

In addition, Germany has been working towards the establishment of a 'European identity ecosystem' reflected in its RRP. In close collaboration with approximately 20 major partners from various business sectors, this initiative seeks to enable people to securely and autonomously manage and share a wide range of government and privately issued digital credentials through a wallet application on their smartphone, in line with the self-sovereign identity (SSI) approach. The integration of the Smart eID into the ecosystem is addressed in this process.

The federal German cloud strategy was approved in mid-October 2020. The strategy determines common standards and interfaces needed for the German public administration to achieve multi-cloud-functionality. The target architecture is currently being developed for the administration with the involvement of IT service providers.

In June 2021, the GovTech Campus³¹ was founded as a non-profit association by the federal government, two federal states and several organisations working in cooperation. The aim is to set up a physical and virtual platform to foster connection and collaboration between the public administration and the GovTech community. It should generate international visibility, foster the development of a GovTech ecosystem and facilitate and sustainably increase collaboration and co-creation between civil society, administration, science, and technology.

The steering project 'Register Modernisation' was initiated by Germany's IT Planning Council (*IT-Planungsrat*) in June 2021 and is also part of the German RRP. The project is concerned with modernising the German register landscape and implementing the 'once-only' principle at national and cross-border level. The federal government and the federal states have adopted a roadmap³², which serves as the steering project's working programme. In March 2021, the German Register Modernisation Act (*Registermodernisierungsgesetz, RegMoG*³³) was adopted, which represents an important step forward for the implementation of the once-only principle.

The IT Planning Council initiated the Qualifica Digitalis research project to identify the skills needed by staff in public administration. So far, a study identified nine competence clusters with a total of 53 skills relevant for the public service and determined the existing skill level according to these 53 skills in different areas of employment in the public sector. On this basis the projects will provide practical recommendations and orientation for training and learning conditions in the public sector by September 2022.

In May 2021, the German Federal Academy for Public Administration (*Bundesakademie für öffentliche Verwaltung -BAkÖV*) launched its new Digital Academy. The Digital Academy provides hybrid learning, with both a physical campus and an online platform. These mixed methods are intended to maximise accessibility and scalability.³⁴ The basis for the heterogeneous learning offering is the Federal Digital Competence Initiative launched in September 2021.

In 2019, the inter-ministerial working group on human resources in digital public administration (AG PersDiV) was launched, with the Federal Ministry of the Interior and Community as lead ministry. The aim is to draw up future-oriented human resource policy for all federal ministries based on digital transformation trends and demographic change.

³¹ [GovTech Campus Deutschland](#)

³² [GovTech Campus Deutschland \(it-planungsrat.de\)](https://www.it-planungsrat.de)

³³ Register Modernisation Act (28 March 2021), see [DIP - Gesetz zur Einführung und Verwendung einer Identifikationsnummer in der öffentlichen Verwaltung und zur Änderung weiterer Gesetze \(Registermodernisierungsgesetz - RegMoG\) \(bundestag.de\)](#)

³⁴ [Future-proofing the public sector through digital and innovation skills training \(apolitical.co\)](#)

By including relevant measures in the RRP, Germany is contributing to the deployment of digital public services. If the measures are implemented efficiently and on time, they are expected to lead to improvements in the relevant indicators.