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COVER NOTE

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PART 3/6

COMMISSION STAFF WORKING DOCUMENT

Digital Decade country reports

EN   EN

State of the Digital Decade 2024

Finland

1 Executive summary

Finland brings a very strong contribution to the European Union's (EU) Digital Decade objectives and targets, in view of a successful digitalisation that fosters competitiveness, resilience, sovereignty, European values and climate action.

In 2023, Finland made notable progress in **gigabit networks roll-out** and continued to record growth in the **digital skills of the population and the digitalisation of its enterprises**. However, **challenges persist** to **keep up with gigabit networks deployment** across its territory and in the area of e-government, where there is a need to **improve on e-health and to ensure that access to other digital public services remains at highest possible levels.**

Using digitalisation as a tool to achieve a thriving and resilient economy and a safe, inclusive society is a priority for the Finnish authorities. Finland set out its vision for 2030 in the national digital compass, in line with the EU-level objectives. As the digital transition is at full speed in Finland, the country is focusing on research, development and innovation (RDI) in advanced technologies, 6G connectivity and opportunities deriving from the data economy. The production of semiconductors and quantum computing are also given a top priority. These developments in Finland are in a context of accessible online public services and a highly digitally literate population. ICT specialists remain sought after to meet labour shortages.

According to the **Special Eurobarometer 'Digital Decade 2024'[1], 78% of the Finnish population consider that the digitalisation of daily public and private services makes their life easier.** This is slightly above the EU average of 73%.

Finland is participating in the works to set up **European Digital Infrastructure Consortia** (EDICs) for the Genome EDIC, the Mobility and Logistics Data EDIC and Connected Public Administration EDIC (IMPACTS-EDIC). The country is finalising membership negotiations for the Local Digital Twins (LDT – CitiVERSE) EDIC and has decided to seek an observer status in the Alliance for Language Technologies one (ALT-EDIC)[2](both already set up). The country also participates in the EuroHPC Joint Undertaking, hosting LUMI, one of the supercomputers procured by the Joint Undertaking.

Finland's recovery and resilience plan dedicates 29% of its budget to digital policy measures (EUR 0.5 billion), with priorities given to e-Health, cybersecurity, and R&D in key technologies (6G, AI, quantum)[3]. Under Cohesion Policy, an additional EUR 0.4 billion (20% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[4].

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[1] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351

[2] Information last updated on 31 May 2024.

[3] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.

[4] This amount includes all investment specifically aimed at or substantially contributing to digital transformation in the 2021-2027 Cohesion Policy programming period. The source funds are the European Regional Development Fund, the Cohesion Fund, the European Social Fund Plus, and the Just Transition Fund.

Digital Decade KPI [1]	Finland			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	FI	EU
Fixed Very High Capacity Network (VHCN) coverage	70.8%	77.7%	9.8%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	50.3%	61.2%	21.5%	64.0%	13.5%	x	-
Overall 5G coverage	94.7%	98.4%	3.9%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		24		1 186		x	10 000
SMEs with at least a basic level of digital intensity	81.6%	85.6%	2.4%	57.7%	2.6%	90%	90%
Cloud	66.3%	73.0%	4.9%	38.9%	7.0%	75%	75%
Artificial Intelligence	15.8%	15.1%	-2.2%[2]	8.0%	2.6%	75%	75%
Data analytics	NA	40.6%	NA	33.2%	NA	75%	75%
AI or Cloud or Data analytics	NA	79.5%	NA	54.6%	NA		75%
Unicorns		7		263		x	500
At least basic digital skills	79.2%	82.0%	1.8%	55.6%	1.5%	87%	80%
ICT specialists	7.6%	7.6%	0.0%	4.8%	4.3%	10%	~10%
eID scheme notification		No					
Digital public services for citizens	91.6	90.6	-1.1%	79.4	3.1%	100	100
Digital public services for businesses	100.0	100.0	0.0%	85.4	2.0%	100	100
Access to e-Health records	90.1	82.6	-8.3%	79.1	10.6%	100	100

[1] See the methodological note for the description of the indicators and other descriptive metrics
[2] The variation between the two years is not considered statistically significant but in line with the stagnation of this indicator.

National Digital Decade strategic roadmap

With respect to **Finland's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating **a very high ambition** and based on this document, intends to allocate **significant effort** to achieve the Digital Decade objectives and targets.

The roadmap is ambitious and coherent including all objectives. Finland's national roadmap includes 2030 targets for all KPIs except for FTTP, edge nodes and unicorns. It also demonstrates ambitions in areas such as semiconductors and quantum. In total, all the national targets presented are aligned with EU 2030 targets. At this stage, trajectories are missing for FTTP, edge nodes, unicorns, take-up of cloud, AI and data analytics, digital public services for citizens and e-health. The roadmap covers all objectives of the Digital Decade, such as technological leadership, sovereignty, competitiveness, cybersecurity, protection of fundamental rights in the digital space and the green transition. The proposed set of measures to achieve them is underpinned by values such as trust and sustainability.

The total budget for the measures is an estimated EUR 499.7 million (0.2% of GDP). The priorities are the uptake of cloud, artificial intelligence and data analytics/big data, the development of quantum computing capacities, innovations in connectivity (such as 6G) and increasing RDI expenditure.

Recommendations for the roadmap

Finland should, when submitting adjustments to its national roadmap in accordance with Article 8(3) of

the DDPP Decision:

- **TARGETS:** (i) Propose a target and trajectory for **FTTP**, **edge nodes and unicorns,** design a trajectory for **VHCN, cloud, data analytics, AI, digital public services for citizens and e-health;** (ii) Propose a higher target for **basic digital intensity of enterprises.**
- **MEASURES:** (i) Strengthen the measures on **ICT specialists and gigabit**, add measures on **digital public services and e-health**; (ii) Review **the budget description** of all presented measures, duly highlighting national and EU sources such as Recovery and Resilience Facility; (iii) Provide **more information on the implementation of digital rights and principles** (and Digital Decade general objectives), including what national measures contribute to it.

Digital rights and principles

The Digital Decade Eurobarometer reveals detailed views from Finland on digital rights. While the majority find digitalisation beneficial, only 58% of Finns believe their rights are well protected by the EU, a 9-point drop since 2023 but still higher than the EU average (45%). Key concerns include safe internet for children and digital legacy control, with only 33% and 36% feeling secure, respectively. However, 71% feel they have sufficient freedom of expression and information online, up by 5 points. Positive trends are seen in access to high-speed internet (68% satisfaction, up 2%) and online privacy protection (69% satisfaction). The monitoring of the Declaration on Digital Rights and Principles shows that increasing the profile of the Declaration at national level and fostering better stakeholder engagement could help improve outcomes in the years to come[5].

A competitive, sovereign and resilient EU based on technological leadership

To underpin its technological leadership and competitiveness, Finland is equipped with excellent mobile network infrastructures, a high level of digitalisation of businesses and high level of investment in disruptive technologies. On infrastructures, Finland is already very close to reaching 100% coverage for 5G (98.4%). 5G in the 3.4-3.8 GHz band, essential for enabling advanced applications requiring large-spectrum bandwidth, covers 89.7% of Finnish households. The rate of deployment of gigabit networks (VHCNs) is rising steadily but the coverage remains slightly below the EU average. However, fixed broadband subscriptions with download speeds of 1 Gbps or more are at 4%, lower than the EU average of 18.5%.

85.6% of SMEs in Finland have at least a basic level of digital intensity and almost 80% use AI, Cloud or Data analytics. Companies are continuously encouraged to increase their productivity and competitiveness by tapping the potential of 6G, the data economy and AI. The Government and industry invest heavily in research and development across multiple digital areas, notably semiconductors, AI and quantum computing. The current approach to cybersecurity frames the issue as an exercise for the whole society, with public investments in citizen skills and resilience of businesses. The national strategy in this area will be updated in 2024.

Recommendations – Finland should:

- **CONNECTIVITY INFRASTRUCTURE:** (i) Intensify efforts to develop fixed gigabit connectivity, including by reinforcing public investments where necessary; (ii) Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to continue the deployment of 5G stand-alone core

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[5] See SWD 'Digital Decade in 2024: Implementation and perspective' with annexes, SWD(2024)260: https://digital-strategy.ec.europa.eu/en/news-redirect/833325, Annex 4.

networks.

- **AI/CLOUD/DATA ANALYTICS:** (i) Encourage enterprises to apply existing advanced technological solutions, such as AI or quantum testing possibilities and innovate further in these areas; (ii) Stimulate the adoption of next generation cloud infrastructure and services by companies of all sizes, including by liaising with the Cloud IPCEI Exploitation office and/or the coordinators and the Member States participating in the IPCEI-CIS.
- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.
- **TECHNOLOGICAL LEADERSHIP:** Secure further sources of funding and encourage private investment in disruptive technologies.

Protecting and empowering EU people and society

Finland is well equipped to deliver the digital transformation based on trust and putting people at the centre. Finland has already reached the EU-level target of at least basic skills with measures planned to boost societal resilience and to keep bridging geographical and demographical divides in formal and informal education and training. The country aims to achieve a 10% proportion of ICT specialists in employment, which requires keeping up the momentum, even though it performs better than other EU countries. To increase the number of employees with advanced digital skills, Finland's roadmap proposes a higher number of places in higher education institutions and incentives for foreigners. The country scores 90.6 in the accessibility of digital public services for citizens and 100 on access for businesses. The e-ID is very widely used, and in 2023 Finland has started the process to notify an e-ID for cross-border authentication under the eIDAS Regulation. Looking beyond the country's above-average performance in e-health, digital support in health and care services could help offset labour shortages in these fields and additional features of the e-health system – increase its user-friendliness.

Recommendations – Finland should:

- **BASIC SKILLS:** Continue empowering literacy of its population and developing competences in areas such as cybersecurity.
- **ICT SPECIALISTS:** Intensify efforts in attracting ICT specialists and offering tailored training paths as well as address the gender gap in this field.
- **e-ID:** Notify to the Commission an e-ID scheme under the eIDAS Regulation.
- **e-Health:** (i) Expand the coverage of the online access service to ensure that all citizens can access their electronic health data online; (ii) Widen the catalogue of data available to citizens in that service; (iii) Consider offering a mobile application for citizens to access their electronic health records and enhanced authentication methods.

Leveraging digital transformation for a smart greening

Finland's ambition for digital leadership is based on sustainability as an underlying value and the goal of facilitating a digital green transition. The government published a [Climate and Environmental Strategy for the ICT Sector](#) in 2021 in cooperation with the private sector and research community and keeps following its implementation. In Finland, research and other activities are ongoing to not only reduce its carbon footprint but also to create a handprint of technological industries. The aim is therefore to develop digital technologies that can help overcome global climate and environmental challenges. One example is the

choice of Finnish supercomputer LUMI to run the Climate Change Adaptation Digital Twin (Climate DT), a high-priority digital twin under the EU flagship initiative *Destination Earth*.

> **Recommendations – Finland should:**
>
> - Continue developing a coherent approach to twinning the digital and green transitions. First, promote improvements in energy and material efficiency of digital infrastructures, in particular data centres. Second, support the development and deployment of digital solutions that reduce the carbon footprint in other sectors, such as energy, transport, buildings, and agriculture, including the uptake of such solutions by SMEs.
>
> - Monitor and quantify the emission reductions of the deployed digital solutions in line with the relevant EU guidance and with the support of the methodology developed by the European Green Digital Coalition, in view of future policy development, as well as of attracting relevant financing.
>
> - Demonstrate leadership in using digital transition for environmental purposes by promoting national tools and methodologies at European level.
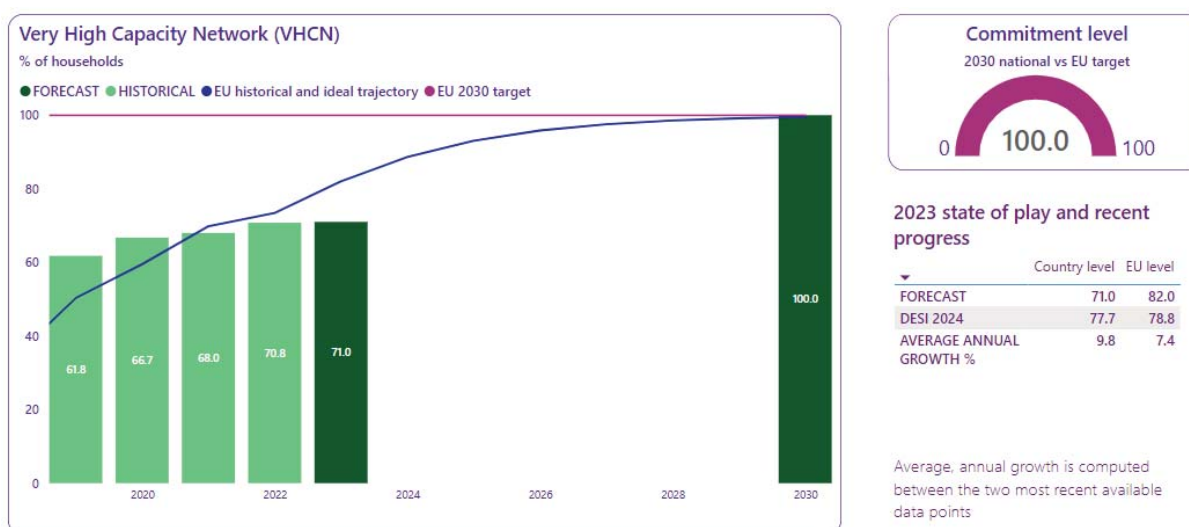
2 A competitive, sovereign and resilient EU based on technological leadership

Finland's vision for 2030 is to be a technological leader. The national digital compass and the roadmap underline the digital maturity of Finnish companies, with a high level of digital intensity and take-up of advanced technologies, notably cloud. The government emphasises the opportunities created by the data economy. Ongoing and planned investments show that there is scope to expand entrepreneurial success, also at international level, by increasing spending on RDI and multilateral cooperation between the state, industry, and academia to innovate and expand the use of disruptive technologies, such as AI and quantum. This transformation in Finland is happening in a context of a high cybersecurity culture and an excellent level of 5G coverage, and yet efforts are still needed to ensure high-speed fixed connectivity. For this purpose, Finland's recovery and resilience plan (RRP) includes a broadband aid scheme.
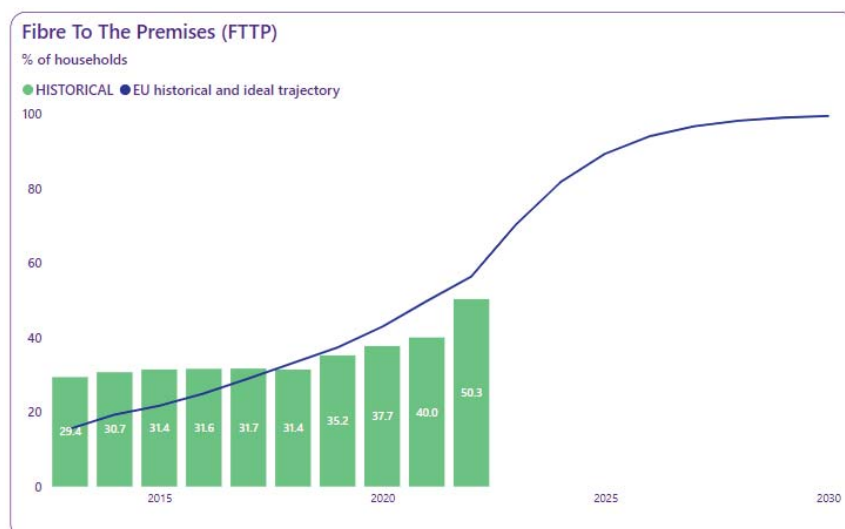
2.1 Building technological leadership: digital infrastructure and technologies

Finland is very active in rolling out connectivity infrastructure. 5G coverage is already very close to 100%, but fixed network coverage is slightly below the EU average, strongly influenced by the country's size and geography. Regarding advanced technologies, the country is also developing resilient quantum infrastructure and investing in semiconductors, making the most out of EU opportunities in those areas.

2.1.a Connectivity infrastructure (gigabit)

Very High Capacity Network (VHCN)
% of households
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

2020	61.8	
	66.7	
2022	68.0	
	70.8	
	71.0	
2030	100.0	

Commitment level
2030 national vs EU target

100.0

2023 state of play and recent progress

	Country level	EU level
FORECAST	71.0	82.0
DESI 2024	77.7	78.8
AVERAGE ANNUAL GROWTH %	9.8	7.4

Average annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Fibre To The Premises (FTTP)

% of households

● HISTORICAL ● EU historical and ideal trajectory

Bar values (HISTORICAL): 29.4, 30.7, 31.4, 31.6, 31.7, 31.4, 35.2, 37.7, 40.0, 50.3

Years shown: 2015, 2020, 2025, 2030

Commitment level

2030 national vs EU target

0 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST		70.3
DESI 2024	61.2	64.0
AVERAGE ANNUAL GROWTH %	21.5	13.5

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Finland has untapped potential to contribute to the EU's Digital Decade gigabit target while showing a positive dynamic. The Very High-Capacity Network (VHCN) and Fibre to the Premises (FTTP) coverage rates are both slightly below the EU average with VHCN at 77.7% against the EU average of 78.8% and FTTP at 61.2% against 64% in the EU. The VHCN rural coverage (39.3%) is markedly below the EU average (55.6%). However, the dynamics of VHCN and FTTP deployment is faster than average in the EU, with an annual growth rate of 9.8% for VHCN and 21.5% for FTTP. Fixed broadband subscriptions of 1 Gbps or more download speeds are at 4%, significantly lower than the EU average of 18.5%.

Given Finland's geography, including large sparsely populated areas, deployment of broadband is frequently not economically viable. To tackle this, Finland adopted a broadband aid scheme tied to the Recovery and Resilience Facility (RRF) with a budget of EUR 32 million. 41 State aid decisions were granted amounting to EUR 27 million in total, which ensure that almost 16 000 households will receive fibre connection by mid-2026. The Ministry of Transport and Communications has published a study on the need to continue the broadband aid scheme. Currently there are no preparations for a new aid scheme. This outlook on future development of fixed connectivity and the need to promote broadband investments were included in Finland's roadmap. On the other hand, in 2023 fibre gained significant prominence on the market and was deployed at a fast pace in residential areas. Several operators have announced hundreds of millions of euros of investments for the upcoming years.

Finland aims to reach 100% VHCN coverage by 2030 in line with the EU target for 2030. This target value is linked to a modest starting point. However, based on the current rate of progress, this level of ambition is achievable, and Finland can make a strong contribution to this target.

2.1.b Connectivity infrastructure (5G)
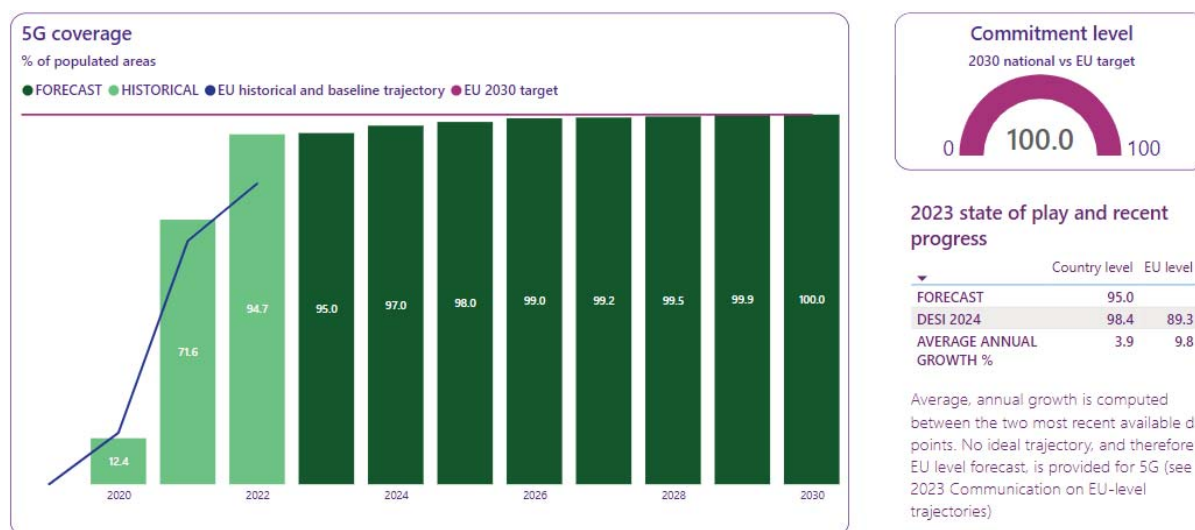
Note: The source of national forecast values is the 2023 country roadmap

Finland brings a positive contribution to the EU's Digital Decade 5G target. 5G coverage in Finland (98.4%) is well above the EU average (89.3%). The deployment rate is sustained (3.9% annual growth) but below the very high average rate in the EU (almost 10% annual growth). This might be due to the frequent issue of the rate of deployment slowing down at the last stage since Finland is already very close to the target. In 2023, 5G in the 3.4-3.8 GHz band, essential for enabling advanced applications requiring a large spectrum bandwidth, covered 89.7% of Finnish households, significantly above the EU average (50.6%). In general, mobile broadband take-up is very high with 97.7% of people using internet on their mobile devices, against the EU average of 89.9%.

Finland has set a 100% 5G target and presented a viable trajectory to achieve it. At the current rate of progress and given that the current performance is higher than the country's own projections (actual rate of 98.4% against forecast of 95%), Finland' will continue to make a very significant contribution to this EU target.

Finland's roadmap introduced a new measure to reach the connectivity targets. For mobile networks, the measure aims to optimise the efficient use of frequencies within the bandwidth of existing frequency bands and to contribute to the target until 2030. This will involve reviewing licence conditions for 2G technology in certain frequency bands, taking account of public interest objectives and the potential to use the frequencies released from the 2G network to develop wireless broadbagernd.

2.1.c Semiconductors

Finland has a very R&D driven semiconductors industry and is willing to increase national support to boost the sector's competitiveness and contribute to the EU's resilience and sovereignty. Despite having relatively small share of the global semiconductor industry (0.2% of total), Finnish industry has invested significantly over the last five years (e.g., expansions of Okmetic wafer fab and Murata MEMS fab, Vaisala R&D centre) and plans to continue investing as one of the R&D heaviest industries (15-20% of revenues in R&D). Cooperation between industry, VTT and universities contributes to this success. Overall, Finnish companies generated approximately EUR 1.6 billion in revenue in 2022 in this sector and expect to double this figure by 2030.

Finnish industry has faster growth prospects than the global industry average. The development-friendly dynamic is also visible through the industry association Technology Industries of Finland under which the

Semiconductors Branch Group worked on a [semiconductor strategy 'Chips from the North' released in April 2024](). The strategy recommends Finland widen its competitive advantages in semiconductors and microelectronics in six spheres: chip design (in mobile networks, edge AI and system-on-chip), MEMS (microelectronical system) and sensor technologies, the photonics value chain, quantum, advanced semiconductors materials and sustainable manufacturing.

Finland has set a 2030 target for semiconductors. Qualitative in nature, it consists of a pilot production line for manufacturing semiconductor components or an industrial scale semiconductor component production plant that is connected with European and global semiconductor research. In April 2024, Chips Joint Undertaking concluded the selection of four new semiconductor pilot lines to be implemented in Europe. VTT, Technical Research Centre of Finland, and Tampere University are among the four consortia behind the pilot lines. The national share of the funding for VTT and Tampere University is ensured. Finland is also preparing its competence centre on semiconductors in accordance with the European Chips Act, for which the call will open in summer 2024. The pilot lines and the competence centre will enable the RDI environment to thrive and further allow new products and services to be scaled up to an industrial scale, as well as foster industrial investments into Finnish semiconductor ecosystem, thus meeting the country's target.

In addition, Business Finland, the Finnish Funding Agency for Innovation, launched campaign on microelectronics, photonics and quantum business (The Chips Campaign) in April 2024. The objective of The Chips Campaign is to support Finnish microelectronics, photonics and quantum (Hardware (HW) Tech) sector to seize the emerging business opportunities in Europe and select global markets, related to restructuring of the global value chains. The campaign facilitates Finnish companies to develop their competitive edge and to find new sources of business growth based on investments into RDI activities.

With an innovative semiconductors ecosystem, a concrete strategy, and the spirit of close cooperation under the EU Chips Act, Finland can strongly contribute to the EU-level target of 20% global production value.

2.1.d Edge nodes

The latest indicators estimate 24 edge nodes in Finland, out of 1186 estimated edge nodes in the EU. For the time being, Finland's roadmap does not set a national target or trajectory was for edge nodes in to contribute to the EU target of 10 000 climate-neutral and secure edge nodes. However, as explained in the roadmap, Finland supports the EU-level target through measures relating to data portability-promoting infrastructure, the creation of environments and ecosystems for high-performance computing and for handling protected data, in developing of AI capabilities, and creating the business conditions and investments required to link all these. Combining the proposed actions with edge deployment could further stimulate technological progress.

2.1.e Quantum technologies

In addition to microelectronics, quantum technologies is a sector where Finland acknowledges its strong competence and competitive advantage. Participating in the EuroHPC joint undertaking, Finland is home to Europe's fastest supercomputer LUMI, which is in part utilised to develop quantum capabilities. Companies can use LUMI's high-performance computing (HPC) as part of RDI activities. Finland is also part of the LUMI-Q consortium which aims to provide academic and industrial users with a quantum computer based on superconducting qubits. In April 2024 the Finnish government decided to allocate up to EUR 250 million for the acquisition and operation of a new EuroHPC supercomputer replacing the LUMI, as its competitive operating time of the EuroHPC LUMI supercomputer is about to end in 2027.

Finland's roadmap sets a target to have a quantum computer with a minimum of 50 qubits in use in Finland by 2025. It commits to provide an additional EUR 70 million from national sources to upscale the quantum computer towards 300-qubit at a later stage. To boost Finland's quantum potential, in January 2024 the Finnish Quantum Flagship project was awarded EUR 13 million by the Research Council of Finland.
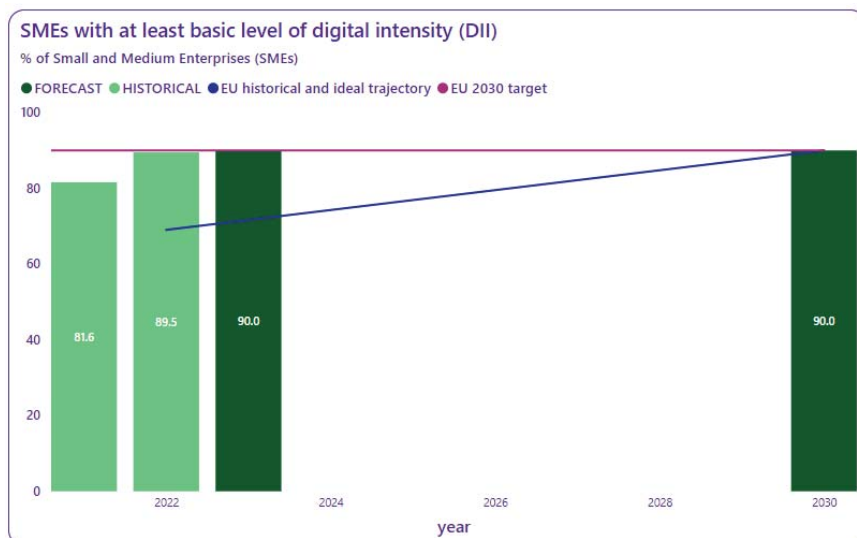
Finland's ambitions are realistic given the continuous developments in the field. VTT's 5-qubit quantum computer is open to Finnish and European companies to develop quantum algorithms. It is also connected to the LUMI supercomputer. This connection enables the best possible use of the quantum computer's computing power. In October 2023 VTT launched a 20-qubit quantum computer. To make best use of existing opportunities, Business Finland has recently launched a **Quantum Computing Campaign** to encourage companies and researchers to develop competitive quantum computing software stack and related services in Finland. Under the EuroQCI intiative, Finland is also setting up a quantum communication infrastructure network, with support from the Digital Europe Programme.

With the clear aim to boost its potential for semiconductors and quantum computing, Finland is stepping up on technological sovereignty and resilience. The indications are that Finland is following the 2023 recommendation to help the EU become a strong market player in these areas.

2.2 Supporting EU-wide digital ecosystems and scaling up innovative enterprises

Finnish enterprises navigate well in the digital ecosystem. Its current performance is close to the EU targets of SMEs with at least basic digital intensity and joint uptake of advanced technologies by enterprises. Finland is seeking to maximise the potential of the data economy, achieve an even higher adoption rate of disruptive technologies and foster its start-up ecosystem.

2.2.a SME with at least a basic level of digital intensity

SMEs with at least basic level of digital intensity (DII)
% of Small and Medium Enterprises (SMEs)
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Note 1: DII 2022 is version IV that is not comparable with DII 2021, that was version III. The EU-level ideal trajectory refers to DII version IV, as published in the 2023 Communication on EU-level trajectories

Note 2: The source of national forecast values is the 2023 country roadmap

Commitment level
2030 national vs EU target

90.0

2023 state of play and recent progress

	Country level	EU level
FORECAST	90.0	71.6
DESI 2024	85.6	57.7
AVERAGE ANNUAL GROWTH %	2.4	2.6

In the case of DII, the average, annual growth is computed between 2023 and 2021 due to data comparability reasons.

Finland brings a very strong contribution to the EU's Digital Decade target on digitalisation of SMEs while showing positive dynamic. Finland performs significantly above the EU average with 85.6% of SMEs with at least a basic level of digital intensity (EU average: 57.7%). This represents an annual growth of 2.4% over the two years since 2021, which is the last comparable year that used a similar methodology to measure the digital intensity of enterprises. This progress is similar to the average progress in the EU, keeping up a good pace despite the strong starting point.

Since 2021, Finland has been digitally empowering SMEs with the RRF-funded 'Real Time Economy' project (EUR 14 million). The aim of the programme is to digitalise the entire life cycle of companies. It envisages an ecosystem of digital documents, such as invoices and receipts linked with the use of digital identity and automatic transfer of necessary data between business partners and authorities. In addition, in September 2023, the social enterprise Digital Commerce Finland was established with the aim of accelerating the growth of digital commerce. The community will include, among others, online stores and SMEs of the commercial sector.

Finland has set a target of 90% for the level of digital intensity of enterprises, in line with the EU target. To achieve this, Finland's roadmap envisages support from four Finnish hubs in the European Digital Innovation Hubs (EDIHs) network until 2029. Robocoast, HealthHub Finland, Finnish AI Region (FAIR) and Location Innovation Hub are half-funded by the Digital Europe programme. They create opportunities for enterprises to be more extensively involved in taking advantage of digitalisation and data economy services and in the role of producers in innovation and business ecosystems.

2.2.b Take up of cloud / data analytics / AI
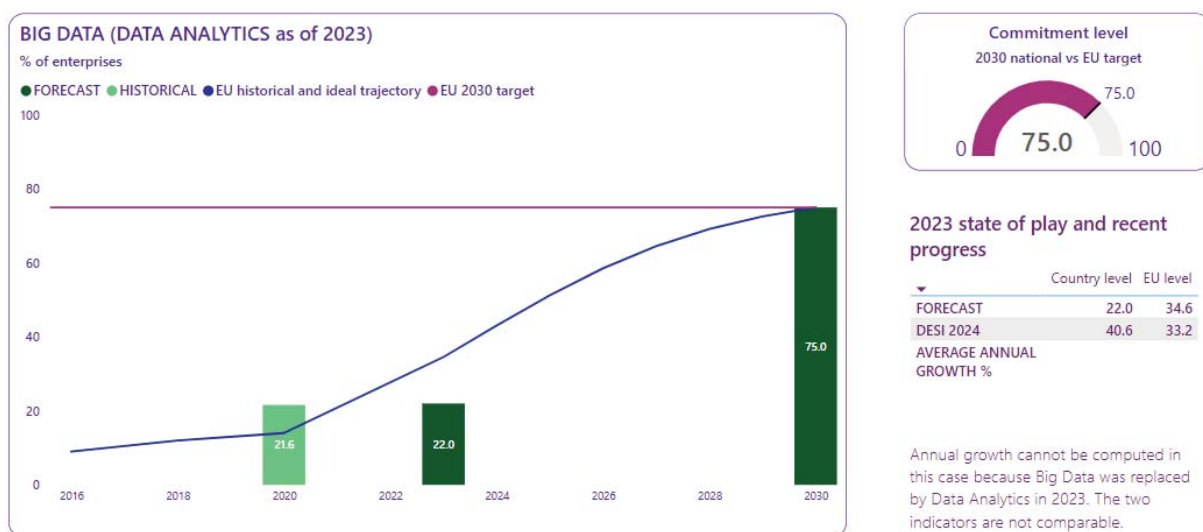
- **Cloud**

Note: The source of national forecast values is the 2023 country roadmap

Finland brings a very strong contribution to the EU's Digital Decade cloud target while demonstrating a limited dynamic. The take-up of cloud solutions by Finnish enterprises (at 73% in 2023) is almost double the EU average (38.9%). It has increased steadily since 2021 with an average annual growth of 4.9% while the EU is improving slightly faster with 7%.

Finland presented in its roadmap a level of ambition equal to the EU-level target for 2030 of 75% of enterprises adopting cloud and is very close to achieving this target. The roadmap details two measures consisting of existing programmes related to data ecosystems and digital innovation, such as EDIHs, which will contribute to this goal.
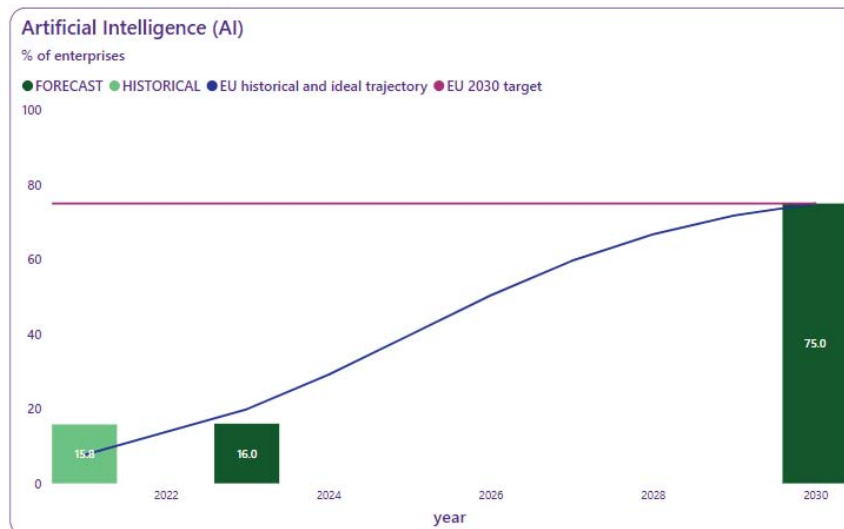
- **Data analytics (Big data)**[6]

BIG DATA (DATA ANALYTICS as of 2023)
% of enterprises
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Commitment level
2030 national vs EU target

75.0

0   75.0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST	22.0	34.6
DESI 2024	40.6	33.2
AVERAGE ANNUAL GROWTH %		

Annual growth cannot be computed in this case because Big Data was replaced by Data Analytics in 2023. The two indicators are not comparable.

Note: The source of national forecast values is the 2023 country roadmap

Finland brings a very strong contribution to the EU's Digital Decade target for the use of data analytics by enterprises. On this indicator, Finland (at 40.6%) ranks above the EU average (33.2%). Progress cannot be assessed since the definition of this indicator has changed.

The level of ambition in Finland's roadmap is equal to the EU's target for 2030 for 75% of enterprises to adopt data analytics. To encourage a wider adoption of the business paradigm to make advanced use of data, Business Finland's Digital Native agenda implements the data economy programme, with envisaged funding of EUR 135 million up to 2027. The measure is specifically designed for Finnish SMEs to understand the added value and importance of data sharing, initiate change within companies, build global data economy ecosystems in Finland, and accelerate new exports created with the help of data economy solutions. Promoting other advanced technologies, such as high-performance computing which enables novel methods in data analytics, can also help Finland reach this ambitious target.

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[6] As of 2023, Eurostat changed the Big Data into a Data Analytics indicator. For this reason, no comparison is possible with previous years. For this reason, no comparison is possible with previous years.

- **Artificial** **Intelligence**

Artificial Intelligence (AI)

% of enterprises

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

Note 2: The source of national forecast values is the 2023 country roadmap

Commitment level

2030 national vs EU target

75.0
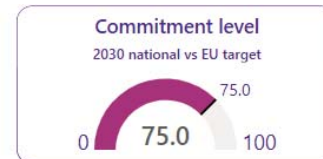
2023 state of play and recent progress

	Country level	EU level
FORECAST	16.0	19.9
DESI 2024	15.1	8.0
AVERAGE ANNUAL GROWTH %	-2.2	2.6

Average. annual growth is computed between the two most recent available data points.

With 15.1% of enterprises using artificial intelligence, Finland brings a very positive contribution to EU's Digital Decade target on AI while demonstrating very limited dynamic. The decrease since 2021 data is not significant and can be explained by various sources of statistical errors such as non-sampling errors or changes in business demography.

Finland's innovation-friendly business ecosystem fosters the adoption of AI by companies. As AI generates added value for data, Finland plans to accelerate the use of this technology with a view to complete its data economy agenda. In addition, similarly to data analytics, the commercial use of high-performance computing enables the use of novel methods in artificial intelligence.

Finland presented in its roadmap a level of ambition equal to the 2030 EU target to reach 75% of enterprises adopting AI. The roadmap refers in this regard to the Finnish EDIHs, such as the Finnish AI Region, and the Digital Native mission. In addition, Finland continuously works to implement its AI strategy, as described in the 2023 report.

Finnish industry is also involved in the AI transformation of enterprises. In November 2023, Technology Industries of Finland announced an investment of EUR 10 million in accelerating the uptake of AI in Finland. The focus will be on recruiting international experts in AI research and teaching (EUR 3.8 million), industrial AI development between member companies (EUR 2.8 million), grants for university students' research (EUR 2.4 million) and the launch of a business-driven AI network (EUR 1 million). An additional EUR 3.2 million will be granted to set up Aalto University's new AI research centre.

- **Take-up by enterprises of cloud or data analytics or AI**

Taking the three technologies together (adoption of either AI, cloud, or data analytics), Finland stands at 79.5%, significantly above the EU average of 54.6%. This means that Finland has already achieved the EU-level target, but the country could still make further progress, as demonstrated by the opportunities reported by the authorities and the potential for synergies with private initiatives.

2.2.c Unicorns, scale-ups and start-ups

Finland's start-up ecosystem is very dynamic and backed by the government's initiatives to foster innovation and find funding opportunities. These actions match the expectations of 86% of Finland's population who, according to the Digital Decade Eurobarometer, consider that public authorities should

ensure that European companies can grow and become European champions able to compete globally. In 2023 Business Finland granted companies EUR 599 million, of which EUR 416 million is for innovation funding and EUR 127 million for research. Specifically for start-ups, in 2023 Business Finland launched a deep tech funding pilot to promote the take-up of research results in start-ups and to speed up their market entry. 17 start-ups received nearly EUR 7 million. In 2023, Finland was home to seven unicorns.

Venture capital investments in seed and start-up capital amounted to 8% of GDP in 2022, one of the best results in the EU. To further promote capital investment, the Business Finland Venture Capital Ltd (BFVC) recently created a Co-Investment Fund. It provides equity financing to Finnish start-up companies alongside business angel syndicates. Since December 2023, the national company has invested EUR 30 million in the fund. Finnish Industry Investment Ltd (Tesi) also provides support to Finnish start-ups directly or through venture capital, strengthening synergies between private and public investment. Since Finland joined NATO in 2023, Tesi now participates in the NATO Innovation Fund, creating fresh opportunities for Finnish start-ups innovating in dual-use technologies.

The roadmap presents a clear, qualitative objective for start-ups by 2030, as Finland wants the start-up ecosystem to grow in number and delivery and to compete fairly at a global scale. For this purpose, start-ups can, among other options, make use of EDIHs and Digital Native Finland mission of Business Finland. The Digital Native mission encourages companies to increase their productivity and competitiveness by investing in connectivity with the 6G Bridge programme (EUR 130 million funding until 2026) and the data economy (mentioned above). Finland expects to launch an additional data economy growth programme in 2024-2025.

2.3 Strengthening cybersecurity & resilience

The Finnish authorities consider resilience to be indispensable for the country's digital development. Finland's digital compass underlines that 'Cyber security and information security must be seen a natural part of each organisation's and individual's social responsibility'. The document also sets the objective for 2030 for Finland's critical infrastructure to have a high level of cyber resilience and a strong international cyber industry ecosystem, matching the EU-level objective of digital sovereignty and resilience. Finland's cybersecurity strategy is currently being renewed to respond to the changed operating environment, alongside ongoing work to make the public administration and critical infrastructure prepared for cyber and information threats.

With this strong sense of priority programmes are available to foster a cybersecurity culture. 'Cyber Citizen' is an RRF-funded initiative to develop a common, shared model to develop cybersecurity skills across the EU. The website, available in Finnish and English, gives everyone access to learn and contribute to a safe and secure online environment. The country has also invested almost EUR 3.5 million for two higher education institutions to develop, coordinate and provide together higher education in cybersecurity. Kajaani University of Applied Sciences is one of the pledger organisations and the only university so far that has offered free cybersecurity training in the Cybersecurity Skills Academy on the EU Digital Skills and Jobs Platform.

As companies rely increasingly on digital technologies, their risk of exposure to cybersecurity incidents is also increasing, as is their need for preparedness in this area. According to Eurostat, in 2022 98.2% of Finnish SMEs had some ICT security measures in place (EU average 91.8%). In the same year, a limited proportion of all enterprises (33.5%) reported being insured against ICT security incidents (EU average 25%). To enhance SME cybersecurity capabilities, the Finnish Transport and Communications Agency Traficom in its capacity as the European Cybersecurity Industrial, Technology and Research Competence Centre's National Coordination Centre Finland (NCC-FI) officially commenced operation in early 2023 and supported

the first companies at the end of that year. Enterprises are also encouraged to enhance their risk-awareness by following programmes such as *Kybermittari*, a customised assessment of their level of cybersecurity maturity along with supply chain and follow-up with best practices for the specific sector

3 Protecting and empowering EU people and society

3.1 Empowering people and bringing the digital transformation closer to their needs

Finland has designed its digital transition to have a strong human-centred approach making trust one of the core values. Finnish population's performance on digital skills suggests a high level of digital inclusion, with measures planned to keep bridging geographical and demographical divides in formal and informal education and training. With a comparatively high percentage of ICT specialists compared with other countries, Finland is nonetheless seeking to increase the number of employees with advanced digital skills by increasing the number of places in higher education institutions and incentives for foreigners. The country scores 90.6 on accessibility of digital public services for citizens, at 100 on their accessibility for businesses, and use of the e-ID is extensive. Digital support for the health system, funded also by the recovery and resilience plan, enables a smoother experience and improved access to services. Finland plans to use digital technologies in health and care services to ease the consequences of labour shortages in these sectors.

3.1.1 Equipping people with digital skills

3.1.1.a Basic digital skills

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Finland brings a very positive contribution to the EU's Digital Decade target on basic digital skills while continuously demonstrating a positive dynamic. Over the last year, the country has reached the EU 2030 target and even surpassed it. 82% of people have at least basic digital skills, with a very good age and gender balance. The dynamics of skills development is also higher than the EU average, with an annual growth rate of 1.8% (EU average: 1.5%). 53.6% of the Finnish population has above basic digital skills, almost double the EU average of 27.3%.

Finland is developing a comprehensive set of policies for digital formal education and as part of lifelong learning. Following the 2023 adoption of Policies for the Digitalisation of Education and Training until 2027 which set out the vision for sustainable digitalisation in teaching and learning, further analysis has been carried out for all stages of education, from early childhood and care, to secondary education, including

vocational training. Qualifications in vocational education are being revised to update and strengthen digital green competence.

Finland has set a target to reach 87% of population with at least basic digital skills, above the EU-level target. Given that the baseline is at 79% according to the 2023 Digital Decade report, the goal is not overly ambitious. The trajectory also seems realistic and in fact in 2023 Finland exceeded the forecast value for that year (82% versus 79%).

Finland's roadmap presents three new measures that aim to improve media literacy, better digital inclusion and societal dialogue on these topics. To promote ICT competences, critical literacy and digital participation among students, adults and special groups, Finland plans to use national and RRF funds on measures running up to 2026, including through its digitalisation programme and reform of continuous learning. In 2024 the government launched a series of discussion with stakeholders on digital bildung in society. This is a follow up to the action taken in 2023. Moreover, to get a comprehensive picture of media literacy, the National Audiovisual Institute KAVI is taking part in a pan-Nordic project to develop a set of indicators for measuring certain aspects of media literacy (Nordic MIL Index).

Given the overall high level of digitalisation of the Finnish economy and society, it is crucial to reach the highest possible level of basic skills to ensure no one is left behind. The objective to exceed the EU target is underpinned by existing initiatives and the measures contained in the roadmap.

3.1.1.b ICT specialists

Note: The source of national forecast values is the 2023 country roadmap

Finland continuously brings a very positive contribution to the EU's Digital Decade target for ICT specialists. The share of ICT specialists in Finland in overall employment is 7.6%, the same as the previous year and still one of the highest in the EU. In absolute numbers, Finland hosts 200 700 ICT specialists, which is 2 800 more than the previous year. Women represented 22.2% of ICT specialists, above the EU average (19.4%) but less than the previous year (23.8% according to the 2023 report, a decrease of 2600). Finland has one of the highest rates of ICT graduates in the EU, with 8.1% of all graduates studying ICT (EU average: 4.5%) and 2.1% of graduates being female ICT graduates.

Looking at the change over time in the number of ICT specialists, the target set by Finland in the roadmap is considered ambitious and acknowledged as such. Finland also plans to increase the share of women ICT

specialists. The proposed trajectory to reach the EU-level target (10% by 2030) requires progress faster than the dynamics observed so far. However, with one of the highest shares of ICT specialists in the EU, Finland is at a good starting point to fulfil this national and EU-level ambition.

Good digital competences, a tech-oriented business sector and the country's strong innovation agenda contribute to the interest in following a career in ICT technologies. Pilots have started to provide targeted training to match labour market needs, for example courses for data management experts at the University of Tampere. To follow full curricula at higher education institutions, in 2020 –2022 over 2 200 separately funded additional student places were allocated to the ICT sector at universities. These students are expected to graduate over the coming years, so that effects of this action will soon become visible. In 2024-2027, 1 000 pilot doctoral positions will be funded by the Ministry of Education and Culture, large part belonging to programmes in cancer medicine, artificial intelligence, and software development. Notably, out of these 1 000 places 190 is allocated to Finnish Doctoral Program Network in Artificial Intelligence and to Quantum projects and another 110 places are allocated also to software development, intelligent work machines and microelectronics.

To increase the number of ICT specialists, Finland takes a multifaceted approach with three new measures in its roadmap. As a continuous measure up to 2030 Finland proposes to increase the attractiveness of STEM sectors at all levels of education through close cooperation with stakeholders. Regarding university studies, it plans to adjust the curricula of ICT education to better match labour market needs and boost completion rates. It will disburse EUR 41.3 million by 2027 to increase the number of student places, although this sum is primarily designed for sectors with even more imminent labour shortages, such as early childhood education and care, health and social services. Alternative educational pathways might be developed. To boost the availability of skilled professionals in the field, the country plans to bring in additional incentives for international students to stay in Finland to work after graduation, for example by waiving tuition fees. However, the roadmap does not include any specific measures to close the gender gaps in the ICT workforce.

Looking at the current performance being above the level forecasted by the country, the measures reported in the Finnish roadmap seem to support the high level of ambition of the proposed trajectories in terms of their diversified scope. However, in terms of intensity, more action could be envisaged. In addition, specific measures could be considered to encourage women to take up the profession of ICT specialists.

3.1.2 Key digital public services and solutions – trusted, user-friendly, and accessible to all
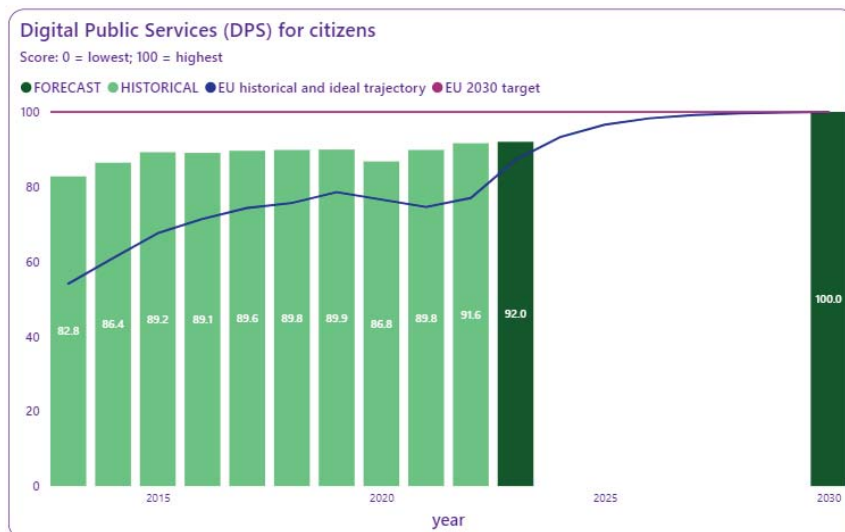
3.1.2.a e-ID

94.4% of Finland's population used e-ID for private purpose within the last 12 months, similar to other Nordic countries and more than double the EU average (41.1%). In 2023 Finland has started the process to notify its e-ID scheme for cross-border authentication under the eIDAS Regulation. In 2024 Finland will prepare for the adoption of the European Digital Identity Framework by also preparing and discussing a national legislative proposal including the technical requirements needed for the digital wallet application. The preparatory work is being coordinated by the Ministry of Finance, which has set up a project to implement the obligations of the revised eIDAS Regulation.

Finland participates in three European consortia to pilot the cross-border use of digital wallet: Multi-Country Digital Credentials for Europe (DC4EU), EU Digital Wallet Consortium (EWC) and PilOTs for EuropeaN digiTal IdenTity wALlet (POTENTIAL). The POTENTIAL consortium, which has received EUR 16 million in EU subsidies (through the Digital Europe programme), is a 'large scale pilot' aimed at piloting a prototype European Digital Identity Card through six use cases. It aims to test the deployment of a digital

identity wallet to simplify and secure online procedures for European citizens, to facilitate the processing of procedures by the administration, and to combat identity theft. It involves 19 EU Member States and Ukraine, including 38 ministries, 34 state operators, 9 research centres, 51 large companies and 12 start-ups. The development and testing of the European digital identity wallet will run for 26 months in two phases: a first phase to test national solutions until October 2024 and a second phase with cross-border tests to ensure the different solutions are interoperable.

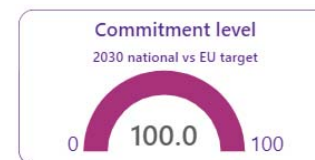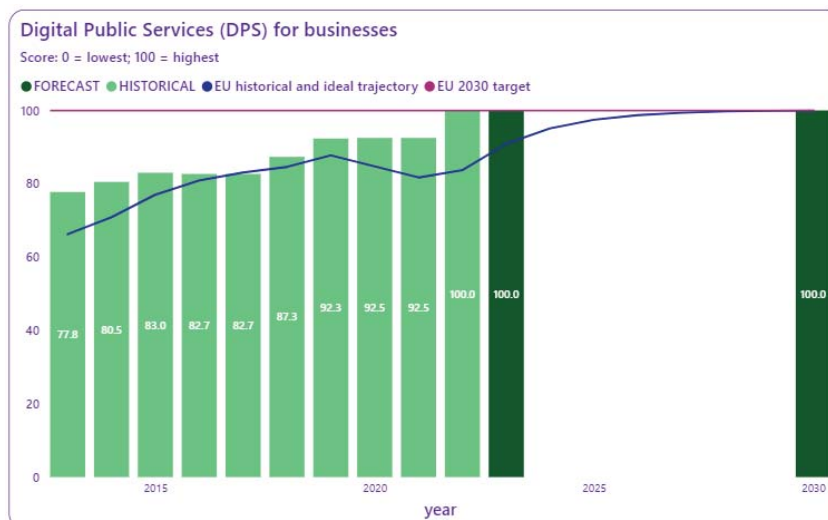### 3.1.2.b Digitalisation of public services for citizens and businesses

Digital Public Services (DPS) for citizens
Score: 0 = lowest; 100 = highest
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Values: 82.8, 86.4, 89.2, 89.1, 89.6, 89.8, 89.9, 86.8, 89.8, 91.6, 92.0, 100.0

Commitment level
2030 national vs EU target
100.0

2023 state of play and recent progress

	Country level	EU level
FORECAST	92.0	87.2
DESI 2024	90.6	79.4
AVERAGE ANNUAL GROWTH %	-1.1	3.1

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Digital Public Services (DPS) for businesses
Score: 0 = lowest; 100 = highest
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Values: 77.8, 80.5, 83.0, 82.7, 82.7, 87.3, 92.3, 92.5, 92.5, 100.0, 100.0, 100.0

Commitment level
2030 national vs EU target
100.0

2023 state of play and recent progress

	Country level	EU level
FORECAST	100.0	90.9
DESI 2024	100.0	85.4
AVERAGE ANNUAL GROWTH %	0.0	2.0

Average, annual growth is computed between the two most recent available data points
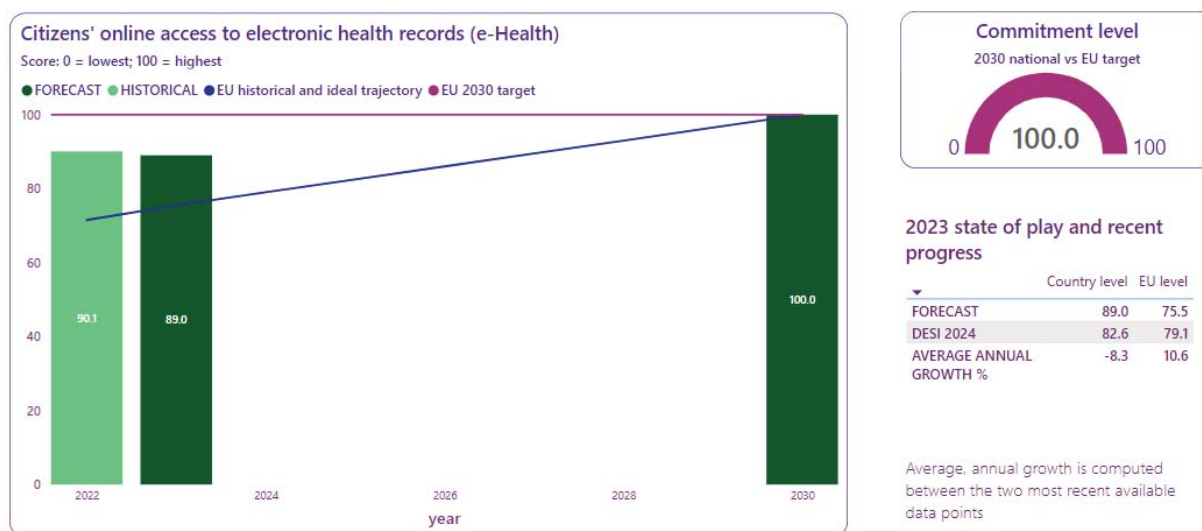
Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Finland brings a very strong contribution to the EU's Digital Decade target while demonstrating a varied dynamic. On both public services for citizens (90.6) and businesses (100), Finland ranks significantly above the EU average. Its score on citizens decreased slightly due to lower scores in sub indicators such as health and justice. Nonetheless, e-government services are almost universally used, as 97.6% of Finnish internet users did so in the last 12 months (EU average: 75.0%). Since Finland achieved the EU-level target related to businesses already last year, no progress was possible.

Finland aims to reach the EU-level target of making 100% of key public services available online by 2030. Having already partially reached this target, the country is on track to maintain and improve its results by providing people with digital support: making training available online, providing hands-on support in libraries and through NGO action. Projects are ongoing to further digitalise public and private services that people need for certain life and business events, for example to make it easier to manage the affairs of a deceased relative. A remaining challenge acknowledged by Finland is to enable the smooth and safe exchange of user data across different sectors and applications.

3.1.2.c e-Health

Note: The source of national forecast values is the 2023 country roadmap

Finland brings a positive contribution to the Digital Decade e-health target while showing a very limited dynamic. The overall e-health maturity score was 82.6 in 2023, compared, however, to 90 in 2022. The decrease could be explained by more enhanced reporting compared to previous years. Nonetheless, the 2023 result is still above the EU average of 79.1. A centralised, nationwide access service is technically available in Finland. 60-79% of the national population is technically able to access the online access services for e-health records through online portal(s), logging in using an e-ID with a two-factor authentication. However, a mobile application is not available. The online access service follows the guidelines on web accessibility and most categories of data are available to citizens on the platform, except for allergies, medical devices/implants, medical images and hospital discharge reports which are not yet available to citizens. On a positive note, all categories of surveyed healthcare providers supply relevant data. In addition, 82.6% of Finland's population sought health information online, much higher than the EU average (56.3%).

For 2030, Finland aims to achieve score of 100 in e-health, in line with the EU target. In its roadmap Finland considers this target to be achieved given the 100 e-government benchmark result from 2021-2022. The measures for this indicator are not covered by Finland's roadmap.

Tapping the digital potential for health and wellbeing remains a priority for Finnish authorities. In December 2023 the Ministry of Social Affairs and Health released its new digital strategy with a focus, i.e., on easiness of use and customisation of digital health tools and using advanced technologies to ease the workload of health personnel. Health innovation is facilitated at multiple levels. For example, all five university hospital cities have their own health ecosystems including social and health service providers, industry, and academia. Test beds and innovation hubs also focus on health data and innovation. Finland is

involved in the preparations for the possible future Genome EDIC and for the implementation of the European Health Data Space Regulation focusing first on primary use of health data and patient rights.

3.2 Building a safe and human centric digital environment and preserving our democracy

According to the Digital Decade Barometer, 75% of Finland's population considers digital technologies will be important for engaging in democratic life by 2030, on par with the average view in the EU (74%). There is a strong perception that public authorities should step up to help achieve secure and human-centred online interactions: 95% of Finnish respondents indicate that building efficient and secure digital infrastructures including connectivity and data processing facilities should be important for authorities (EU average: 84%) and 89% respondents share this view towards shaping the development of AI and other digital technologies to ensure they respect rights and values (EU average: 78%). However, hate speech is a growing problem in Finland since 46.3% of the population encountered messages online that were considered hostile or degrading the last 3 months preceding a Eurostat survey, significantly above the EU average of 33.5%.

To respond to safety risks online and encourage responsible participation in the digital public space, the Finnish Competition and Consumer Authority created an online learning environment, KKV-campus with courses on several topics, such as influencer marketing. On a similar note, the Finnish data protection authority cooperates with the third sector to explain GDPR to children and ensure GDPR-compliance of their activities.

Finland shows that digital infrastructures can also support democratic innovation. Following the results of an analysis carried out by the Finnish Innovation Fund Sitra, the governmental platform set up to facilitate citizen's legislative initiative not only enables to publish projects and collect signatures, but also offers security and accessibility features and ensures integration with other government information systems, for example, to check authenticity of signatures[7].

Best practice: Coordination Group for Digitalisation (the Digital Office)

Created first in October 2021, the Coordination Group for Digitalisation (the Digital Office) brings together all government ministries and their representatives and serves as the secretariat for the ministerial working group on reforming society in the areas of digitalisation and the data economy. Its aim is to plan, implement and prioritise measures at government level in a uniform and coordinated manner to maximise interoperability and ensure no sub-area lags behind with slower progress.

The Digital Office manages cross-sectoral cooperation, coordination and information flow at ministerial level, director-general level and expert level. The four most digitally-involved ministries chair its operations on a rotational basis. The Digital Office also acts as a single contact point for stakeholders on matters related to digitalisation, ensuring regular and flexible cooperation also outside the public administration.

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[7] Maarja-Leena Saar, Onni Pekonen, Maarja Olesk, Henna Hiilamo, Citizen's initiatives in Finland and Estonia: The journey so far, Sitra's working paper, March 2024, p. 41.

4 Leveraging digital transformation for a smart greening

Finland's ambition of digital leadership is underpinned by the value of sustainability and the goal of facilitating the digital and green transitions. Finland's digital compass envisages that in the future, Finland will develop and apply digital technologies that respond to global climate and environmental challenges. The country therefore aims to go one step further – not only to minimise the carbon footprint of advanced technologies on the environment but to use them to create a more resource-efficient economy and society. Finland's roadmap underlines this vision and highlights specific measures supporting the green transition, such as the Climate and Environmental Strategy for the ICT Sector published in 2021.

Finnish enterprises and citizens are also sensitive to the green transition of the digital sector. 80% of the Finnish population consider that public authorities should ensure that digital technologies serve the green transition, on par with the EU average (81%). In Finland, 44.4% of enterprises considered the environmental impact of ICT services, or ICT equipment, before selecting them and applied some measures, affecting the paper or energy consumption of the ICT equipment, which is along the EU average. People in Finland tend to recycle their ICT devices (17.7% for laptops and tablets, 20.4% for desktops) significantly more than the EU average (9.7% and 12.8%, respectively).

Private and public bodies begin to step up for more sustainable digital choices. The 'Green ICT project' launched in 2021 and ongoing, led by NGOs and LUT University, accelerated the green transition in the Uusimaa region for 7 000 companies by developing tools and providing information for both application developers and those making digital purchases. The project promoted low-carbon digital service production and climate-wise procurement expertise in companies and the public sector. For more sustainable digital infrastructures, the Finnish Transport and Communications Agency Traficom is monitoring power consumption in Finnish networks based on the yearly reports issued by the operators.

Looking at digital assistance in developing green solutions, Business Finland offers programmes that provide funding for projects supporting the twin transition. These are also supported by Finnish EDIHs, such as the Finnish AI Region EDIH (FAIR). Under the REPowerEU chapter of Finland's RRP, the country also undertook to digitalise the permitting process to support the green transition. Finally, Finland's supercomputer LUMI runs fully on hydropower with waste heat used to warm neighbouring households. LUMI is also one of the platforms to run the Climate Change Adaptation Digital Twin (Climate DT), a high-priority digital twin of *Destination Earth*. The Climate DT will be a state-of-the-art climate simulation and information system that can be used to support decision-making on the impacts of climate change and different adaptation strategies at local and regional levels over multiple decades.

Best practice: Climate and Environmental Strategy for the ICT Sector

The Climate and Environmental Strategy for the ICT Sector was published in 2021, following the work carried out by a working group appointed by the Ministry of Transport and Communications in November 2019. The strategy presents recommendations for measures related to a climate- and environment-friendly ICT infrastructure and data economy, sustainable material flows and a circular economy. It also plans to expand the knowledge base and develop the measurement framework, raise consumer awareness and expertise, use emerging technologies to respond to challenges. It is accompanied by a monitoring system which consists in actions by the Ministry of Transport and Communications and the Finnish Transport and Commmunications Agency Traficom, an annual forum for stakeholders on the topic and possible update of the strategy at each governmental term of office.

Annex I – National roadmap analysis

Finland's national Digital Decade strategic roadmap

Finland submitted its national strategic roadmap on 9 October 2023.It was published in December 2023 (link to the roadmap in Finnish and in English). Finland's roadmap is based on the Government Report on digital compass which was adopted in 2022 and has been implemented ever since. The compass was consulted with stakeholders through a series of workshops and two rounds of written comments.

Finland's national roadmap includes 2030 targets for all KPIs except for FTTP, edge nodes and unicorns. It also demonstrates ambitions in areas such as semiconductors and quantum. Most of national targets match and sometimes exceed the EU-level targets (87% target for at least basic digital skills). The proposed trajectories are set on correct KPI basis, while the trajectories on VHCN, cloud, data analytics, AI, digital public services for citizens and e-health are missing. In some remaining cases, such as digital public services for businesses, a missing trajectory is tied to the fact that Finland has already achieved the target.

Finland presents a non-exhaustive selection of the main policies and measures contributing to the achievement of the Digital Decade targets. Although attributed just to a single category in the table above, the measures presented contribute to multiple targets simultaneously, for example the European Digital Innovation Hubs. The measures also cover the objectives of the Digital Decade: technological leadership, sovereignty, competitiveness, cybersecurity, fundamental rights, and the green transition. In total, **the budget for the measures amounts to EUR 499.7 million**. While the vision set out in the roadmap is presented as comprehensive, a substantial share of the budget of the roadmap will contribute to increasing the uptake of Cloud, Artificial intelligence, and Data analytics/Big data (56%) and the development of quantum computing capacities (30%). The table below reflects a best-effort attempt at categorising the measures and budget as presented in Finland's roadmap.

Digital Decade Target/objective	Budget (EUR Million)	Number of measures
Connectivity Gigabit	32.0	1
Connectivity 5G	-	-
Semiconductors	-	-
Edge nodes	-	-
Quantum computing	149.0	2
SME take up	-	-
Cloud/AI/Big Data uptake	277.3	3
Cloud only uptake	-	-
AI only uptake	-	-
Big data uptake	-	-
Unicorns	-	-
Basic Digital Skills	0.0	3
ICT Specialists	41.3	3
e-ID	0.0	1
Key Public Services	-	-
e-Health	-	-
Objectives	-	-
Total	**499.7**	**13**

The roadmap also underlines the importance of R&D, by offering possibilities in this regard across multiple domains (e.g., 5G, semiconductors, quantum, cloud, AI). This is tied to Finland's ambition to increase RDI expenditure to 4% of GDP by 2030 and to export technological innovation, including by wide cooperation between private and public stakeholders. The interplay between the digital and green transitions is also visible across the measures. The information on sources and amounts of funding, including EU funding, remains imprecise.

The roadmap is overall coherent with efforts in most dimensions of digitalisation. It takes into account Finland's early achievement of some targets. Given the country's role as a frontrunner in the digital transformation, in some respects the roadmap is cautious. In addition to the three missing targets, it is rather brief on the vision for further digitalisation of public services (regardless of very strong results), the deployment of gigabit connectivity as well as leadership in multi-country projects and in the twin transition. Measures in these areas could be developed. For most of the proposed measures, it could be useful to reassess the requisite and already mandated resources in order to identify any gaps and map further funding opportunities.

Annex II – Factsheet on multi-country projects (MCPs) and funding

MCP and EDICs

Finland is finalising membership negotiations for the Local Digital Twins towards the CitiVERSE (LDT CitiVERSE) EDIC and has decided to seek an observer status in the Alliance for Language Technologies (ALT-EDIC), both already set up. As for the possible future EDICs, Finland is participating in the works for the Genome EDIC, the Mobility and Logistics Data EDIC and the Connected Public Administration EDIC (IMPACTS-EDIC)[8].

The country also participates in the IPCEI on Microelectronics and Communication Technologies (IPCEI-ME/CT) and in the EuroHPC Joint Undertaking, hosting LUMI, one of the supercomputers procured by the Joint Undertaking.

EU funding for digital policies in Finland

Finland's recovery and resilience plan (RRP) allocates EUR 526 million (28.9% of the total) to the digital transformation. According to a Joint Research Centre's study[9] EUR 390.9 million of that sum directly contribute to achieving the Digital Decade targets. According to the same study, Finland also received EUR 174.8 million of Digital Decade-relevant budget from cohesion policy funds, focusing on digitalisation of enterprises, including fostering the growth of unicorns.

The largest digital measure in the recovery and resilience plan is dedicated to digitalisation of healthcare services (EUR 145 million). Other measures are designed to support rail digitalisation, boosting the potential of data economy, RDI in advanced technologies, such as 6G, AI and quantum, and training in the public and private sector, including in cybersecurity. The high-speed broadband scheme receives EUR 32 million from the plan. As of April 2024, implementation of Finland's RRP goes as planned as evidenced by the first payment request that successfully led to the disbursement of EUR 202 million with no missed targets or milestones.

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[8] Information last updated on 31 May 2024.

[9] Based on an estimation of the possible contribution to the Digital Decade (Joint Research Centre report 'Mapping EU level funding instruments to Digital Decade targets - 2024 update' (Signorelli et al., 2024)).

State of the Digital Decade 2024

France

1 Executive summary

France brings a positive contribution to the European Union's (EU) Digital Decade objectives and targets, in view of a successful digitalisation that fosters competitiveness, resilience, sovereignty, European values and climate action.

In 2023, France made notable **progress** in **e-health** and rolling out its **fibre network**. However, **important challenges** persist in the **digitalisation of SMEs** and the **adoption of advanced technologies** (such as AI and cloud) by enterprises.

Digitalisation is a priority for the French authorities with an emphasis on infrastructure and research and development (R&D) in key technologies. Under its investment plan 'France 2030', France is investing massively in research and innovation in new technologies such as cloud, cybersecurity, Artificial Intelligence (AI), and quantum. The production of semiconductors on the national territory is also given a top priority. France also benefits from robust digital infrastructures. Although its digitalisation policies cover a broad range of areas, there is scope to improve several metrics related to the general population of citizens and enterprises. According to the **special Eurobarometer survey on the 'Digital Decade 2024'[10]**, only 64% of the French population consider that the digitalisation of daily public and private services makes their life easier, one of the lowest scores in the EU.

France is hosting the **European Digital Infrastructure Consortium** (EDIC) ALT-EDIC (already set up), which addresses the scarcity of European language data needed for AI solutions, and is candidate to host two more EDICs, both in the making: Agrifood EDIC and (along with The Netherlands) and Digital Commons EDIC. France is also a member of the Local Digital Twins towards the CitiVERSE EDIC (already set up). In addition, France is developing the Statute of the possible future Mobility and Logistics Data EDIC and the Genome EDIC[11].

France allocates 21.6% of its total Recovery and Resilience plan to digital (EUR 8.1 billion)[12] with the priorities given to e-Health and R&D in key technologies (5G, quantum, and cloud). Under Cohesion Policy, an additional EUR 1.9 billion (11% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[13].

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[10] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351

[11] Information last updated on 31 May 2024.

[12] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.

[13] This amount includes all investment specifically aimed at or substantially contributing to digital transformation in the 2021-2027 cohesion policy programming period. The source funds are the European Regional Development Fund, the Cohesion Fund, the European Social Fund Plus, and the Just Transition Fund.

Digital Decade KPI [1]	France			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	FR	EU
Fixed Very High Capacity Network (VHCN) coverage	73.4%	81.4%	10.9%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	73.4%	81.4%	10.9%	64.0%	13.5%	x	-
Overall 5G coverage	88.8%	93.2%	4.9%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		257		1 186		x	10 000
SMEs with at least a basic level of digital intensity	47.0%	52.0%	[2]	57.7%	2.6%	90%	90%
Cloud	25.3%	22.9%	[2]	38.9%	7.0%	53.3%	75%
Artificial Intelligence	6.7%	5.9%	[2]	8.0%	2.6%	46.7%	75%
Data analytics	NA	33.9%	NA	33.2%	NA	49.7%	75%
AI or Cloud or Data analytics	NA	44.9%	NA	54.6%	NA		75%
Unicorns		40		263		100	500
At least basic digital skills	62.0%	59.7%	-1.9%	55.6%	1.5%	80%	80%
ICT specialists	4.3%	4.7%	9.3%	4.8%	4.3%	10%	~10%
eID scheme notification		Yes					
Digital public services for citizens	71.3	72.1	1.1%	79.4	3.1%	100	100
Digital public services for businesses	79.3	79.3	0.0%	85.4	2.0%	100	100
Access to e-Health records	54.5	79.3	45.5%	79.1	10.6%	100	100

[1] See the methodological note for the description of the indicators and other descriptive metrics
[2] Comparison with previous years cannot be done for France due to methodological changes.

National Digital Decade strategic roadmap

With respect to **France's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating **a high ambition** and, based on this document, intends to allocate **some effort** to achieve the Digital Decade objectives and targets.

Overall, France's roadmap is ambitious and consistent including on objectives but with some weaknesses in the digitalisation of enterprises. France's national roadmap includes 2030 targets for all KPIs except for **FTTP and edge nodes** (the former is assumed to be similar to VHCN but needs formalisation). In total, 9 national targets are aligned with EU 2030 targets, but 3 are below: **take up of AI**, **take up of data analytics** and **take up of cloud**. Trajectories are missing for **FTTP, edge nodes** and **unicorns**. The roadmap covers all objectives of the Digital Decade such as a human-centred digital space, resilience and security, sovereignty, green, and protection of the society with a high level of ambition, especially on the human centred digital space, on sovereignty, and on the green transition.

The total budget of the measures (public and private) presented in the roadmap **is estimated to EUR 17.8 billion** (about 0.6% of GDP) with the priorities being semiconductors, connectivity, and e-Health. Some aspects require more action, especially regarding ICT specialists to double the current number of ICT professionals and for the digitalisation of enterprises (both in terms of basic digital intensity and the rate of adoption of advanced technologies).

Recommendations for the roadmap

France should, when submitting adjustments to its national roadmap in accordance with Article 8(3) of the Digital Decade Policy Programme (DDPP) Decision:

- **TARGETS:** (i) Provide a target and trajectory for **edge nodes,** design a trajectory for **unicorns**, and formalise the trajectory for **FTTP**; (ii) Consider aligning **the level of ambition of targets for the 3 technologies take-up by enterprises (AI, cloud, data analytics) to the EU's targets**.

- **MEASURES:** (i) Strengthen the measures contributing to targets that are the most difficult to achieve, especially as regards **skills and digitalisation of enterprises**; (ii) Review the budget description of all presented measures, duly highlighting EU sources such as Recovery and Resilience Facility (RRF); (iii) Provide **more information on the implementation of digital rights and principles** (and Digital Decade general objectives), including what national measures contribute to it.

- **CONSULTATION:** Report on the consultation of stakeholders in the roadmap.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' provides insights into French perceptions of digital rights. Although 39% of French respondents believe the EU protects their digital rights effectively, this marks a decrease and is below the EU average of 47%. Concerns have intensified, with 52% worried about children's online safety and 45% about control over personal data, reflecting growing unease. On a positive note, 85% value digital technologies for connecting with friends and family, and 82% for accessing public services, indicating strong appreciation for digital advancements. The monitoring of the Declaration on Digital Rights and Principles shows that increasing the profile of the Declaration at national level and fostering better stakeholder engagement could help improve outcomes in the years to come[14].

A competitive, sovereign and resilient EU based on technological leadership

To underpin its technological leadership and competitiveness, France is equipped with good infrastructures with a positive deployment dynamic but should boost the digitalisation of its businesses. On infrastructures, France is on track to reach 100% coverage for VHCN (+3.5 million fibre connections in 2023) and 5G for 2025, 5 years earlier than the EU target. France shows the highest share of fixed broadband subscriptions with speed > 1 Gbps in the EU with 51.6%. This is mainly due to the successful roll-out of the fast broadband plan 'France très haut débit', the choice of FTTH as the leading technology, and the French appetite for high-speed broadband. 5G coverage stands at 93.2% with 64.8% of French households covered by the 3.4-3.8 GHz band, an essential band for enabling advanced applications requiring large spectrum bandwidth. Several calls for projects were launched to develop industrial 5G and the 26GHz band has been open since 2019 for experimentation purposes. However, the indicators on the digitalisation of enterprises (basic intensity of SMEs and take-up of data analytics, AI, and cloud) all point to a performance below the EU average. Although France hosts some innovative frontrunners (including dynamic start-ups), as a whole, the global business sector underperforms on digitalisation. France has made digital sovereignty a priority by, for example, increasing the production of semiconductors and is developing sovereign solutions in AI, cloud, quantum, and cybersecurity. On AI, a national commission recently released a report guiding the future actions of the government. The national cybersecurity strategy will be updated in 2024 with a focus on skills.

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[14] See SWD 'Digital Decade in 2024: Implementation and perspective' with annexes, SWD(2024)260: https://digital-strategy.ec.europa.eu/en/news-redirect/833325, Annex 4.

> **Recommendations – France should:**
>
> - **CONNECTIVITY INFRASTRUCTURE**: Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.
>
> - **CYBERSECURITY:** (i) Continue efforts in cybersecurity to address evolving threats and restore the confidence of enterprises and general public; (ii) Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.
>
> - **SMEs:** Set up additional measures and increase resources for existing schemes to improve the SMEs digitalisation performance and to further leverage the impact of the European Digital Innovation Hub in regions and its close presence to regional ecosystems, paying special attention to its outermost regions.
>
> - **AI/CLOUD/DATA ANALYTICS/EDGE NODES:**
>
>   - (i) Review the mix of measures to support the adoption of advanced digital technologies (with a particular attention to AI and cloud). Foster the creation of local ecosystems to allow technologies (AI, cloud, data analytics) and best practices to diffuse across the broader business sector. Build on the recent national AI Commission report to design new measures to develop the AI ecosystem and foster related technologies adoption by enterprises.
>
>   - (ii) Ensure the broad uptake of the next generation of cloud infrastructure and services under development in the IPCEI-CIS by companies of all sizes, including by developing a country-specific dissemination strategy (complementing what has already been committed under IPCEI-CIS); contributing to the additional dissemination activities led by the Cloud IPCEI Exploitation Office.
>
>   - (iii) Consider measures specific to edge nodes deployment, supplementary to the IPCEI-CIS participation.

Protecting and empowering EU people and society

France is well equipped to deliver an inclusive digital transition, but it will require sustained efforts to continuously increase the level of digital skills of the population and train ICT specialists. The level of digital skills of the population is still slightly above the EU average, with a slight decrease compared to last year's report, possibly due to post-COVID-19 effects (i.e., lower usage of ICT tools). Over the last years, France has integrated digital skills in curricula at different stage. In 2023 it also announced measures to strengthen the basic education (especially in mathematics) and boost the attractiveness of science, technology, engineering, and mathematics (STEM). This could increase the number of young people embarking on a digital career in the future. The proportion of ICT specialists (4.7%) in employment is broadly in line with the EU average and in strong progress. However, it will require sustained action to reach the EU and national Digital Decade targets given the relatively slow change in population indicators. The digitalisation of public services will require acceleration as France is slightly below the EU average. France improved its overall e-Health maturity score from 54.5 in 2022 to 79.3 in 2023. In February 2024, the authorities launched 'France Identité', a companion application enabling e-ID users to authenticate and access digital ID services. France has a long history of prioritising inclusiveness in designing policies. Digitalisation is current practice with measures in place to narrow the geographical divides and the gender gap and to reduce digital illiteracy.

Recommendations – France should:

- **BASIC DIGITAL SKILLS:** Take measures to boost the digital skills of the population on the shorter term, with additional efforts in its outermost regions.
- **ICT SPECIALISTS:** (i) Increase the attractiveness of STEM disciplines at school to boost the number of young people, including girls, interested in taking up ICT-related studies or careers; (ii) Increase the visibility and readability of training and reskilling options. Design incentive schemes to attract and retain ICT specialists.
- **KEY DIGITAL PUBLIC SERVICES:** Make efforts to digitalise public services, with particular attention to re-use of information available to public administrations and user support.
- **E-HEALTH:** (i) Make all data types available to citizens through the online access service; (ii) Enhance the authentication method for logging in to the online access service by using a (pre)notified e-ID; (iii) Introduce a legal basis and provide the technical functionality for authorised persons to access electronic health data on behalf of others.

Leveraging digital transformation for a smart greening

France emerges as an EU leader in its ability to create links between the digital and green transitions. It is at the forefront in monitoring the footprint of the ICT sector and in promoting energy sobriety and the eco-design of ICT equipment and services. During the French presidency of the EU, France drafted a joint declaration on the dual digital and environmental transition, signed by 22 Member States.

Recommendations – France should:

- Develop a coherent approach to twinning the digital and green transitions. First, promote improvements in energy and material efficiency of digital infrastructures, in particular data centres. Second, support the development and deployment of digital solutions that reduce the carbon footprint in other sectors, such as energy, transport, buildings, and agriculture, including the uptake of such solutions by SMEs.
- Demonstrate leadership and continue monitoring and quantifying the emission reductions of the deployed digital solutions in line with the relevant EU guidance and with the support of the methodology developed by the European Green Digital Coalition, in view of future policy development, as well as of attracting relevant financing.

2 A competitive, sovereign and resilient EU based on technological leadership

France aims to regain competitiveness by investing in key technologies, notably through the France 2030 investment plan. In particular, the plan aims to support the digital transition for the next decade. It should enable France to catch up with the industrial delays it accrued in the early 2000s when it lost significant market shares and its competitiveness decreased. The investment plan should also enable France to recover from the COVID-19 and Ukraine crises and prepare the country for future challenges. With a EUR 54 billion budget, the France 2030 plan will invest in several areas including innovative digital technologies such as semiconductors, AI and cloud and should cover both R&D and training.

France is equipped with good digital infrastructure, a dynamic start-up ecosystem and substantial supports to R&D&I in digital. The country also invests massively in semiconductors. However, its performance is weaker in terms of business take-up, as the metrics tracking the digitalisation of SMEs and the take-up of technologies are sub-par. It is essential for France to foster the digitalisation of its whole business sector (not only the front runners) including SMEs in order to boost its competitiveness. The digitalisation of businesses can lead to productivity gains lowering production costs, by raising the quality of tech-intensive goods or by providing new ICT services that could eventually improve the non-cost competitiveness of the country.[15]

2.1 Building technological leadership: digital infrastructure and technologies

France is very active in rolling out connectivity infrastructures. Both fibre and 5G networks are expected to reach 100% coverage by 2025, narrowing the geographical divides in a large territory with sizeable rural areas.
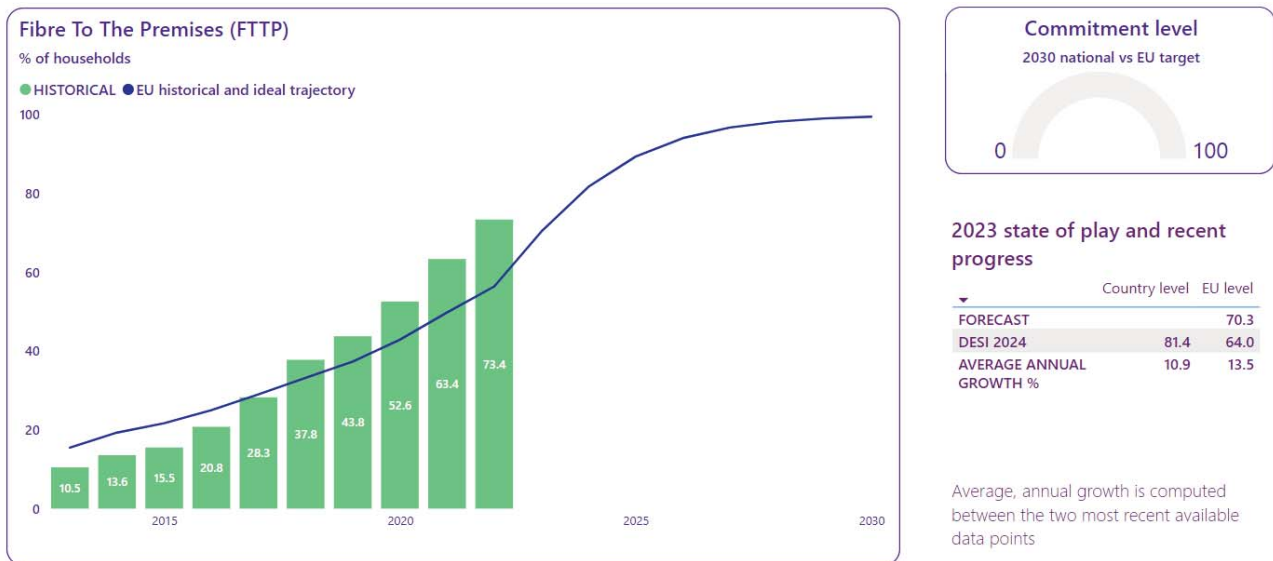
2.1.a Connectivity infrastructure (gigabit) [16]
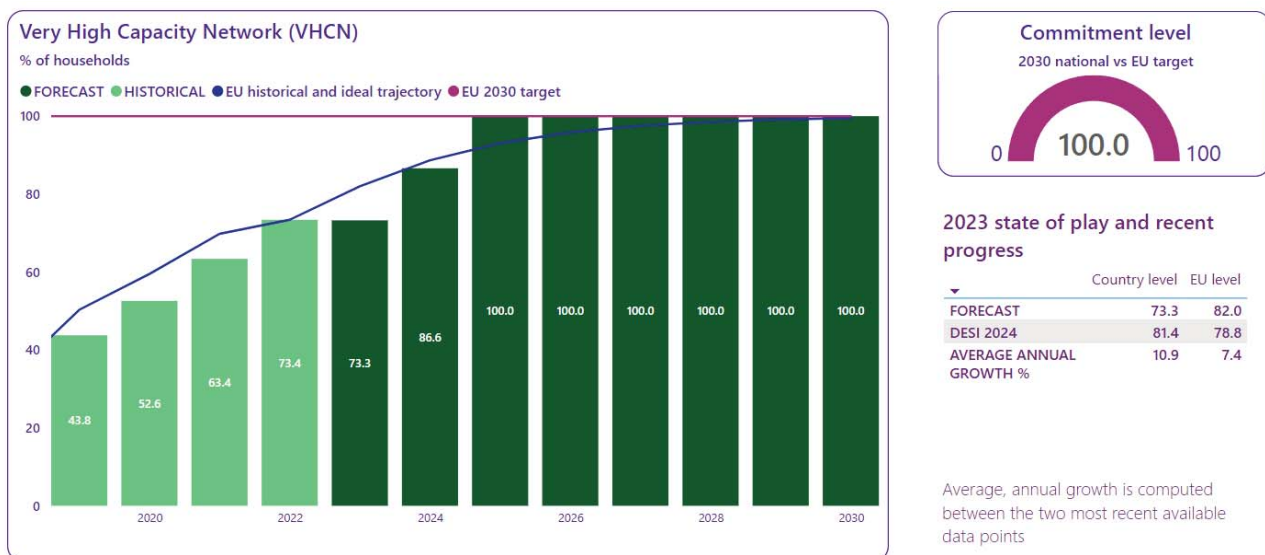
Note: The source of national forecast values is the 2023 country roadmap

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[15] *Can We Evaluate the Non-Price Competitiveness of French Products Based on Export Data?* J.Burton, M.Kizior, Directorate-General for Economic and Financial affairs. Economic Brief 064, 2021

[16] All historical values presented in the figures are sourced from the corresponding data sources and not the national roadmaps.

Fibre To The Premises (FTTP)

% of households

● HISTORICAL ● EU historical and ideal trajectory

Commitment level

2030 national vs EU target

0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST		70.3
DESI 2024	81.4	64.0
AVERAGE ANNUAL GROWTH %	10.9	13.5

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

France brings a positive contribution to the EU's Digital Decade target for Very High-Capacity Networks (VHCN) and maintains a very strong dynamic. On Fibre-to-the-premises (FTTP), France brings also a very strong contribution to the EU's Digital Decade target and shows positive dynamic. Fibre networks have completely overbuilt the cable networks. Both VHCN and FTTP figures are at 81.4% of households coverage (i.e., FTTP being the leading and nearly only technology, and DOCSIS 3.1 coverage is neglectable) and new deployments focus on fibre. VHCN and FTTP coverages are both above the EU average with the FTTP coverage particularly high (81.4%) compared to the EU average (64.0%). The pace of VHCN and FTTP deployment has reached double-digit annual growth rates. VHCN coverage in rural areas (64.6%) is also above the EU average (55.6%). France shows the highest share of fixed broadband (> 1 Gbps) subscriptions in the EU at 51.6%.

France aims at reaching 100% fibre coverage by 2025, much earlier than the EU target of 2030. The 2025 objective was set in the plan *France très haut débit* aiming at covering the entire territory with FTTP. This will automatically allow achieving the 100% VHCN coverage target before 2030. The current level of coverage indicates that this target can be considered realistic. However, the last deployments might prove more difficult to achieve by nature.

The plan 'France très haut débit' is a successful tool to roll out fibre in the entire territory. The progress of the plan was sustained in the recent years, achieving concrete results on the ground and often surpassing previsions. For example, in 2021 and 2022, 10.3 million new premises were eligible to fibre. In 2023, 3.5 million new premises were eligible to fibre nationwide. This plan benefits from EUR 240 million funding from the Recovery and Resilience Facility which allowed France to review upwards the initial ambitions of the plan to the generalisation of fibre networks even in the most remote areas.

Last difficult connections and unexpected costs might delay the achievement of the full fibre coverage. In particular, some areas in densely populated cities (private initiative zones) encounter obstacles linked for example to security in high criminality areas. Other remaining bottlenecks identified touched upon heritage protection or environmental issues. Also, the outermost regions require particular attention. Some premises turned out to be more expensive to be made eligible to fibre than expected, which required additional private and public funding. The State of the Digital Decade report 2023 recommended France to continue its efforts in implementing its policies on digital infrastructures. While the policy actions are still in force, the

last observed developments (difficult areas, regulatory friction, need of marginal public funding…) might require monitoring.

Market dynamics can be considered healthy. The four main telecom operators are present in most of the territory (83% of premises covered by at least 4 operators, 95% by 3, by the end of 2023), providing fibre connexions at affordable prices through market competition. The take-up of fibre is very dynamic with 3.3 million new users in the past year, representing now 66% of total Internet subscriptions by the end of 2023.

Despite its large territory and diverse geography, France is in a favourable position to achieve full fibre VHCN coverage within the Digital Decade horizon. The plan 'France très haut débit' proved to be an efficient measure, but the finalization will require monitoring the last deployments and providing sufficient budget.

Best practice: turning the page of the copper network

The massive roll-out of the fibre network enables the incumbent operator Orange to decommission its copper network. ARCEP, the French telecom national regulatory authority, oversees the switch from copper to the fibre network. ARCEP and Orange agreed on a switch-off plan that ARCEP then made binding. This plan provides for the complete switch-off of the copper-based network by 2030. Such technological shift requires accompanying the population through this transition as it implies new technological habits and may lead to changes in the price of the service. Consequently, several actions and conditions were envisaged to allow a smooth transition:

- Planning: the closure is planned by areas with a monitoring and a 'lessons learned' process carried out after each closure project to improve the process of the following closures.
- Transparency: the incumbent operator has the obligation to respect notice periods and publish the progress of the works.
- Replacement solution: ensuring that a replacement fibre connection is available to everyone before starting the closure.
- Social fares: several operators committed to maintaining social fares to ease the switch to fibre (that is often more expensive than cable). The operators kept the option of only subscribing to a fixed phone contract (no bundling).
- Accompanying: communication efforts include dedicated websites and the involvement of counsellors (*France Services*), mainly deployed in rural areas.
- Sustainability: the copper and other materials will be recovered and recycled. Also, a fibre subscription consumes four times less electricity than a copper connection.

2.1.b Connectivity infrastructure (5G)

5G coverage
% of populated areas
● FORECAST ● HISTORICAL ● EU historical and baseline trajectory ● EU 2030 target

74.4 | 88.8 | 88.8 | 94.4 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0

2020 | 2022 | 2024 | 2026 | 2028 | 2030

Commitment level
2030 national vs EU target

0 — **100.0** — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	88.8	
DESI 2024	93.2	89.3
AVERAGE ANNUAL GROWTH %	4.9	9.8

Average, annual growth is computed between the two most recent available data points. No ideal trajectory, and therefore no EU level forecast, is provided for 5G (see 2023 Communication on EU-level trajectories)

Note: The source of national forecast values is the 2023 country roadmap

France brings a positive contribution to the EU's Digital Decade target for 5G while demonstrating limited dynamic. 5G coverage in France (93.2%) is above the EU average (89.3%). The deployment is sustained (+4.9% annual growth) but below the observed very high dynamics in the EU (+9.8% annual growth). Also, 64.8% of French households are covered by 5G in the 3.4-3.8 GHz band, an essential band for enabling advanced applications requiring large spectrum bandwidth, which is above the EU average (50.6%).

The four main operators are actively rolling out 5G in the 3.4-3.8 GHz band. In total, around 5100 sites gained coverage in that band by the end of 2023 with a target of 8000 by the end of 2024. However, they have different presence in the 700-800 MHz and the 1.8-2.1 GHz bands. As of 1 January 2024, 43 134 sites implementing 5G technology had been authorised for a total of 66 562 mobile network sites in France, all generations combined.

The public 3.4-3.8 GHz band is also used for industrial 5G applications. However, only 59.2% of the 5G pioneer bands are assigned, against 73.4% at the EU level. The 26 GHz band is only used for experimentations with no new actors interested recently, as reported by the national regulatory authority ARCEP. Perennial frequencies are already available in the 2.6 GHz band for mobile networks meeting the specific needs of professionals. They concern 40 authorised geographic sites in the energy sector, transport, logistics, and industry.

As for VHCN, France is very ambitious in deploying 5G, aiming at covering 100% of the households by 2025. This would place France in the front runners in the EU. The target is realistic since France stands already at 93.2% coverage with a sustained growth. While the mobile broadband take-up (90.3%) is around the EU average (89.9%), the specific take-up of 5G by the population could be fostered as only 15.3% of the population has a 5G SIM card, below the EU average of 24.6%.

French mobile operators have made strong commitments regarding the deployment of 5G. They aim at several objectives: (1) deployment of 10 000 5G sites by 2025, (2) reach a speed of at least 240 Mbps for all sites by 2030, (3) coverage of road axes and railroad lines with 5G, and (4) the development of offers including the most innovative functionalities enabled by 5G, such as network slicing.

The French authorities pursue the support of projects promoting the deployment and use of industrial 5G. This support comes in the form of state aid and selected calls for projects. First, the call 'Innovative

solutions for the networks of future 5G/6G' focusses on R&D work to anticipate developments in 5G and the future 6G, the development of sovereign solutions, and improving the environmental impact of networks. Second, the call 'Sovereignty in networks of telecommunications to accelerate 5G applications' supports 5G experimentation platforms bringing together the different actors in the value chain. And third, the call 'Campus Fablab 5GI' will aim at accelerating the process of appropriation of the uses of 5G by industrial companies of any size. The '5G and future telecommunications network technologies' strategy received EUR 300 million from the RRF.

2.1.c Semiconductors

Semiconductors are a clear priority highlighted in France's roadmap and the long-term investment strategy *France 2030*. The various forms of supports should contribute significantly to increasing the national and EU production of semiconductors. The measures presented in the roadmap account for more than two thirds of the total budget identified in the roadmap. The aim is to reinforce the semiconductors R&D ecosystem, boost production capacity, and support breakthrough innovation and training in the sector.

The French state will promote the establishment of semiconductor production capacities in France. The strategy will cover the different segments of the value chain (in particular the production of components) by investing EUR 2.9 billion, which should attract EUR 7.5 billion of private investment (mainly from STMicroelectronics et GlobalFoundries). The additional production capacity could reach 620 000 wafers per year by 2028. The construction works are planned for 2022-2027 while 1000 jobs should be created in the period 2023-2026.

The roadmap also presents a support for innovation and first industrialisation projects. These subsidies are designed for lead companies and partners of the IPCEI Microelectronics and connectivity (approved in 2023). The expected impact is quite substantial with an estimated EUR 7 billion of private investment leading to the installation of factories and production lines and the creation of 2500 jobs by 2027.

The current production capacity mainly provides for low or medium tech chips used in car and telecom industries. The government now aims to upscale the production toward high-end 'chips for AI' to compete against big players from the US and China. The electronics sector will also be supported through aid for innovation (with a focus on exploratory research leading to breakthrough discoveries) and training of qualified staff to meet the needs of the industry.

With its ambitious and multifaceted strategy, France should contribute considerably to EU sovereignty in the semiconductors sector. The 2023 State of the Digital Decade report encouraged France to continue actions in semiconductors to help the EU become a strong market player in this area. The level of ambition and the actions contained in the roadmap largely contribute to addressing this recommendation.

2.1.d Edge nodes

The latest studies estimate that France has 257 edge nodes, making it a leader in the EU. It represents 22% of all edge nodes estimated in the EU (1186), above its share of GDP or population in the EU. France's roadmap does not set a national trajectory for edge nodes to contribute to the EU target of 10 000 climate neutral and secure edge nodes.

At the EU level, France participates to the IPCEI Next Generation Cloud Infrastructure and Services. It supports the development of software technologies useful for the exploitation of edge nodes, notably industrial 5G. It should also allow Europe to develop cutting-edge technologies for innovative edge nodes, with low latency and energy footprint. According to the French roadmap itself, France will have to

accelerate the roll-out of peripheral nodes by 2030. At national level, France has adopted a cloud acceleration strategy (see Cloud section).
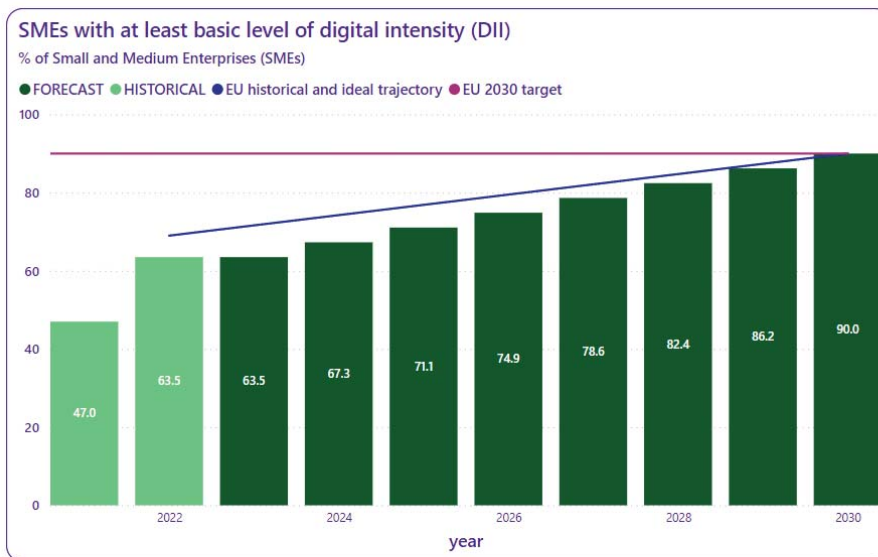
2.1.e Quantum technologies

France pursues a national strategy for quantum technologies and aims to be one of the first countries to develop a large-scale universal quantum computer. The strategy is structured around four objectives: i) the development of technologies and uses of quantum computing, ii) the mastery of quantum sensor technologies; iii) the development and diffusion of post-quantum cryptography; and iv) mastery of quantum enabling technologies. In 2023, France obtained the installation of an Exascale EuroHPC supercomputer which will also integrate experimental partitions of hybrid quantum computing allowing the development and testing of quantum technologies. This supercomputer will also be able to integrate new European sovereign technologies. France also participates to the EuroQCI initiative, a secure quantum communications infrastructure covering the entire EU, including its overseas territories. Like for semiconductors, the State of the Digital Decade report 2023 encouraged France to continue its activities regarding quantum to help the EU become a strong market player. The latest developments in this area, including the actions presented in the roadmap, contribute to addressing this recommendation.

On the training side, the project 'QuanTEdu-France' brings together 21 French universities and schools in partnership with companies and startups in the sector. The programme aims to train the quantum talents of tomorrow, both through initial and continuing training, at all levels, with a major focus on PhDs. The ambition is to double the number of experts in quantum technology by 2027. The French private quantum ecosystem saw positive developments in 2023, as evidenced by the fundraising from Pasqal (EUR 100 million), Quandela (EUR 50 million) and Quobly (EUR 20 million).

2.2 Supporting EU-wide digital ecosystem and scaling up innovative enterprises

France lags behind on the digitalisation of its enterprises but can count on a thriving start-up ecosystem. By improving the digitalisation of its businesses, France could give its competitiveness a boost. This technological transition shall contribute to a fair digital environment as enshrined in the Declaration of Digital Rights and Principles while also ensuring the principle of freedom of choice for the consumer.

2.2.a SMEs with at least basic digital intensity

SMEs with at least basic level of digital intensity (DII)
% of Small and Medium Enterprises (SMEs)
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Note 1: DII 2022 is version IV that is not comparable with DII 2021, that was version III. The EU-level ideal trajectory refers to DII version IV, as published in the 2023 Communication on EU-level trajectories

Note 2: The source of national forecast values is the 2023 country roadmap

Commitment level
2030 national vs EU target

90.0

2023 state of play and recent progress

	Country level	EU level
FORECAST	63.5	71.6
DESI 2024	52.0	57.7
AVERAGE ANNUAL GROWTH %	5.2	2.6

In the case of DII, the average, annual growth is computed between 2023 and 2021 due to data comparability reasons.

France has untapped potential to contribute to the EU's Digital Decade target on digitalisation of SMEs. In France, 52.0% of SMEs have at least a basic level of digital intensity, lower than the EU average (57.7%). Due to a methodological change (implementation of the 'statistical unit enterprise' (SU ENT)), the new data produced in 2023 is not fully comparable with previous survey results, although a progress of +5.2% is observed. However, other indicators confirm that French SMEs could improve in digitalisation such as the share of SMEs selling online (12.7%) among the lowest in the EU (EU average: 19.1%).

The perception of digitalisation is a key factor for French SMEs to take the plunge. According to the France Num barometer, 76% of VSEs and SMEs managers consider that digitalisation brings a real benefit for their company, in particular to improve communication with their clients and sell online. At the same time, doubts remain on the return on investment of digitalisation (only 39% of companies believe that digital technologies allow them to save money) and cyberthreats spark some fear among 48% of SMEs (a rise of +4pp since 2022). These perceptions might prevent some VSEs and SMEs from adopting certain technologies.

France presented in its roadmap a level of ambition in line with the 2030 target for the EU of 90% of digitalised SMEs. The effort is considered ambitious as the country starts below the EU average. With the current observed growth rate of the indicator, France will reach its target well after 2030. This suggests that extra efforts are warranted to catch up on this indicator. France received a recommendation in the 2023 State of the Digital Decade report to take specific actions to improve SMEs' rate of digitalisation, but France Num remains the main national tool to address that matter, combined with other schemes such as 'Industrie du futur', 'Cyber PME', or 'IA Booster'. However, no new additional actions were taken recently to answer the State of the Digital Decade report 2023 recommendation. The country hosts 13.4% of European SMEs; its performance is key to achieve the target of 90% of SMEs digitalised at EU level.

The main measure presented in the French roadmap to digitalise SMEs is the established France Num **scheme**. In response to the reluctance of some VSEs and SMEs to digitalise, one of the missions of the initiative France Num is first to convince enterprises on the benefits of digitalisation via awareness campaigns (website, TV show 'Connecte ta boîte'), before accompanying them in their digital journey.

France Num targets companies from 0 to 249 employees, with a focus on companies with less than 10 employees (VSEs). Until now, more than 210 000 aid or support actions have been provided since November 2020 to this segment of businesses, including a wave of 34 000 diagnostics, 71 000 training actions, and 112 000 checks of EUR 500 allocated to very small businesses. Under its Digital Decade roadmap, France allocated around EUR 63 million to this measure, which includes RRF funding, with a concrete calendar of target performances. As for training actions, a new call for projects launched in 2023 should lead to a total of 125 000 of these awareness/training actions by mid-2025.

With a strong regional presence, 16 European Digital Innovation Hubs (EDIHs) have been established in two phases (2022, 2023) that contribute to the digitalisation of industry (notably in the manufacturing, mobility and plastics sectors) and the adoption of mainly AI and cybersecurity technologies, in synergy with national interventions. EDIHs are cofinanced by DIGITAL and by the regions, and they are being listed on France Num list of recognised interventions, and similar approaches have been taken to ensure complementarity with the national AI (IA Booster) and cybersecurity (Cyber PME) schemes implemented by BpiFrance on behalf of the Ministry.

2.2.b Take up of cloud / data analytics / AI
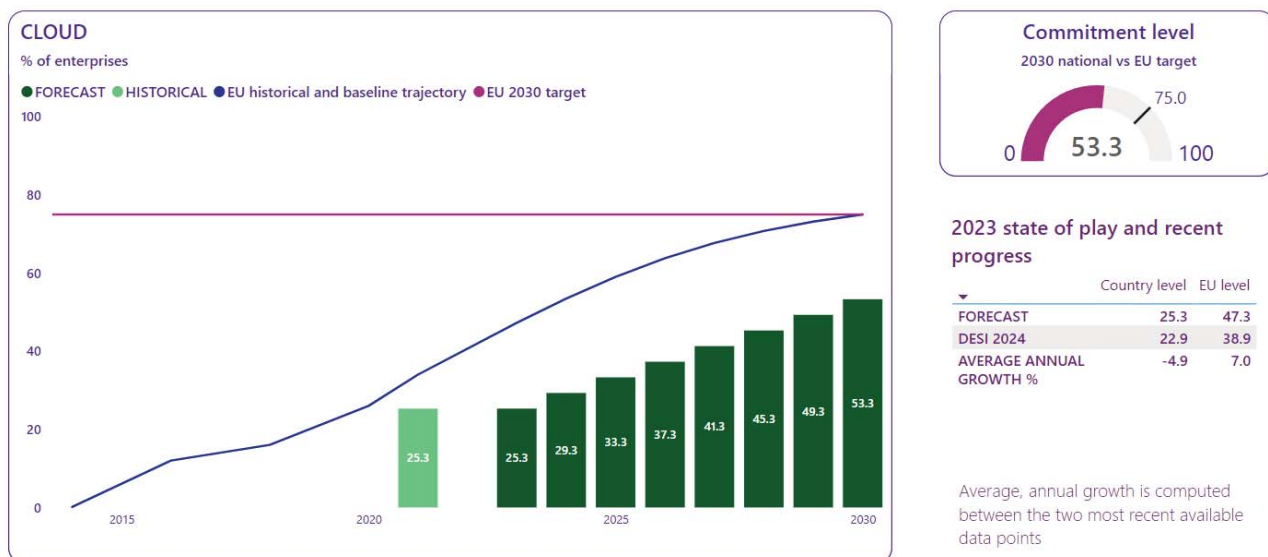
- **Cloud**

Note: The source of national forecast values is the 2023 country roadmap

France has scope to improve its performance to contribute to the EU's Digital Decade target on cloud adoption. The take-up of cloud solutions by French enterprises (at 22.9% in 2023) is significantly below the EU average (38.9%). The progression since last measurement cannot be assessed since there was a break in series for France due to the implementation of the 'statistical unit enterprise' (SU ENT).
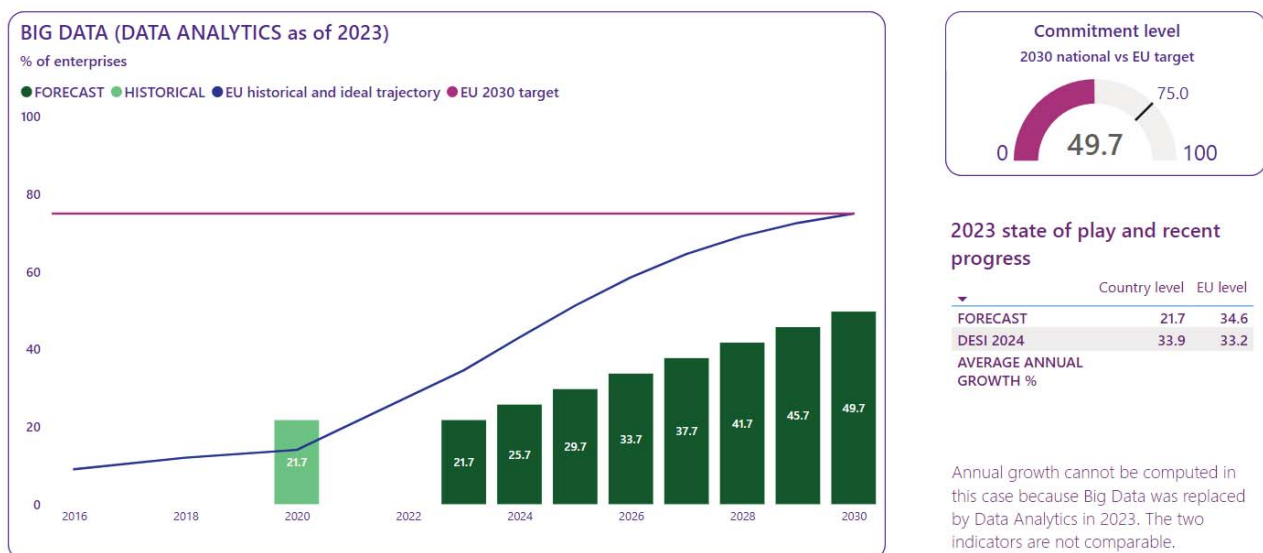
France presented in its roadmap a level of ambition (53.3%) below the 2030 target for the EU of 75% of enterprises adopting cloud. The value is linked to a modest starting point, far below the EU average. In absence of an intensification of efforts over the coming years, France's contribution to the EU target will probably remain limit

The main instrument from France 2030 is the Cloud Acceleration Strategy, partly funded by the RRF. This strategy, endowed with EUR 550 million, supports innovation and development by companies, in order to

develop cloud and edge services. It also finances research programmes at a low level of technological maturity in areas such as the orchestration and optimization of cloud resources and peripheral resources in a decentralized network. At the EU level, France participates to the recently approved (December 2023) IPCEI Next Generation Cloud Infrastructure and Services. As a coordinator of this IPCEI, France is at the forefront of developing and deploying cutting-edge cloud and edge capacities. Furthermore, the working group created in 2022 and led by *Embedded France* should publish its conclusions in 2024.

France's cloud strategy focusses more on the supply than on fostering adoption by enterprises. The cloud strategy of France is centred on developing cloud R&D&I and boosting the supply side with the aim of doubling the market share of French cloud market players. However, given the low level of adoption and the general delay in the digitalisation of French enterprises, the roadmap could benefit from measures focussing specifically on the adoption of cloud technologies by enterprises, as monitored in the Digital Decade. It is crucial that enterprises step up the adoption of cloud since it supports the deployment of other technologies such as AI and edge nodes, both associated to the Digital Decade targets.

- **Data Analytics (Big Data)** [17]

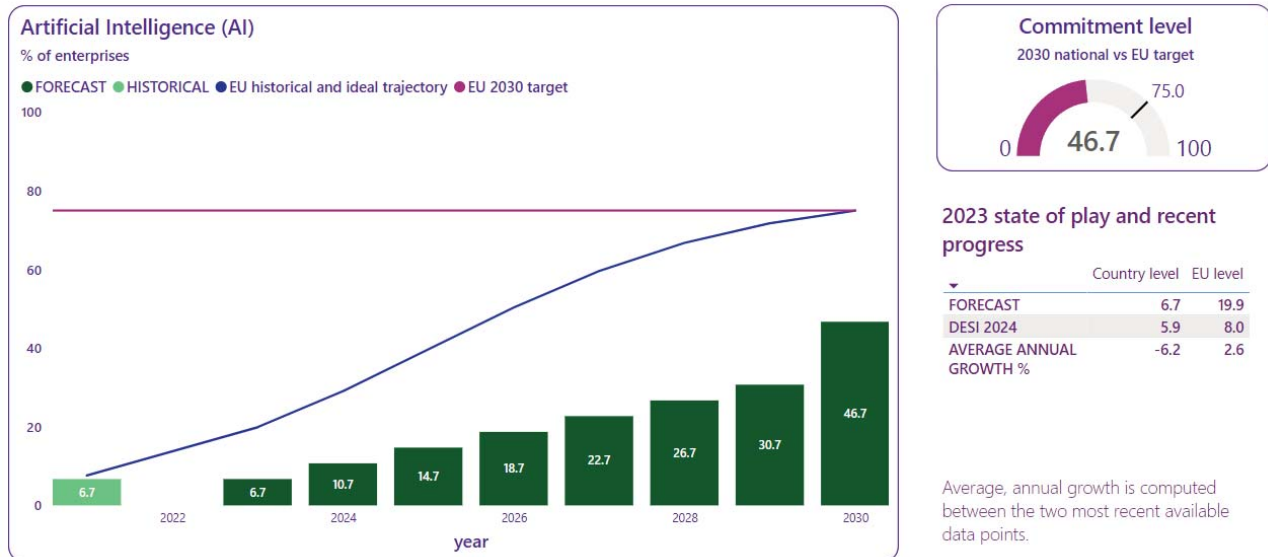Note: The source of national forecast values is the 2023 country roadmap

Concerning the use of data analytics by enterprises, France has untapped potential to contribute to this EU's Digital Decade target. The situation of France (33.9%) is in the EU average (33.2%). Progress cannot be assessed since the indicator's definition evolved.

France presented in its roadmap a level of ambition (49.7%) below the 2030 target for the EU of 75% of enterprises adopting data analytics. The country starting around the EU average, a higher level of ambition for this national target could be envisaged. The growth rate of the indicator cannot be computed, making it difficult to assess if France is on track or not to reach this target.

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[17] As of 2023, Big Data was changed by ESTAT, in agreement with all the EU National Statistical Institutes, into Data Analytics and covers a broader range of technologies including Big Data. For this reason, no comparison is possible with previous years.

France's roadmap does not contain specific measures to foster the adoption of data analytics. However, given the current average level of adoption, France could rely on existing generalist digitalisation schemes (e.g., France Num) and the organic growth of the technology.

- **Artificial Intelligence**

Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

Note 2: The source of national forecast values is the 2023 country roadmap

France has untapped potential to contribute to the EU's Digital Decade target on AI adoption. Just like in the rest of the world, interest in AI soared in 2023 in France. According to a recent survey, 58% of software publishers consider AI as one of their three technological priorities, up 19 pp. compared to 2022. However, few French businesses are adopting AI solutions with a share of 5.9% in 2023, below the EU average of 8.0%. Due to a methodological change (implementation of the 'statistical unit enterprise' (SU ENT)), the new data produced in 2023 are not fully comparable with previous survey results.

France's roadmap sets a 2030 target of 46.7% of AI adoption in its roadmap, below the EU-level target of 75%. It appears that, in absence of an intensification of efforts over the coming years, France's contribution to the AI EU target will remain very limited. There seems to be a divide between frontrunners (e.g., start-ups) developing or actively adopting AI and the bulk of the French enterprises. Without mainstreaming AI in businesses from all sectors, the spread of the technology may remain limited, and this would have detrimental consequences on competitiveness.

Acknowledging this apparent delay in AI adoption, French authorities set out a national AI strategy**.** Its second phase is currently under implementation (2021-2025). In particular, 3 700 AI specialists should be trained to increase the offer of highly skilled workforce. The will of the authorities is also to increase the uptake of AI by companies through innovative schemes, such as 'AI Booster', with the aim of raising awareness, spreading the culture, and supporting SMEs in the adoption of AI technologies. France also launched call for projects focusing on accelerating the use of generative AI in specific sectors of the economy. As the second EU economy, the leading role of France is to be acknowledged, notably through the joint trilateral declaration from October 2023 with Germany and Italy on the industrial cooperation and AI. The collaboration between the three countries aims to prepare the way for the emergence of a globally competitive European AI industry, via notably exploiting the potential of the European Digital Innovation

Hubs (EDIHs), Testing and Experimentation Facilities (TEFs) and the European Digital Infrastructure Consortia (EDICs).

On 13 March 2024, the national AI Commission published its work. The report highlights that France invested three times less than the US in AI in term of % of GDP and recommends investing EUR 5 billion per year for 5 years to bridge the gap. Experts recommended the creation of a 'France & AI' fund of EUR 10 billion to finance the emergence of the AI ecosystem and the digital transformation of the French economy thanks to AI. The experts insist that there is a risk of missing the AI revolution which affects all sectors and activities. They also state that France's annual economic growth could potentially double in 10 years thanks to AI.

- **Take-up by enterprises of cloud or data analytics or AI**

Taking the three technologies together (adoption of either AI, cloud, or data analytics), France stands at 44.9%, significantly below the EU average of 54.6%. The below-average performance of France is the consequence of the low adoption rate of cloud and AI, a diagnosis shared by the French authorities in their roadmap.

2.2.c Unicorns, scale-ups and start-ups

The French start-up ecosystem is very dynamic, backed by government initiatives in the sector over the past decade. Although the size of the ICT sector in France (4.7% in 2020) is below the EU average (5.2%), the venture capital investments for seed and start-up amounted to 0.07% of GDP in 2022, according to the OECD, which is above the other large EU economies (Germany, Italy, Spain). The French government launched several financial actions to nurture the start-up ecosystem with investment (see SDDR 2023 France country report for more details).

France benefited in the past years from a record attractiveness for foreign direct investments. In 2023, for the fourth consecutive year, France tops the European ranking for foreign direct investments for all sectors (i.e., not only ICT). This is mainly due to incentives in innovation policy, notably through the tax credit for research 'Crédit d'impôt recherche'. The attractiveness of France for foreign investments also relies on the access to a decarbonized energy, access to a qualified workforce and the overall quality of life. The latter could also contribute to attracting the necessary talents for a flourishing start-up ecosystem.

France had 36 unicorns in 2022 rising to 40 in 2023, and the ambition is to reach 100 unicorns by 2030. It should also include 25 'green sector' unicorns. This goal means far more than doubling the number of unicorns and represents 20% of the EU-level target (500 by 2030) while France accounts for roughly 17% of the EU's GDP. Though this is ambitious, the dynamic start-up ecosystem allows France to punch above its weight.

2.3 Strengthening cybersecurity & resilience

As companies rely increasingly on digital technologies, their risk of exposure to cybersecurity incidents is increasing, as is their need for preparedness in this area. In 2022, 2.4% of enterprises in France reported ICT service outage due to cyberattacks (e.g., ransomware attacks, denial of service attacks), which is below the EU average (3.5%). French enterprises seem more prepared than their EU peers as 39.9% of enterprises reported being insured against ICT security incidents (above the EU average of 25%) and 93.4% reported using ICT security measures (EU average: 91.8%).

Cyberthreats also affect the French public administration. The recent cyberattack on the national employment agency *France Travail* in February 2024 that potentially led to the leak of personal data of 43 million citizens is a reminder that cyberattacks not only target businesses but also public administration.

Since 2018 France has implemented its national cybersecurity and cyber defence strategy. Its review work resulted in a set of technical, legal, and even organisational measures to better protect France against cyber-attacks. The system has been continually adapted and will be key in 2024 to monitor important events such as the EU elections or the 2024 Olympic and Paralympic Games. In preparation for the Games, the national cybersecurity agency ANSSI has identified entities whose cyber resilience is important for the success of this event and has undertaken capacity building activities. To support the implementation of the NIS2 Directive in France, ANSSI has launched the MonEspaceNIS2 web portal that offers information for entities in scope of the requirements.

For companies, the *Cyber PME* scheme action is designed to support SMEs in carrying out their cybersecurity strategy. It provides support and advice ranging from diagnosis to the implementation of an action plan, including the purchase of solutions. The spread of cyber hygiene practices among enterprises relies a lot on the sector strategic committees (*comités stratégiques de filière*) where leading companies can spread their best practices to their partners or subcontractors.

On research and innovation in cybersecurity, the France 2030 investment plan supports the development of sovereign and innovative cybersecurity solutions. The plan also funds the training of cybersecurity experts and helps meet demand of individuals, businesses, local authorities, and the State. The Cyber Campus is a flagship achievement of French cybersecurity policy. It brings together more than 160 national and international players on a single site and aims to promote the implementation of research and development projects, as well as the emergence of the cyber unicorns. The target of the French authorities is to triple the turnover of French cybersecurity firms by 2030.

French authorities consider that international cooperation is key in cybersecurity. The national strategy is well aligned with the objectives of the European Cybersecurity Competence Centre's strategic agenda and will allow France to contribute to the challenges of training, support for small structures and boost research, development and innovation in cybersecurity.

3 Protecting and empowering EU people and society

3.1 Empowering people and bringing the digital transformation closer to their needs

France is designing its digital transition to have a strong emphasis on inclusiveness. Putting people at the centre of the digitalisation is the consequence of a long history of welfare state. Regarding digital training, France acts on basic education but also on life-long learning, both aiming at narrowing socio-economic divides. It has developed several specific inclusion programmes such as the training of digital advisors to be deployed in all the territories, included rural areas. The gender gap at work in the ICT sector is addressed by tailored actions. Finally, the digitalisation of public services, including that of the health sector, has gained attention in recent years with many measures implemented at all levels of administration. Many of the government's measures aim to narrow existing divides (geographical, socio-economic, gender, generational). Recent events in France evidenced that leaving no one behind is a crucial and sensitive topic, across all domains. The topic of child protection online and screen time of the youngest recently gained prominence in the political debate. The government is introducing a bill with additional measures to strengthen the protection of minors online. It provides for the publication of a technical reference system for a better age verification. The bill also makes it a priority to combat cyber-harassment and it temporarily bans people convicted of cyber-harassment or online hate crimes from recreating an account on the online platforms. According to the **Digital Decade Eurobarometer**, only 64% of the French population consider that the digitalisation of daily public and private services make their life easier. This is one of the lowest scores in the EU and significantly below the EU average (73%).

3.1.1 Equipping people with digital skills

3.1.1.a Basic digital skills

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

France brings a positive contribution to the EU's Digital Decade target on basic digital skills but demonstrates very limited dynamics. In 2023, 59.7% of the French population had at least basic digital skills. It is above the EU average of 55.6%, but behind the frontrunners' performance. The indicator is slightly below the level reached in 2021 (62.0%), while the EU progressed slightly over the same period. The

decrease could however be explained by post-COVID-19 effects with a decreased digital activity of the population with, for example, less telework or use of e-commerce between 2021 and 2023. Other digital skills indicators such as internet use (92.2%), above basic digital skills (30.6%), and basic digital skills in content creation (71.8%) point to a similar performance: France is above the EU average, but behind the frontrunners, and ranks in the second quartile of the EU distribution.

The above EU average performance gives France a slight head start to achieve its 2030 target. The national target is set to 80%, on par with the EU 2030 target. However, given the current rate of progress, reaching this target by 2030 would imply an intensification of efforts.

To improve the basic digital skills of the population, France acts on the very fundamental aspects of education. In a response to the drop in PISA results, especially in science subjects, it will boost the teaching of mathematics and authorities announced the creation of a baccalaureate test dedicated to mathematics and scientific culture. The aim of these measures is to increase the pool of young people that would ultimately be interested in studying STEM and ICT and/or embarking on a digital career in the future. The strategy is long-term and will probably bear fruits during and beyond the Digital Decade's time horizon. The weakness in mathematics was identified both in the State of the Digital Decade and European Semester country reports of 2023 and the authorities' actions are thus a very welcome answer in this respect.

The French authorities have taken inclusion measures to improve the digital literacy of the overall population. In particular, France has trained digital advisors (with the objective to train 20 000 'helpers' by 2025) and provided support to over 2 million French people in performing digital tasks (see best practice box below). Inclusion measures are key to reducing digital divides in a country with a sizeable rural population and where recent events have highlighted that the centralisation of economic activities and decisions is an issue.

3.1.1.b ICT Specialists

Note: The source of national forecast values is the 2023 country roadmap

France brings a positive contribution to the EU's Digital Decade target for ICT specialists and shows a very strong dynamic. The share of ICT specialists of total employment is 4.7%, the highest ever observed in France and around the EU of 4.8%. It is however more dynamic than the average with an annual growth

rate of +9.3% (+4.3% in the EU). Of these ICT specialists, 20.1% are women, which is higher than the EU average (19.4%). This is a progression toward gender convergence as this share was 19.0% in 2022. However, the share of ICT graduates represents only 4.1%, below the EU average of 4.5%.

Looking at the change over time in the number of ICT specialists, the target set by France in the roadmap is ambitious. The long timeseries provided by the Eurostat's Labour Force Survey shows that the percentage of ICT specialists among the total employment varied between 3.9% and 4.7% between 2018-2023 (reaching 4.7% in 2023, the last datapoint). The sharp increase of the proposed trajectory, required to reach the EU target (10% by 2030), contrasts with the sluggish trend observed, albeit the recent numbers are encouraging. The path to the 2030 target would correspond to more than doubling the current share of ICT specialists. In absolute numbers, France had 1.35 million ICT specialists in 2023; reaching the 2030 EU goal requiring almost doubling the current share would mean increasing to about 2.5 million ICT experts. In early 2023, the government announced the goal of training 400 000 digital experts by 2030, which is far off the required effort to reach the Digital Decade goal. Due to its large population, the efforts of France will have decisive consequences on the achievement of this 2030 EU target.

To increase the number of ICT specialists, France proposes to take action both on initial training and lifelong learning. On the initial training, the 'Digital and Computer Sciences Week' programme and the digital strategy for education (January 2023) will promote specialised studies and baccalaureates leading to digital careers, including attracting more young women. In this context, the 'Grande Ecole du Numérique' launched a new portal in June 2023, to give visibility to more than 15 000 digital training courses to reorient students toward digital study fields. The call for expressions of interest 'Skills and Jobs of the Future' (EUR 2.5 billion in total for all topics) should fund training more than 9 000 cybersecurity specialists by 2025 and more than 3 700 artificial intelligence specialists by 2030. The French authorities intend to support several innovative training schemes to strengthen lifelong learning. A dedicated action plan is currently being designed with skills operators. The State of the Digital Decade report 2023 suggested France continues to upskill and reskill the workforce, a recommendation which this set of measures addresses at least partially.

France actively promotes the inclusion of women in technological start-ups. The Parity Pact sets up a framework for enterprises to, among others, support women in high responsibility jobs. The initiative 'Tech pour Toutes' aims to support at least 10 000 female students each year in their training in digital careers by 2026.

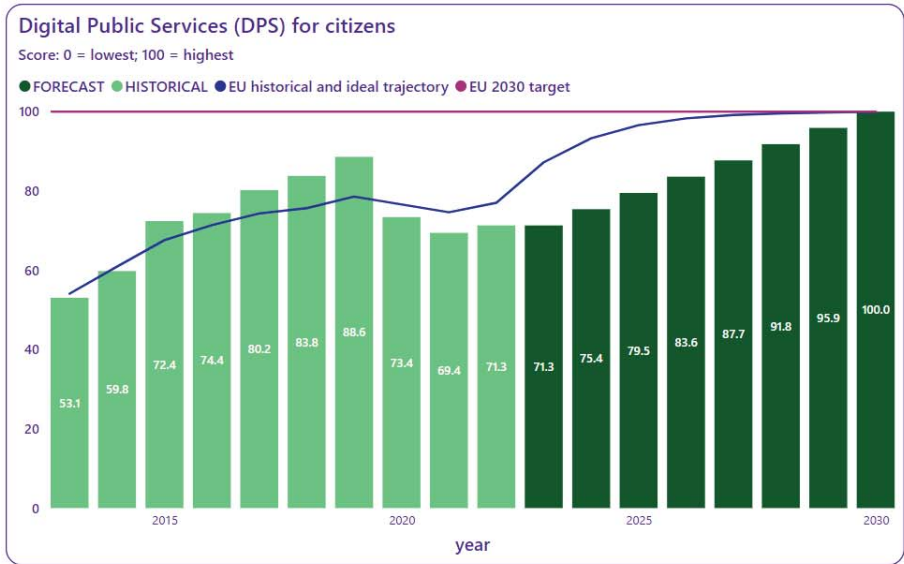### 3.1.2 Key digital public services and solutions – trusted, user-friendly, and accessible to all

3.1.2.a e-ID

France considers e-ID a priority as evidenced by the quick and recent development of the e-ID framework. The country is making progress in producing e-ID cards and releasing e-ID applications. In February 2024, the authorities launched 'France Identité', the companion application which allow the e-ID users to authenticate and access digital ID services. The development of the e-ID framework is designed toward future identity dematerialisation usage such as the inclusion of the driving license and within the European framework of the eIDAS regulation.

France participates to the European consortium called POTENTIAL (PilOTs for EuropeaN digiTal Identity wALlet), EWC (European Wallet Consortium), and DC4EU (Digital Credentials for Europe). It aims to test the deployment of a digital identity wallet to simplify and secure online procedures for European citizens, to facilitate the processing of procedures by administration services, and to fight against identity theft. It

involves 19 Member States and Ukraine, including 38 ministries, 34 state operators, 9 research centres, 51 large companies and 12 start-ups. The development and testing of the European digital identity wallet will extend over a period of 26 months, dived in two phases: a first phase for testing national solutions, until October 2024; a second phase with cross-border tests aimed at securing the interoperable nature of the different solutions. The consortium benefits from EUR 16 million of European subsidies.

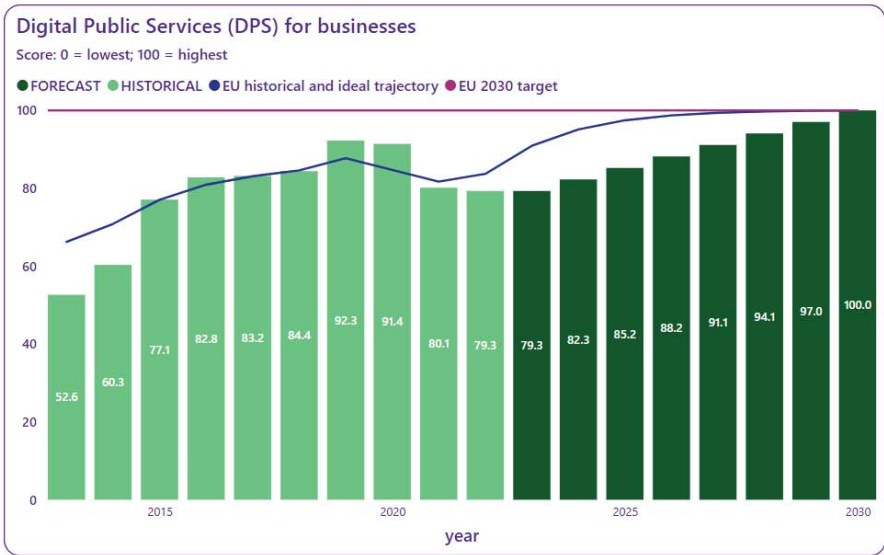### 3.1.2.b Digitalisation of public services for citizens and businesses

Digital Public Services (DPS) for citizens
Score: 0 = lowest; 100 = highest
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Historical values: 53.1, 59.8, 72.4, 74.4, 80.2, 83.8, 88.6, 73.4, 69.4, 71.3
Forecast values: 71.3, 75.4, 79.5, 83.6, 87.7, 91.8, 95.9, 100.0

Commitment level
2030 national vs EU target
0 **100.0** 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	71.3	87.2
DESI 2024	72.1	79.4
AVERAGE ANNUAL GROWTH %	1.1	3.1

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Digital Public Services (DPS) for businesses
Score: 0 = lowest; 100 = highest
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Historical values: 52.6, 60.3, 77.1, 82.8, 83.2, 84.4, 92.3, 91.4, 80.1, 79.3
Forecast values: 79.3, 82.3, 85.2, 88.2, 91.1, 94.1, 97.0, 100.0

Commitment level
2030 national vs EU target
0 **100.0** 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	79.3	90.9
DESI 2024	79.3	85.4
AVERAGE ANNUAL GROWTH %	0.0	2.0

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

France has untapped potential to contribute to the EU's Digital Decade target on the digitalisation of key public services for citizens and businesses, while demonstrating limited dynamic. On both public services for citizens (72.1) and businesses (79.3), France ranks below the EU average in absolute value and annual growth. However, very good performances could be observed in the use of e-government by internet users

in the last 12 months (90.8%, EU average: 75.0%). This large appetite of the population for digital public services should encourage speeding up their development.
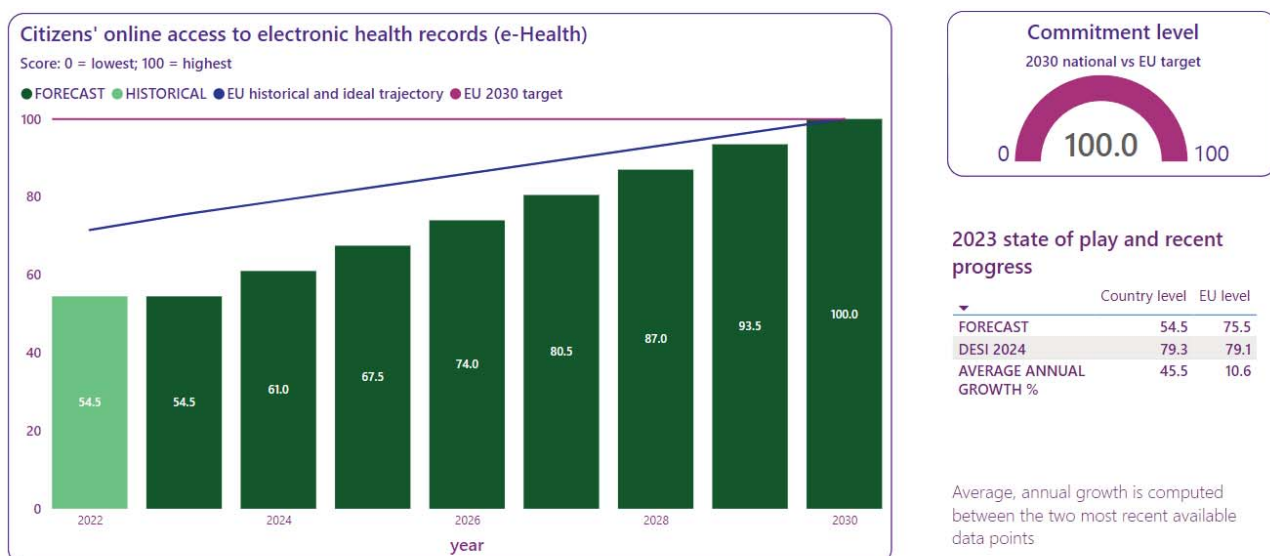
France aims to reach the EU target of 100% digital public services by 2030. However, given the current limited growth of digitalisation, the country is at risk of missing the target. It is below the average dynamic of the EU which, according to projections, is adequate to realistically reach the target at the end of this decade.

In France, the digitalisation of public services is a crucial enabler to relieve administrative burden, hence to improve competitiveness. The issue of administrative burden and complexity is often raised as limiting growth, especially for businesses. Therefore, the digitalisation of administration goes hand in hand with the administrative simplification strategy being implemented since 2017 and should have benefits, not only for citizens, but for the economy in general.

The French authorities have committed to investing resources to digitalise 250 of the most essential administrative procedures by 2027.

The strategy for the digitalisation of public services also relies on advanced technologies such as responsible data sharing and experimentation with AI tools. Several monitoring tools were also implemented such as 'Services Public +' and the observatory 'Your essential digital steps' which are intended to improve the quality and the efficiency of public services through consultations. France experiments the use of AI tools in the administration with its sovereign solution Albert presented in 2024, aiming at increasing the efficiency of public services. The State of the Digital Decade report 2023 suggested France takes measures to further strengthen the alignment of the different administrative levels involved and to improve the interoperability, effectiveness, and availability of online public services. The current actions seem to go in the right direction, but actual implementation should be monitored up to 2027.

3.1.2.c e-Health

Citizens' online access to electronic health records (e-Health)
Score: 0 = lowest; 100 = highest
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

(bar values: 2022: 54.5 (historical), 54.5, 61.0, 67.5, 74.0, 80.5, 87.0, 93.5, 100.0 by 2030)

Commitment level
2030 national vs EU target

0 — **100.0** — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	54.5	75.5
DESI 2024	79.3	79.1
AVERAGE ANNUAL GROWTH %	45.5	10.6

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

France has untapped potential to contribute to the EU's Digital Decade target on e-health but shows very strong dynamic. France has an overall e-health maturity score of 79.3 in 2023. This compares to a maturity score of 54.5 in 2022, showing a spectacular progression. It allowed France to catch up with the EU average

of 79.1. A centralised, nationwide access service is technically available in France. Between 80 and 100% of the national population is technically able to access the online access services for e-health records through both native mobile applications and online portals, logging in using an e-ID based on two-factor authentication. The access to e-prescription/e-dispensation is however poor. All but three data types – medical devices/implants, medical images, and eDispensations – are made available to citizens. The types of connected healthcare providers have expanded since 2022, with public and private primary care centres, rehabilitation centres, and mental health facilities additionally contributing data to the national electronic health record system. Furthermore, the online access service is now reported to comply with the general accessibility improvement reference framework (https://accessibilite.numerique.gouv.fr/). France can further improve its e-health maturity by implementing functionality for authorised persons to access electronic health records on behalf of others. Regarding access opportunities for certain categories of people, France scores 75 compared to a European average of 77 and does follow the Web Content Accessibility Guidelines.

For 2030, France aims to achieve a score of 100 in e-health, in line with the EU target. Given that France caught up with the EU average and demonstrated significant progress recently, the target seems achievable if France maintains this pace of progress.

In 2023, 55% of people in France sought health information online, close to the EU average (56%). However, the Digital Decade Eurobarometer suggests that only 72% of French respondents find digital technologies are important to access or receive healthcare services, which is below the EU average of 79% and a drop from last year.

The digitalisation of the health sector is a priority in France, as evidenced by the largest digital measure from the French Recovery and Resilience Plan (RRP) dedicated to e-health. The digital health acceleration strategy aims to promote the emergence of innovative e-Health solutions supported by innovative multidisciplinary scientific approaches. The strategy operates along 5 axes: (1) developing the knowledge necessary for tomorrow's digital health, (2) supporting and facilitating access to the market, (3) catalysing the development of a large French digital health ecosystem, (4) strengthening confidence in e-health through training, and (5) strengthen the policy of sharing and exploitation of health data. Notably, the strategy includes calls for projects aimed at evaluating the benefits of digital medical devices or based on AI. France is also a member of the working groups working towards setting up the Genome EDIC and the European Cancer Imaging Initiative (EUCAIM) EDIC. The State of the Digital Decade report 2023 suggested France complements the RRP funding of hardware equipment in hospitals with measures to involve users and adapt the organisation to the new data flows. While no new measure was proposed yet, the implementation of the RRP is considered on track until now.

3.2 Building a safe and human-centric digital environment and preserving our democracy.

Only 67% of people in France consider digital technologies important for engaging in democratic life. As measured in the Digital Decade Eurobarometer, this rate is below the EU average (74%) but in progress since last year (+7pp).

France considers the Digital Service Act (DSA) as a major tool for the protection of people online. The DSA was adopted during the French presidency of the Council of the EU and aims at protecting online users from the spread of illegal and harmful content, illegal and dangerous products, and disinformation. The DSA also imposes strong obligations to protect user privacy, in particular by banning advertising that target minors or the use of sensitive data within the meaning of the GDPR. At the national level, a bill to secure and regulate

the digital space provides for other concrete measures relating to consumers, in particular the establishment of an anti-scam filter to block sites which, with phishing practices, seek to extract money or sensitive data to users.

Hate speech online is a growing problem in France. Indeed, in 2023, 41% of the population encountered hostile or degrading online messages in the last 3 months of a Eurostat survey, significantly above the EU average of 33.5%. Under the DSA, all platforms must put in place mechanisms for reporting illegal content, in particular discriminatory content, harassment, or incitement to hatred. As soon as they become aware of the report, they must process it as quickly as possible.

France prioritises child protection online. The topic of children protection online and screen time of the young children has recently gained in prominence in the political debate. The government is introducing a bill with additional measures to strengthen the protection of minors online for example by restricting access to sites containing pornographic content. The bill provides that the Regulatory Authority for Audiovisual and Digital Communication (Arcom) publishes a technical reference system relating to age verification systems for sites offering pornographic content to ensure their validity. The fight against cyber-harassment is also a pillar of this bill, which will temporarily prohibit people convicted of cyber-harassment or for online hate crimes from recreating an account on the online platform concerned. According to the Digital Decade Eurobarometer, 38% of French citizens consider that the recent EU regulations of online platforms might have a strong impact on the protection of minors, which is above the EU average of 33%.

4 Leveraging digital transformation for a smart greening

For France, the green transition is a top priority in all policies, including those related to digitalisation. France demonstrated in recent years a pioneer mindset in developing policies for the green transition with flagship measures such as the law 'Climate and Resilience' or the national low carbon strategy (*Stratégie Nationale Bas Carbone*). The country developed many monitoring frameworks to assess the environmental impact of policies in all areas such as the annual green budgeting exercise. France has a broad approach of the green transition, acting at several degrees by designing methodologies, fostering innovation, accompanying enterprises, training workers with the relevant skills, and coupling it with the digital transition

The digital sector represents 2.5% of France's carbon footprint (17Mt CO_2)[18]. The terminal equipment (computers, tablet, screens, mobile phones, …) account for the majority of the digital carbon footprint (79%). While most of the equipment is imported (and therefore also its emissions), France set up a bonus in 2022 to incentivize the reparation of electric and electronic equipment. The share of sales of reconditioned mobile phones represents now 15% of the total sales. Networks energy consumption continues to increase but at a slower rate than in previous years (+3% in one year in 2021 compared to +6% in 2020). Moreover, the adoption of fibre is expected to play a positive role in this respect, since the average energy consumption per subscription amounts to 34 kWh on a copper network compared to less than 10 kWh on fibre optic networks.

On the whole, French people and companies are sensitive to the green transition of the digital sector. In France, 45.1% of enterprises considered the environmental impact of ICT services, or ICT equipment, before

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[18] Etude ADEME – Arcep sur l'empreinte environnementale du numérique en 2020, 2030 et 2050 (2023)

selecting them and applied some measures, affecting the paper or energy consumption of the ICT equipment, which is along the EU average (Eurostat). French citizens tend to recycle more their ICT devices (11.9% for laptops and tablets, 14.9% for desktops) than the EU average (9.7% and 12.8%, respectively).

France emerges as a European leader in monitoring the impact of digitalisation on the environment and in promoting the adoption of sustainable digital principles. France follows a general policy aimed at reconciling digital and environmental transition and supporting the eco-responsibility of the digital sector while developing a more sober competitive offer of digital solutions. France is demonstrating leadership in the green transition of the digital sector by being a frontrunner in the development of monitoring methodologies. For example, France developed a general framework for the eco-design of digital services (see dedicated 'Best practice' box) and, since 2021, a repairability index to better inform the consumer on repairable nature of their purchases.

France published in July 2023 a digital decarbonization roadmap, that benefited from a large consultation with stakeholders in the sector and a review by a committee of technical experts. The roadmap identifies the obstacles to be removed and the actions to be taken to reduce the digital carbon footprint by 40% by 2030. This work feeds into the update of the French National Low-Carbon Strategy, planned for 2025, which will set, for the first time, objectives dedicated to the digital sector.

The country is also a provider of a mostly decarbonized electricity that could be an incentive for attracting digital businesses willing to lower their carbon footprint. The State of the Digital Decade report 2023 encouraged France to continue its activities regarding the environmental aspect of digital sectors and the set of polices currently in place largely contributes to addressing this recommendation.

During its Presidency of the Council of the EU, France drafted a joint declaration on the dual digital and environmental transition, signed by 22 Member States. They called for defining, by 2026, objectives to maximize the use of digital technology in favour of the ecological transition while limiting its carbon and environmental footprint. At national level, France proposed in 2023 a decarbonisation roadmap for the digital sector to identify instruments to reduce its environmental footprint. The acceleration strategy for eco-responsible, competitive, and sovereign digital technology included in the France 2030 plan embodies the financial aspect of this ecological planning and foster concrete commitment of the digital sector. The French administration itself (with DINUM, the inter-ministerial digital department) commits to 'digital sobriety' with, for example, a target of buying 20% of reconditioned terminals or the donation of digital equipment.

France is a member of the CitiVERSE EDIC (already set up). The CitiVERSE initiative aims at connecting existing local digital twins across Europe. Local digital twins are virtual representations of a city's physical assets, processes, and systems. The CitiVERSE focuses on advancing generative AI applications in smart cities, including simulations addressing the impact of changing traffic conditions on air quality, decarbonization and congestion. This EDIC is a very good example of an EU-level collaboration to use digital tools to manage the green transition.

Best practice: a general framework on the eco-design of digital services

According to a study conducted by the ecologic transition agency ADEME and the national regulatory agency for telecoms ARCEP, data traffic will be multiplied by 6 in 2030 and the number of terminal equipment will raise by +65%, increasing drastically the environmental impact of the digital sector.

Consequently, French authorities launched in 2022 the development of a general non-binding framework on the eco-design of digital services targeting all development and digital design professions. It has four objectives:

1. To design more sustainable digital services to extend the lifespan of terminals;
2. To promote an approach of sobriety in strategies designed to capture the user's attention;
3. To reduce IT resources mobilized (in particular the demand on infrastructure);
4. To increase the level of transparency on the environmental footprint of digital services.

To enable self-assessment of eco-design approaches, the framework set 91 criteria covering nine topics (strategy, specifications, architecture, user experience, content, front/backend, hosting, training). The results are presented as a progress score and an eco-design declaration (including details of the implementation of the benchmark and the calculation of the score). This self-assessment would constitute an opportunity for digital service providers to showcase their eco-responsibility while allowing users to make educated choices on the impact of various digital services on the environment.

A first consultation was launched in 2023 and the final publication is expected in 2024.

Annex I – National roadmap analysis

France's national Digital Decade strategic roadmap

France submitted its national strategic roadmap on 18 January 2024. It was officially presented to the public on 25 March 2024 at an event involving the Secretary of State in charge of Digital, the Director General of Enterprises and a range of stakeholders from the digital sector, along with the Director General of DG CNECT from the European Commission. (link to the official roadmap)

The French roadmap is mostly complete and contains 12 targets and 11 trajectories until 2030 (out of 14 expected). The FTTP trajectory is assumed to be similar to the one presented for VHCN, since France relies integrally on fibre deployment, but missing edge nodes and unicorns. Most of the national targets match those of the EU for 2030, with the notable commitment of 100% fibre and 5G coverage to be achieved as early as 2025. The adoption of technologies by enterprises (cloud, AI, data analytics), taken separately are set below the 75% target (53%, 50%, 35%, respectively). The trajectories have been computed on the basis of the correct KPI definitions but might require adjustments to correct the starting year (DESI2023 indicators were measures in 2022 or earlier, depending on the indicator). The below table reflects a best-effort attempt at categorising the measures and budget as presented in France's roadmap:

Digital Decade Target/objective	Budget (EUR Million)	Number of measures
Connectivity Gigabit	35.7	2
Connectivity 5G	128.0	2
Semiconductors	12 160.0	3
Edge nodes	550.0	1
Quantum computing	1 000.0	1
SME take up	61.7	1
Cloud/AI/Big Data uptake	-	-
Cloud only uptake	150.0	1
AI only uptake	25.0	2
Big data uptake	-	-
Unicorns	-	-
Basic Digital Skills	204.0	2
ICT Specialists	2 500.0	2
eID	16.0	4
Key Public Services	0.0	2
e-Health	848.4	2
Objectives	129.0	3
Total	**17 807.9**	**28**

France presents a non-exhaustive selection of the main policies and measures contributing to the achievement of each of the Digital Decade targets. The roadmap's measures also cover several types of objectives: technological leadership, sovereignty, competitiveness, cybersecurity, fundamental rights, and sustainability. In total, the measures presented amount to EUR 17.8 billion, not including confidential budgets. While the vision set out in the roadmap is presented as comprehensive, a substantial share of the

roadmap's budget (68%) will contribute to increasing the production of semiconductors. Also, the roadmap emphasises R&D measures across several domains (e.g., 5G, chips, quantum, cloud, AI), a consequence of the ongoing implementation of the France 2030 investment programme. The interplay between the digital and green transitions is strongly developed and backed by measures and proposals. The source of funding (especially EU funding) does not seem accurate in the current document. The roadmap is weak on proposing new/scaled up measures for the digitalisation of enterprises, especially SMEs' digital intensity and the take-up by enterprises of advanced technologies (not only R&D). New tailored measures to answer challenges identified in the State of the Digital Decade report 2023 (e.g., digitalisation of SMEs) would have been welcome.

Overall, the roadmap is consistent with efforts in all the dimensions of digitalisation. However, some aspects might require more effort. For example, the skills elements could benefit from more focus given the ambitious targets at EU and national levels, especially for ICT specialists that will require roughly doubling the current number of ICT professionals. The resources dedicated to the digitalisation of enterprises (both basic intensity and adoption of advanced technologies) could also be increased given the delay observed in France compared to the EU's progress.

Annex II – Factsheet on multi-country projects (MCPs) and funding

MCPs and EDICs

France is the hosting member of the ALT EDIC (already set up), the candidate host for the possible future AgriFood EDIC, and is co-leading the prospective EDIC Digital Commons together with the Netherlands. France is also a member of the Local Digital Twin towards CitiVERSE EDIC[19](already set up).

France is developing the Statute and other relevant documents for the possible future EDICs for Mobility and Logistics EDIC and the Genome within informal Working Groups. It is engaging in discussions on the setup of possible future Cancer Image Europe (EUCAIM) EDIC, also within an informal Working Group. All in all, France is active in a number of EDICs already set-up or in the making.

France also reported participating in several multi-country projects: the POTENTIAL consortium on e-ID, the blockchain experimentation on university degree certification, EuroHPC, and Joint Undertakings on Chips and Smart Networks and Services.

EU funding for digital policies in France

EU funds support the digitalisation efforts in Member States. The French Recovery and Resilience plan devotes EUR 8.1 billion (22% of the total) to the digital transformation. According to a Joint Research Centre's study[20], EUR 7.7 billion of the French Recovery and Resilience Plan directly contribute to achieving Digital Decade targets. Out of the Cohesion Policy funds received by France, EUR 1.2 billion contribute directly to Digital Decade targets according to the same mapping study.

The largest digital measure of the Recovery and Resilience Plan is dedicated to the modernisation of the public health sector (EUR 2 billion). The measure 'Innovating for the resilience of our business models' (EUR 1.8 billion) supports R&D in key digital technologies such as 5G, cloud, quantum, cybersecurity, and digital skills. The high-speed broadband plan ('France très haut débit') receives EUR 240 million from the RRF. As of March 2024, the implementation of the French RRP goes as planned as evidenced by the two first payment requests that successfully lead to the disbursement of EUR 22.8 billion with no missed targets or milestones.

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[19] Information updated on 31 May 2024

[20] Based on an estimation of the possible contribution to the Digital Decade (Joint Research Centre report 'Mapping EU level funding instruments to Digital Decade targets - 2024 update' (Signorelli et al., 2024)).

State of the Digital Decade 2024

Germany

1 Executive summary

Germany brings a positive contribution to the European Union's (EU) Digital Decade objectives and targets, in view of a successful digitalisation that fosters competitiveness, resilience, sovereignty, European values and climate action.

In 2023, Germany made notable progress in the deployment of connectivity infrastructure, in particular 5G stand-alone-ready infrastructure and in FTTP. There is also good progress in enhancing basic digital skills. However, the country is still facing **important challenges** in reaching full FTTP coverage as well as in the digitalisation of public services.

Digitalisation is a top priority for the Federal Government, reflected in several targeted strategies and massive investments in research and development of digital technologies. Germany's cornerstone policy is the Digital Strategy, adopted in August 2022 and updated in April 2023, which encompasses all facets of a sovereign, digital society, an innovative economy and a digital state. Several other strategies focus on specific aspects of digitalisation in Germany, such as the Gigabit Strategy, the AI Strategy, the Data Strategy, the Start-up Strategy; Education in the Digital World Strategy and the National Further Education Strategy.

According to the **Special Eurobarometer survey, the 'Digital Decade 2024'[21],** 70% of the German population said that the digitalisation of daily public and private services makes their life easier, below the EU average of 73%.

Regarding **European Digital Infrastructure Consortia** (EDICs) Germany is engaging in discussions on the setting up of the Mobility and Logistics Data EDIC, the Digital Commons EDIC, the Cancer Image Europe (EUCAIM) EDIC, the Genome EDIC and the AGRIfood EDIC. The country is also finalising membership negotiations with the Local Digital Twins towards the CitiVERSE – EDIC[22](already set up). As part of the EuroHPC Joint Undertaking, Germany will host one of the two EU's exascale supercomputers, and one of the quantum computers.

Regarding EU funding, both Germany's Recovery and Resilience plan (DARP) and the cohesion funds support Germany's commitment to digitalisation. The DARP focuses on digital investments, featuring two important projects of common European interest (IPCEIs), one on semiconductors and one on cloud. Germany allocates 48% of its total Recovery and Resilience plan to digital (EUR 13.5 billion)[23]. Under cohesion policy, an additional EUR 2.3 billion (12% of the country's total cohesion policy funding) is allocated to the country's digital transformation[24].

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[21] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351

[22] Information last updated on 31 May 2024.

[23] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.

[24] This amount includes all investment specifically aimed at or substantially contributing to digital transformation in the 2021-2027 cohesion policy programming period. The source funds are the European Regional Development Fund, the Cohesion Fund, the European Social Fund Plus, and the Just Transition Fund.

Digital Decade KPI [1]	Germany			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	DE	EU
Fixed Very High Capacity Network (VHCN) coverage	70.1%	74.7%	6.6%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	19.3%	29.8%	54.2%	64.0%	13.5%	100%	-
Overall 5G coverage	93.2%	98.1%	5.3%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		351		1 186		x	10 000
SMEs with at least a basic level of digital intensity	58.9%	61.4%	2.1%	57.7%	2.6%	91%	90%
Cloud	31.8%	38.5%	10.0%	38.9%	7.0%	x	75%
Artificial Intelligence	10.6%	11.6%	4.6%	8.0%	2.6%	x	75%
Data analytics	NA	37.1%	NA	33.2%	NA	x	75%
AI or Cloud or Data analytics	NA	58.0%	NA	54.6%	NA	75%	75%
Unicorns		67		263		122[25]	500
At least basic digital skills	48.9%	52.2%	3.3%	55.6%	1.5%	80%	80%
ICT specialists	5.0%	4.9%	-2.0%	4.8%	4.3%	x	~10%
eID scheme notification		Yes					
Digital public services for citizens	78.4	75.8	-3.3%	79.4	3.1%	x	100
Digital public services for businesses	80.7	78.6	-2.6%	85.4	2.0%	x	100
Access to e-Health records	70.3	87.0	23.7%	79.1	10.6%	100	100

[1] See the methodological note for the description of the indicators and other descriptive metrics

National Digital Decade strategic roadmap

With respect to **Germany's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating **some ambition** and, based on this document, intends to allocate **very significant effort** to achieve the Digital Decade objectives and targets.

More specifically, the targets set are ambitious, but not all targets are covered. The roadmap sets 2030 **targets for 8 KPIs** (VHCN, FTTP, 5G, the AI or cloud or big data joint indicator (the three technologies together), digital intensity, unicorn companies, digital skills and e-health). It sets **no target and therefore also no trajectory for 7 KPIs**: ICT specialists, edge nodes, AI, cloud, big data (separately), digital public services for citizens and for businesses. All the national targets are aligned with the EU's 2030 targets, but **full trajectories are provided for only 2 KPIs**: SMEs with at least a basic level of digital intensity and e-health. **Trajectories with one or two datapoints are provided for 3 KPIs**: FTTP/VHCN and 5G. Although this is not required, the roadmap also provides a full trajectory on quantum, the joint AI or cloud or big data indicator and on e-ID.

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[25] No concrete number was provided in the roadmap. The target is assumed by the European Commission, which uses Dealroom as database. For DESI 2023, the European Commission determined 61 unicorns in Germany. Germany does not have direct access to the data and therefore cannot take any responsibility for comparability with other countries or for completeness and accuracy. In the event of a change in the database, the target would have to be adjusted if necessary.

The roadmap briefly covers the objectives of the Digital Decade such as digital citizenship, promoting leadership and sovereignty and contributing to the green transition.

The total budget of measures **is estimated** at almost EUR 100 billion (about 2.4% of Germany's GDP), with 60% allocated to fibre roll-out, followed by 17% for semiconductors and 10% for unicorn companies/start-ups. Some aspects require more action, such as the aim to increase the current number of ICT professionals. The roadmap assesses the key challenges related to the targets and analyses the impact of the measures on areas where specific challenges exist.

Recommendations for the roadmap

Germany should, when submitting adjustments to its national roadmap in accordance with Article 8(3) of the Digital Decade Policy Programme (DDPP) Decision:

- **TARGETS:** (i) Propose a target and a trajectory for ICT specialists, edge nodes, AI, cloud and data analytics (separately), digital public services for citizens and for businesses; (ii) Complement the trajectory and thus provide yearly datapoints for the following 5 KPIs: FTTP, VHCN, 5G, unicorns and basic digital skills.

- **MEASURES:** Provide **more information on the implementation of digital rights and principles** (and Digital Decade general objectives), including what national measures contribute to it.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' provides insights into German perceptions of digital rights. Although 41% of Germans believe the EU protects their digital rights effectively, this is a decrease of 6 points from last year and is below the EU average of 45%. Concerns have intensified, with 58% worried about children's online safety, up 4 points, and 44% about control over personal data, up 2 points. On the positive side, 57% value freedom of expression online, re satisfied with the level of digital skills, both figures remaining below the EU average. The monitoring of the Declaration on Digital Rights and Principles shows that increasing the profile of the Declaration at national level and fostering better stakeholder engagement could help improve outcomes in the years to come[26].

A competitive, sovereign and resilient EU based on technological leadership

Germany aims to become a technological leader and is investing massively in leading technologies (semiconductors, quantum etc.), but it should continue to increase its fibre network coverage, where it made a very positive progress in deployment over the past year. On infrastructure, Germany is second last in the EU on FTTP coverage with 29.8%, well below the EU average, however, with a strong growth (more than 10 percentage points from last year). To reach 100% coverage by 2030, it must continue deployment at this high growth rate. The necessary funding will come from both public and private sources, with the private sector forecast to invest EUR 50 billion in the coming years. The share of broadband retail lines with above 1 Gbps speeds is still very low at 5.45%, well below the EU average of 18.5%. At 98.1%, Germany is close to reaching full overall 5G household coverage. German authorities reported 87.3% stand alone-ready 5G coverage of Germany's territory. However, the coverage in the 3.4-3.8 GHz band, which is needed for this technology to realise its full potential, is rather limited (43.8% household coverage). Moreover, only 16.5% of the German population uses 5G SIM cards in 2023, well below the EU average of 24.6%.

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[26] See SWD 'Digital Decade in 2024: Implementation and perspective' with annexes, SWD(2024)260: https://digital-strategy.ec.europa.eu/en/news-redirect/833325, Annex 4.

The digitalisation of enterprises is slowly gaining traction in Germany, as almost all relevant KPIs indicate an above-EU-average performance. Germany also hosts 67 unicorn companies, accounting for 25% of all EU unicorns. Innovative, technology-driven start-ups are supported by the 'Future Fund' with EUR 10 billion. Digital and technological sovereignty is one of the priorities Germany set in its Digital Strategy and the country is strongly involved in projects that will advance this goal in the area of semiconductors (IPCEI on microelectronics), data (Gaia-X) and cloud (IPCEI-CIS).

Recommendations – Germany should:

- **CONNECTIVITY INFRASTRUCTURE:** (i) Maintain the recent higher pace of deployment of the fibre infrastructure to reach the Digital Decade target. (ii) Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to continue the deployment of 5G stand-alone core networks.

- **CLOUD:** Ensure the broad uptake of the next generation of cloud infrastructure and services under development in the IPCEI-CIS by companies of all sizes, including by developing a country-specific dissemination strategy (complementing what has already been committed under IPCEI-CIS); contributing to the additional dissemination activities led by the Cloud IPCEI Exploitation Office.

- **SMEs:** Continue supporting the digitalisation of SMEs.

- **CYBERSECURITY:** (i) Continue efforts in cybersecurity to address evolving threats and strengthen in this regard the collaboration between the state and the industry; (ii) Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

Protecting and empowering EU people and society

Germany is committed to enhancing the digital skills of the population and to training ICT specialists, but progress is slow, and it will require sustained efforts to digitalise public services. The level of digital skills of the population is slightly below the EU average, but slowly increasing. Skills development is a joint responsibility of the Federal Government and the Länder, meaning that a good cooperation is necessary. In recent years, Germany has launched several initiatives to develop digital skills. It included related measures in the Recovery and Resilience Plan and listed in its roadmap 17 measures that are relevant in this area with EUR 7.5 billion in support. The Digital Pact for Schools, with a budget of EUR 6.5 billion, supports the Länder in providing a minimum level of digital infrastructure and teaching-learning technologies in schools. However, this project is due to end in May 2024. A follow-up project (Digital Pact School 2.0) is being negotiated at the time of writing (March 2024). The proportion of ICT specialists in employment is slightly above the EU average. However, a challenge that Germany faces is the overall decline in the number of first year students due to demographic changes. The country will need to accelerate the pace of digitalisation of public services as it is below the EU average and even saw a slight decline in the related indicators.

As of April 2024, there were 157[27] digital public services available nationwide out of the 575 services that Germany had proposed to digitalise by the end of 2022 based on the Online Access Act. To promote the uptake of these services, Germany is increasingly focusing on the user friendliness of its digital public services. To this end, in February 2024, it adopted the Online Access Amendment Act (*Onlinezugangsänderungsgesetz*) 20/8093. Germany is below the EU average in digitalisation of public services both for citizens (score 75.8 versus the EU average of 79.4) and businesses (78.6 versus 85.4).

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[27] https://dashboard.digitale-verwaltung.de/

Germany had an overall e-health maturity score of 87 in 2023, above the EU average of 79 and well above its score of 70 in 2022.

Recommendations – Germany should:

- **BASIC DIGITAL SKILLS:** Step up cooperation at all levels of administration to boost the digital skills of the population by 2030.
- **ICT SPECIALISTS:** (i) Increase the attractiveness of STEM disciplines at school to boost the number of young people, including girls and women, interested in taking up ICT-related studies or careers; (ii) Design incentive schemes to attract/retain ICT specialists.
- **DIGITAL PUBLIC SERVICES:** Accelerate the digitalisation of public services for citizens and businesses.
- **E-HEALTH:** (i) Ensure that all data types are made available in a timely manner; (ii) Increase the supply of health data by onboarding more categories of healthcare providers.

Leveraging digital transformation for a smart greening

For Germany the green and digital twin transition is a top priority, underpinned by an action plan of the Federal Ministry of Education and Research (BMBF) 'Natural. Digital. Sustainable'. This is the basis for the 'Digital Sustainability Innovations' initiative that creates specific funding to connect between digitalisation and sustainability.[28] German enterprises and people are generally sensitive to the green transition of the digital sector. Germany has brought a wealth of measures that aim to green the digital economy, ranging from the application of AI technologies, organising workshops to promoting implementation of the Blue Angel criteria. Germany is committed to monitoring the impact of ICT systems. The German National Regulatory Authority, the *Bundesnetzagentur* commissioned a study, published in 2023, which resulted in a set of indicators assessing the environmental sustainability of the telecommunications infrastructure. Four digitalisation measures were launched in Germany providing direct support for the green transition and that will also have a positive impact on the environment.

Recommendations – Germany should:

- Continue developing a coherent approach to twinning the digital and green transitions. First, continue promoting improvements in energy and material efficiency of digital infrastructures, in particular data centres. Second, continue supporting the development and deployment of digital solutions that reduce the carbon footprint in other sectors, such as energy, transport, buildings, and agriculture, including the uptake of such solutions by SMEs.
- Demonstrate leadership and continue monitoring and quantifying the emission reductions of the deployed digital solutions in line with the relevant EU guidance and with the support of the methodology developed by the European Green Digital Coalition, in view of future policy development, as well as of attracting relevant financing.
- Share its experience in developing resource-efficient AI technologies and its best practice in using AI to increase resource efficiency and material savings.

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[28] Digitalisierung und Nachhaltigkeit - BMBF

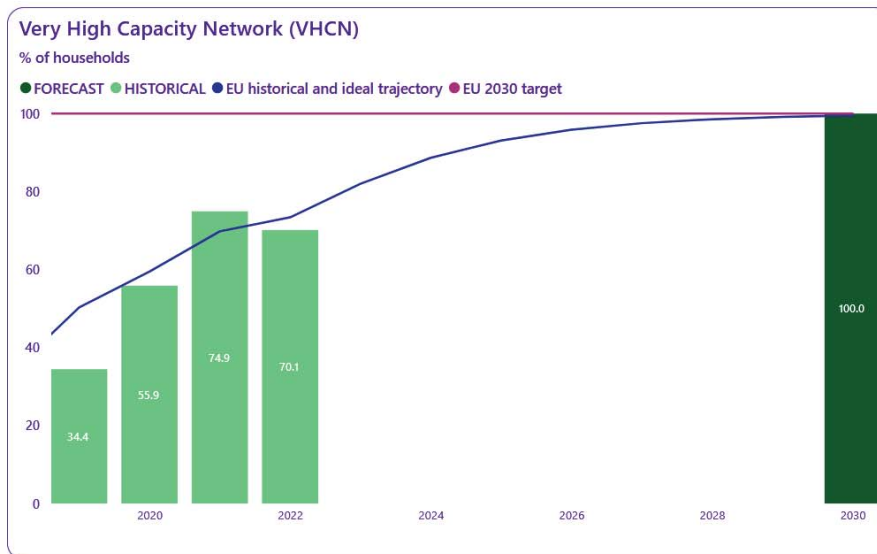# 2 A competitive, sovereign and resilient EU based on technological leadership

Germany is pursuing its goal to become a technological leader in Europe, investing significant amounts in both fibre network infrastructure and leading digital technologies. The country started from a very low point on fibre coverage, with limited dynamic for years. However, Germany's increased focus on rolling out fibre network infrastructure is beginning to show results, given the spectacular increase of 54.2% in fibre coverage over the past year from 19.3% in 2022 to 29.8% in 2023. However, the country ranks still second last among EU Member States in this regard. Germany's 5G coverage is almost reaching saturation level (98.1%). The main market development in 2023 was to roll out 5G stand-alone-ready networks to reach 87.3% coverage of Germany's surface area by October 2023. However, the 5G coverage in the 3.4-3.8 GHz band, which is needed for this technology to realise its full potential, is rather limited (43.8% household coverage).

The ICT sector accounted for a 4.44% share of GDP in 2020, below the EU average of 5.23%. Germany is investing heavily in research and development of semiconductors, quantum computing and edge nodes. Given the exposure of enterprises to cyberattacks, the government is sharpening focus on resilience and cybersecurity. The country is participating in 12 multi-country projects with a focus on strengthening cybersecurity (see the list in the relevant section below).

2.1 Building technological leadership: digital infrastructure and technologies

Germany is making good progress in deploying connectivity infrastructure. 5G coverage is at 98.1%, close to 100%. It plans to extend fibre networks, currently at 29.8%, to reach 50% coverage by 2025 and 100% by 2030, according to the commitments made by the Federal Government. Furthermore, also gigabit connections (VHCN) show a positive roll-out dynamic over time.

63

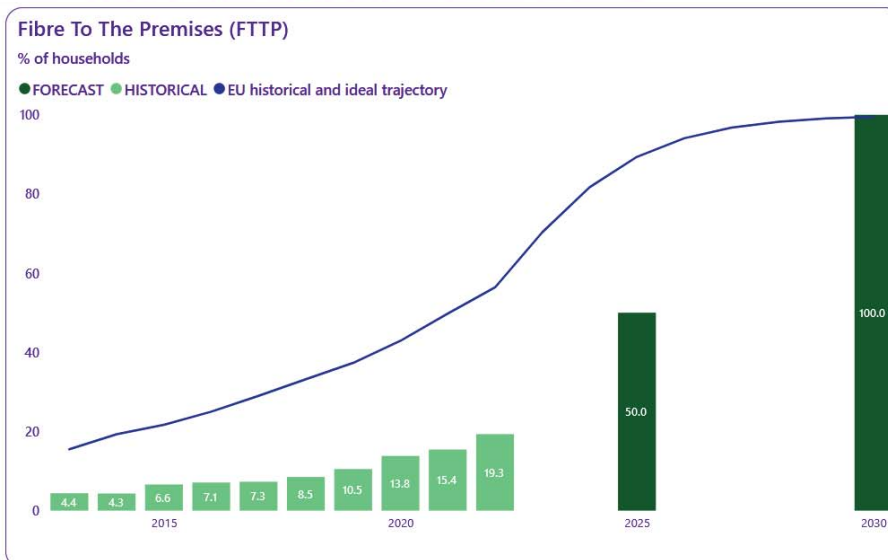## 2.1.a Connectivity infrastructure (gigabit)[29]

Very High Capacity Network (VHCN)

% of households

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Note: The source of national forecast values is the 2023 country roadmap

Commitment level

2030 national vs EU target

0 **100.0** 100

2023 state of play and recent progress

	Country level	EU level
FORECAST		82.0
DESI 2024	74.7	78.8
AVERAGE ANNUAL GROWTH %	6.6	7.4

Average, annual growth is computed between the two most recent available data points

Fibre To The Premises (FTTP)

% of households

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory

Note: The source of national forecast values is the 2023 country roadmap

Commitment level

2030 national vs EU target

0 **100.0** 100

2023 state of play and recent progress

	Country level	EU level
FORECAST		70.3
DESI 2024	29.8	64.0
AVERAGE ANNUAL GROWTH %	54.2	13.5

Average, annual growth is computed between the two most recent available data points

Germany has untapped potential to contribute to the EU's Digital Decade target with 74.7% of households currently covered with VHCN, and a comparatively positive dynamic since the last reporting period. There is a significant urban-rural digital divide, with VHCN coverage reaching only 37.6% in rural areas. At 29.8%, FTTP coverage is also increasing rapidly, at a considerable annual rate of 54.2% over the past year. 25.6% of rural areas are also covered by FTTP networks. The share of broadband retail lines with above 1 Gbps speeds is still very low at 5.45%, well below the EU average of 18.5%.

The fibre roll-out is mainly operated by the private sector. This can lead to competitive situations in which several network operators are interested in economically attractive areas. Competition is the most

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[29] The decline in VHCN coverage can be explained through major refinements in data collection in Germany: The requirements for data provision have been specified and deviate in part from the standards previously recorded. Furthermore, since 2022 data collection has been carried out on an address-by-address basis for the first time and includes a larger number of telecommunications companies.

important driver for the rapid, nationwide fibre roll-out. The *Bundesnetzagentur* examines whether abusive or unfair methods are being used to prevent competitors from expanding their own networks. On 11 April 2024, the *Bundesnetzagentur* published its interim report. Based on the cases reported to them it was not yet possible to make a reliable competitive assessment.

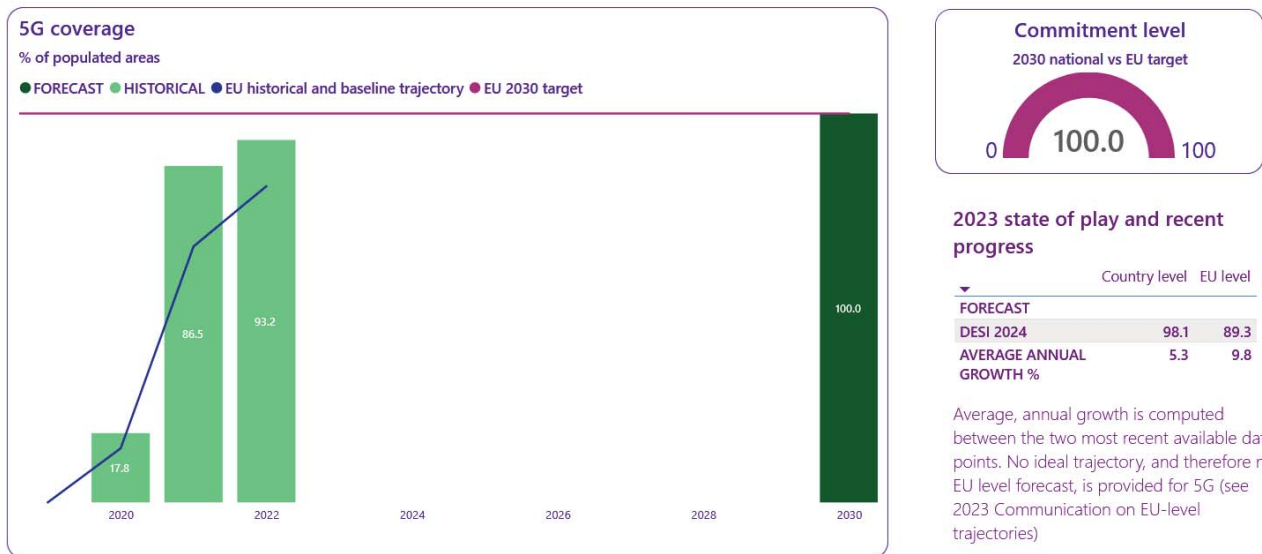**In line with last year's Digital Decade recommendation for Germany to increase its efforts to roll-out gigabit connectivity infrastructure, remove obstacles and boost investment in very high-capacity networks, the country implemented numerous measures of the Gigabit Strategy (of 13 July 2022) that pave the way for a nationwide roll-out of fibre and 5G by 2030.** The measures include accelerating and further digitalisation of planning and approval procedures and creating a new Gigabit Registry as a central data hub that bundles, connects, processes, and makes available relevant information. To maintain the pace of FTTP deployment, in August 2023 the Federal Ministry for Digital and Transport (BMDV) presented the draft Telecommunications Network Expansion Acceleration Act, which proposes to further accelerate and simplify relevant procedures and boost transparency.

Germany has also strengthened and uses alternative deployment methods. The standardised use of trenching, milling and ploughing procedures (DIN 18220) will accelerate the deployment of gigabit infrastructure. To further develop digital infrastructures, Germany complements private-sector roll-out where necessary with optimised public support, especially in rural areas. The introduction of the analysis of potential for future roll-out *(Potentialanalyse)* by the BMDV helps municipalities to assess whether fibre expansion with public funding is needed in their area.

Germany aims to reach 50% fibre coverage by 2025 and 100% by 2030, indicating that its gigabit connectivity target is in line with the EU's target. This aim is high given the country's starting point and size. However, based on the current high rate of progress, and assuming the ongoing efforts will continue, Germany will continue to make a very significant contribution to this EU target. In a context of multiple and persistent urban rural divides in the country, reaching full coverage with gigabit connectivity is crucial to ensure that no one is left behind.

In its roadmap, Germany presents four measures to promote gigabit connectivity, with different timelines, such as the gigabit promotion 2.0 *(Gigabitförderung 2.0)* and the KfW investment loan. Public funding from national sources already allocated to expanding the fibre network amounts to EUR 4.3 billion in 2023; fibre roll-out will be further promoted unrelievedly in 2024. Additional funds are not yet quantifiable for 2025, but the private sector (telecom associations) has committed to invest an additional EUR 50 billion over the coming years. Significant support from both the public and private sector are essential for Germany to reach this Digital Decade goal.

2.1.b Connectivity infrastructure (5G)

5G coverage
% of populated areas
● FORECAST ● HISTORICAL ● EU historical and baseline trajectory ● EU 2030 target

Commitment level
2030 national vs EU target

0 — **100.0** — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST		
DESI 2024	98.1	89.3
AVERAGE ANNUAL GROWTH %	5.3	9.8

Average, annual growth is computed between the two most recent available data points. No ideal trajectory, and therefore no EU level forecast, is provided for 5G (see 2023 Communication on EU-level trajectories)

Note: The source of national forecast values is the 2023 country roadmap

Germany brings a positive contribution to the EU's digital decade target while demonstrating a limited dynamic, given that it is already at saturation levels. At 98.1% 5G coverage in Germany is above the EU average (89.3%) and very close to the national 2030 target of 100% (the same as the EU target) set in Germany's roadmap. Given the strong starting point, the target is easily reachable, with no extra efforts required. The pace of deployment is sustained (5.3% annual growth) but given the high coverage level reached already, it is below the high average pace across the EU (around 10% annual growth). Most new sites are 5G stand-alone (5G SA)-ready and can offer full quality potential. According to the German authorities, by October 2023, 87.3% of land of Germany was covered by 5G SA-ready networks. **5G in the 3.4-3.8 GHz band**, essential for enabling advanced applications requiring a wide spectrum bandwidth, covers 43.8% of German households in 2023, below the EU average (50.6%). Mobile broadband is used by 89.9% of individuals. The share of Germans using 5G SIM cards was 16.5% in 2023, well below the EU average of 24.6%.

As set out in Germany's roadmap, several measures in the Gigabit Strategy (of 13 July 2022) contributed to the nationwide roll-out of 5G. It also contains a measure to support the construction and operation of passive mobile telecommunications infrastructure in areas where the deployment of at least 4G proves to be uneconomical for mobile network operators. Germany has allocated EUR 1.1 billion public funding to this measure. Given that 5G roll-out is progressing well, no further action by the government is necessary. However, initiatives for the next generation of mobile communications 6G are being intensified. The BMBF launched the 6G research initiative in 2021 with four research hubs, the coordinating 6G-platform and multiple industry-led projects with a funding volume of up to EUR 700 million.

2.1.c Semiconductors

Overall, the market for microelectronics in Germany continued to grow in 2023, with Germany's share of global microelectronics production remaining stable at around 3 % (~10 % of the EU) due to very high global growth rates. German semiconductor companies have invested in the development and production of future microelectronics, which contribute to digitalisation and decarbonisation of the EU economy. This includes energy-efficient chips installed, for example, in electric cars or in automated production processes.

In 2023, Germany put in place framework conditions at both national and EU level to help achieve the 20% target. The country contributed to the drafting of the European Chips Act, which entered into force on 21 September 2023, and it has put in place significant national funds. Germany has approved 27 projects under the IPCEI for microelectronics and communication technologies, worth some EUR 4 billion. The country plans to support Intel with EUR 9.9 billion in Magdeburg in the construction of two 'Leading Edge Fab' factories, a project worth EUR 30 billion. Germany also intends to support a joint investment project by TSMC, Bosch, Infineon and NXP in Dresden amounting to EUR 10 billion by contributing EUR 5 billion of the funding.

The country is a major participant in the EU co-financed microelectronics research initiative 'Chips Joint Undertaking', which implements the R&D pillar of the European Chips Act. EU-wide collaborative research projects and research capacities in Germany are funded by the EU and Germany. In 2023, Germany supported partners in European industrial-driven interconnection projects by contributing some EUR 35 million. It actively participates in the initiative through the governance bodies of the Chips Joint Undertaking. Germany also launched a Chips Design Initiative, which it implemented in 2023.

Germany intends to support a Chips Act pilot line on advanced packaging and hetero integration at the Microelectronics Research Factory, which will receive EUR 370 million in EU funding from the Chips Joint Undertaking. The pilot line is intended to improve the transfer of technology 'from lab to fab' and support the technological base of German and European semi-lead industries.

Germany's roadmap highlights semiconductors as a clear priority. The country's strategy is to take a leading role on this front. Two measures included in the roadmap, the IPCEI on Microelectronics and Communication Technologies and the individual investments under the European Chips Act (ECA) total up to EUR 17 billion. Germany receives EUR 1.5 billion in EU funding up to 2026 for this IPCEI via the DARP. The planned measures aim to tackle the following challenges: strengthening the value chain and ensure commercialisation in Germany; ensuring the availability of microelectronics; maintaining Europe's market position in microelectronics; reducing single-side dependencies; reaping and further developing competitive advantages. It also aims to develop existing skills of the workforce and to fill a few important gaps, for example in chip design, production and processing.

According to the recommendation in the Digital Decade 2023 report, the measures taken by Germany on semiconductors are continued in order to help the EU to become a strong market player in this sector. This approach will also boost Germany's (and Europe's) role in the value chain.

2.1.d Edge nodes

Latest estimates report 351 edge nodes in Germany, making it the leader in the EU. It represents 30% of all edge nodes estimated in the EU, above its share of GDP or population in the EU. Germany's roadmap does not set a national trajectory for edge nodes to contribute to the EU target of 10 000 climate-neutral and secure edge nodes, since at the time of writing no data was available yet from the *Bundesnetzagentur*. As the provision of highly secure, climate-neutral edge nodes is linked to the provision of 5G stand-alone (SA) networks, the deployment of 5G SA networks is the main market development in 2023 contributing to this objective. In October 2023, 87.3% of land in Germany was covered by 5G SA-ready networks.

At EU level, Germany – together with France – coordinates the IPCEI Next Generation Cloud Infrastructure and Services, which is anticipated to be a catalyst for participating Member States. The measure focuses on R&D&I and will develop open-source software components for energy-efficient, safe and sovereign edge nodes as part of several integrated national projects. These nodes are synchronized with cloud networks to form what is termed a 'cloud edge continuum'. Germany receives EUR 750 million EU funding for the IPCEI CIS via the DARP. This will be complemented by private-sector investments estimated at EUR 330 million.

2.1.e Quantum technologies

Germany has a good starting point on this front. In its roadmap it plans to become a leader in quantum technologies, together with its European partners. By 2030, Germany aims to achieve the sovereign development and deployment of quantum computing systems based on all relevant technology platforms through direct project funding, public procurement and public equity (in particular venture capital). Regional hubs and innovation centres should make available at least 16 systems for research and industrial applications by 2030. This is by far the highest commitment made by EU Member States. It has already allocated some EUR 1.3 billion (both federal and Länder contributions) and planned at least EUR 80 million. Further steps are needed for 2026 and afterwards to scale up the most promising technology platforms for quantum computing and to set up pilot productions in cooperation between research and industry. According to initial estimates, this implies additional R&D investment needs of EUR 500 to 1 000 million by 2030.

Germany launched the following actions in 2023 in quantum computing: the decision and publication of the Federal Government's approach to quantum technologies (04/23) as a policy framework for measures up to 2026; publication of two new BMBF calls for quantum computing (10/23): 'System functionality of the quantum computer' and 'application-oriented quantum computing'; and investment in the first stage of the deployment and expansion of industrial production of photonic quantum chips[30] by the start-up Q.ANT belonging to the TRUMPF group, in cooperation with the Institute für Microelectronics Stuttgart IMS CHIPS (06/23).

The measures set out in Germany's roadmap that support the achievement of the objective focus on hardware and software development, and on institutional support. The BMBF's 'Quantum Computer Demonstration Structures' measure, including involvement with the European Joint Undertaking EuroHPC, the quantum computing initiative of the German Centre for Aerospace (*Quantencomputing Initiative des Deutschen Zentrums für Luft- und Raumfahrt (DLR QCI)*) and well-known measures at Länder level contribute to the establishment of high-performing innovation ecosystems for the development and use of quantum computers. The measures are further detailed below.

Nine BMBF-funded consortia carry out R&D with the aim of making quantum computer demonstrators available by 2026, as planned in the roadmap. In 2023, an initial upgrade of a quantum computer based on superconducting qubits (initially with five qubits) was installed in this framework at the Leibniz Data Centre of the Bavarian Academy of Sciences. The next stages of the roll-out will take place by 2026.

The Federal Ministry of Economic Affairs and Climate Action (BMWK) funds the DLR QCI with the aim of developing quantum computers for the DLR's engineering needs with EUR 540 million in total. These computing capacities should also be accessible to academic and industrial partners of the DLR. Residual capacity will be offered to European companies, in particular SMEs. As part of the QCI, 10 quantum computing systems with up to 100 qubits based on photonics, ion traps, neutral atoms, nitrogen vacancy-centres and spin qubits are being developed by commercial enterprises following a competitive bidding process on behalf of the DLR.

The installations involved in the EuroHPC Joint Undertaking will also contribute to the goals in this area. At the end of 2024, a quantum simulator based on neutral atoms will be installed at the Jülich research

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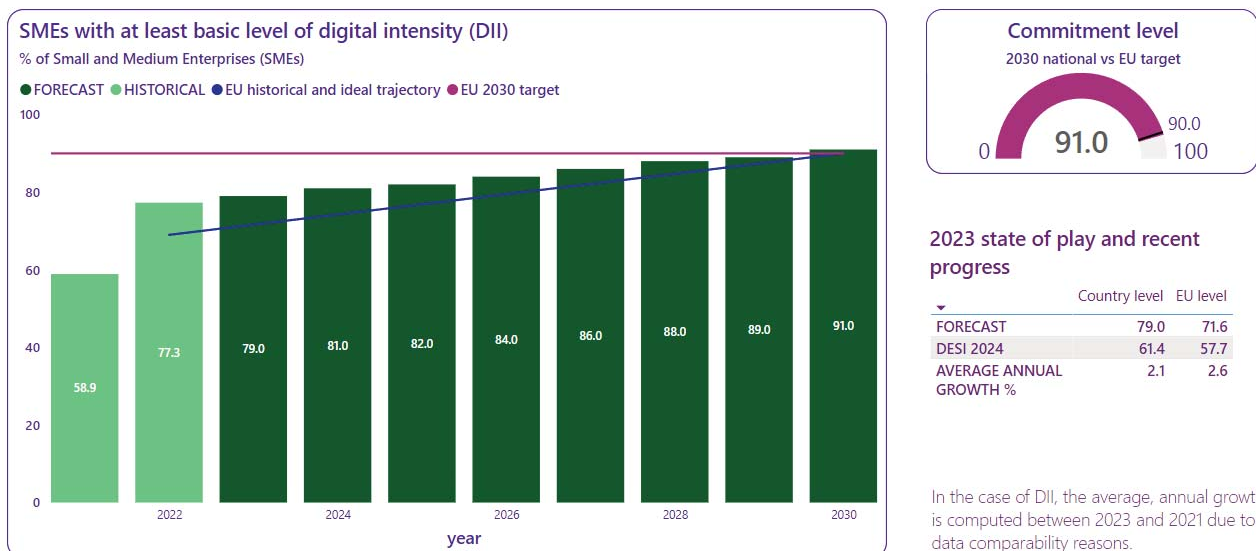[30] https://qant.com/press-releases/q-ant-and-ims-chips-set-up-quantum-chip-fabrication/

centre.[31] In 2025, a quantum computer based on superconductive qubits is expected to be installed at the Leibniz Data Centre of the Bavarian Academy of Sciences.

At Länder level, the Bavarian initiative 'Munich Quantum Valley' and the Lower Saxony initiative 'Quantum Valley Lower Saxony' are well known and have a strong focus on developing quantum computing hardware and software. Further planning at Länder level (including Bavaria, North Rhine-Westphalia) has not yet been specified.

2.2 Supporting EU-wide digital ecosystems and scaling up innovative enterprises

The digitalisation of enterprises is slowly gaining traction in Germany, as almost all related KPIs indicate above-EU-average performance. In addition, the country hosts 67 unicorn companies in the country, which is 25% of all EU unicorns. Innovative, technology-driven start-ups are supported by the 'Future Fund' of EUR 10 billion. Germany is committed to the digitalisation of its enterprises with several targeted strategies (such as the start-up strategy) and measures in its roadmap. Digital and technological sovereignty is one of the priorities Germany set in its Digital Strategy and the country is strongly committed to projects that will advance this goal for semiconductors (IPCEI on microelectronics), data (Gaia-X) and cloud (IPCEI-CIS). These actions should help create to a fair digital environment as enshrined in the Digital Rights and Principles, while also ensuring the principle of freedom of consumer choice.

2.2.a SMEs with at least basic level of digital intensity

SMEs with at least basic level of digital intensity (DII)
% of Small and Medium Enterprises (SMEs)
■ FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Commitment level
2030 national vs EU target
0   **91.0**   90.0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST	79.0	71.6
DESI 2024	61.4	57.7
AVERAGE ANNUAL GROWTH %	2.1	2.6

In the case of DII, the average, annual growth is computed between 2023 and 2021 due to data comparability reasons.

Note 1: DII 2022 is version IV that is not comparable with DII 2021, that was version III. The EU-level ideal trajectory refers to DII version IV, as published in the 2023 Communication on EU-level trajectories

Note 2: The source of national forecast values is the 2023 country roadmap

Germany brings a positive contribution to the EU's digital decade target on digitalisation of SMEs while demonstrating limited dynamic. Germany performs above the EU average with 61.4% of SMEs with at least a basic level of digital intensity (EU: 57.7%). This represents an annual growth of +2.1% over two years since 2021 (below the EU average of +2.6%), which is the last comparable year that used a similar methodology to measure the digital intensity of enterprises. 18.8% of German SMEs sell online, slightly below the EU average of 19.10%. This is in line with their performance in e-commerce turnover at 11.3%, just below the

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[31] This deployment is part of the project HPC-QS (https://www.hpcqs.eu/)

EU average of 11.9%. On electronic information sharing, German enterprises score 42.2%, slightly above the EU average of 42%.

The digital transformation of businesses in Germany is advancing, despite national and global headwinds. In 2023, 76.5 % of companies surveyed by the German Chamber of Commerce assessed their level of digitalisation as very good, good or even satisfactory.[32] According to the survey, to which over 4 000 companies responded, the three main drivers of the digital transformation are flexible working, quality improvement and cost savings. At the same time, the main challenges are lack of time and high complexity. Companies need gigabit bandwidths, i.e., fibre connections, but network deployment is barely keeping pace with the rising demand. The public administration, which should be the trigger of digitalisation, also lags behind on this front, which is another hindrance in the digitalisation of businesses.

The German government's Digitalisation Index **is less optimistic as regards SMEs**: 'The index score for small companies with 1 to 49 employees remains almost constant at 94.5 points in 2023 compared to 94.8 points in 2022. The index score is still substantially below the average for company size classes. Small companies remain the least digitally advanced company size class.' 'Medium-sized companies with 50 to 249 employees decline slightly in digitalisation after exhibiting gains in 2022. Their index score falls from 124.0 index points in 2022 to 122.3 points in 2023. However, their index score is still below the starting level of 125.9 in 2020'.

The main actions in 2023 were related to the development of the 'SME Digital' (*Mittelstand-Digital*) Innovation Hubs network, setting up the European Digital Innovation Hubs (EDIHs) network and adoption of the Future Financing Act. The construction of the nationwide network of *Mittelstand-Digital* Innovation Hubs (successor of the *Mittelstand* 4.0 Centres of Excellence) started in 2021 and was completed in mid-2023. 29 hubs (as of May 2024) support SMEs, start-ups and crafts in the twin transition (green and digital transitions) with low-threshold free offers. As of mid-2024, the network will focus more on AI and AI readiness. The EDIHs network, set up by the European Commission progressively by mid-2023, complements the network of *Mittelstand-Digital* Innovation Hubs. In 12 of the 17 EDIHs, consortium partners from *Mittelstand-Digital* Innovation Hubs are active, with the result that institutional networking and coordination of offers is already taking place there. The 'Digital Now' investment grant scheme, which expired at the end of 2023, helped SMEs implement digitalisation projects in 2023. The Future Financing Act, which entered into force on 15 December 2023, aims to improve the conditions for capital market financing, especially for start-ups and small businesses. For example, it will do so by facilitating initial public offerings and making it possible to introduce multiple-vote shares, along with several other measures. Improvements to the tax provisions for employee capital holdings should help German companies compete internationally for the best skilled workers.

In addition to the above measures, the *Bundesnetzagentur* publishes a comprehensive database **of over 275 (mostly publicly funded) regional and national bodies that support SMEs in their digital transformation processes.** These bodies offer a wide range of support measures, including financial support, training, demonstrators, networking events and best practice examples. The database increases transparency about the support measures available, thus making it easier for SMEs to find appropriate support.

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[32] The result is in line with the above-mentioned figure of SMEs with at least a basic level of digital intensity.

Germany's target of 91% of SMEs having at least a basic level of digital intensity is slightly above the EU target of 90%. It has a strong starting point, at 61.4%. At the current rate of progress (2.1%) and assuming that it maintains its current pace of progress, Germany will continue to make a very significant contribution to the EU target. Germany received a recommendation in the 2023 State of the Digital Decade report to continue implementing its policies on the digitalisation of businesses. Given the size of its economy, its performance is key to achieve the target of 90% of SMEs reaching a basic level of digital intensity at EU level.

The roadmap comprises several measures supporting the digitalisation of SMEs. The funding priority *Mittelstand-Digital* supports SMEs, start-ups and crafts with currently two sectoral support initiatives: the network of Mittelstand-Digital Innovation Hubs and the Initiative for Cybersecurity in SMEs.

2.2.b Take up of cloud/AI/data analytics

Germany brings a positive contribution to the EU's digital decade target of 75% with a 58% take-up by enterprises of AI or cloud or data analytics[33], above the EU average of 54.6%. Germany set the national target at 75%, in line with the EU target. To reach this target, it needs an annual growth rate of 3.74% for the next 7 years. Given the current growth rates in cloud and AI, which exceed this rate, it is realistic to assume that Germany will achieve the target.

- **Cloud**
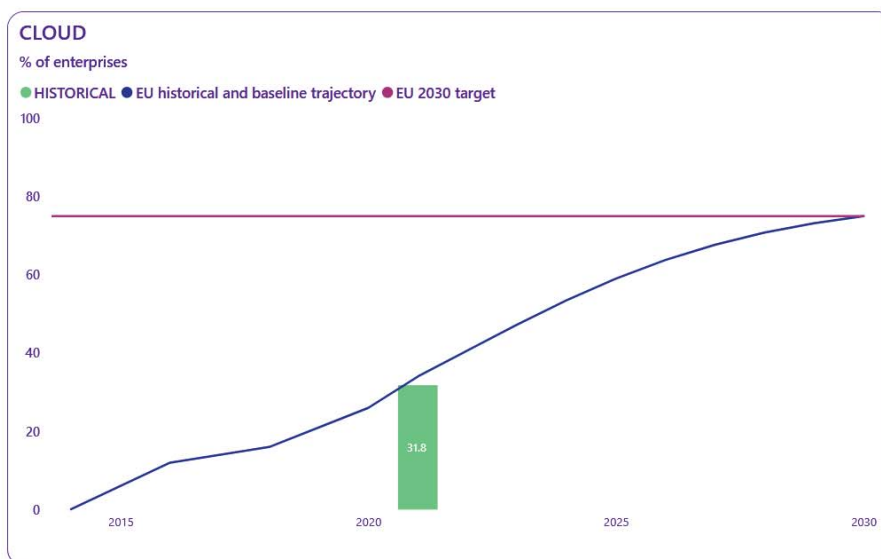
2023 state of play and recent progress	Country level	EU level
FORECAST		47.3
DESI 2024	38.5	38.9
AVERAGE ANNUAL GROWTH %	10.0	7.0

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Germany brings a positive contribution to the EU's digital decade target on cloud and demonstrates positive dynamic. The take-up of cloud solutions by German enterprises (at 38.5% in 2023) is almost at the EU average (38.9%) and increasing quickly, with a 10% annual growth rate, above the EU-level average growth of +7%.
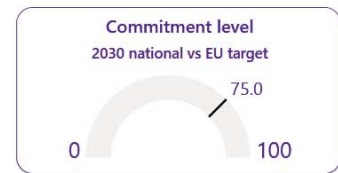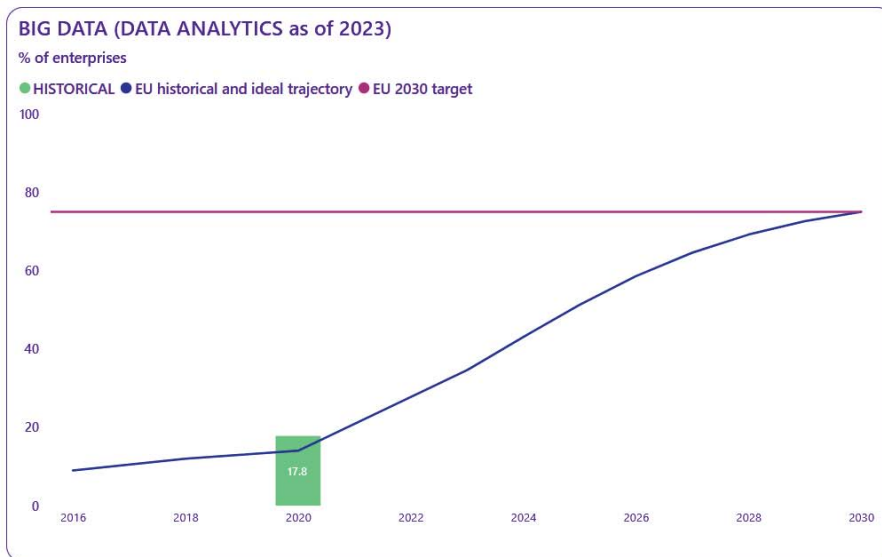
On cloud, the main development in 2023 was that in December 2023, the European Commission approved the IPCEI Next Generation Cloud Infrastructure and Services (IPCEI-CIS). IPCEI-CIS is the central digital initiative for Europe, composed by 7 Member States with 19 companies as direct participants, which

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[33] Eurostat measured the indicator for the Digital Decade target, i.e., enterprises taking up either AI or cloud or data analytics for the first time in 2023.

is claimed to encompass in the so-called IPCEI CIS-created ecosystem additional 5 Member States with more than 90 projects of companies and research organisation; thus one may consider IPCEI CIS to encompass into the ecosystem created by it in total more than 100 companies and research institutions from 12 EU Member States, to create the first ever multi-provider of cloud-edge-continuum. The main objective is to create a completely new decentralised environment allowing for a software infrastructure for the advanced use of computing resources from the cloud to the edge. This novel open ecosystem, operated by multiple suppliers, will reduce technological dependencies and lock-in effects. It will also enable a completely new dimension of data-driven business models, such as those related to AI and the Internet of Things, for a wide range of sectors and sectors such as manufacturing, mobility, energy, and tourism. For this measure, the EU will make available up to EUR 750 million via the DARP up to 2026. As a coordinator of the IPCEI-CIS, Germany is at the forefront of developing and deploying cutting-edge cloud and edge capacities. A focus should be on ensuring the broad uptake of future solutions by companies of all sizes in Germany with a special focus on SMEs.

Other than the IPCEI CIS, the most important measure promoting cloud in Germany's roadmap is Gaia-X. The BMWK supports implementation of applications and the setup of data spaces based on Gaia-X through the Gaia-X funding competition (~EUR 117 million, for 2021-25). The 11 winners have a lighthouse function and aim to stimulate demand for Gaia X-based data-driven applications and data spaces. These projects were launched at the end of 2021/early 2022. BMWK also promotes scientific monitoring, networking and the transfer of results to the Gaia-X funding competition over the duration of the project. The National Gaia-X Hub Germany coordinates, manages and facilitates 14 sectoral working groups with around 1400 members belonging to 400 companies, organisations and institutions. It is the first point of contact to Gaia-X for interested stakeholders from Germany and builds a broad user base within individual domains/sectors. Since 2020, acatech (National Academy of Science and Technology) has coordinated the national Gaia-X Hub Germany on behalf of the BMWK, financed by a grant (of some EUR 5.8 million up to and including 2025). In addition, the Trusted Cloud skills network supports SMEs from all sectors to use cloud technologies by means of a publicly available catalogue of trusted cloud services (including future Gaia-X services), as well as guidance in the form of checklists, white papers, and best practice examples. The objective of the Gaia-X Federation Services (GXFS) project is to develop basic components to enable a secure digital ecosystem that maintains data sovereignty and enables participants. The Federation Services are open-source code to form data federations and develop new business models.

- **Data Analytics (Big Data)** [34]

BIG DATA (DATA ANALYTICS as of 2023)

% of enterprises

● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Commitment level
2030 national vs EU target

75.0

0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST		34.6
DESI 2024	37.1	33.2
AVERAGE ANNUAL GROWTH %		

Annual growth cannot be computed in this case because Big Data was replaced by Data Analytics in 2023. The two indicators are not comparable.

Note: The source of national forecast values is the 2023 country roadmap

Germany brings a positive contribution to the EU's digital decade target on big data (data analytics). The take-up of big data by German enterprises (at 37.1% in 2023) is above the EU average (33.2%).

The main development in 2023 is related to the Manufacturing X initiative, which focuses on developing a large-scale data ecosystem for the industrial sector. Its aim is to enable companies to autonomously share data across the production and supply chain, using open standards. This enables digital innovation for greater resilience, sustainability and competitiveness. Since 2023, Germany has played a very active role in the new International Manufacturing X Council. Germany has also launched a new programme to support research and development for data ecosystems. The first funding decisions were signed in December 2023. It will allocate up to EUR 150 million to this programme up to 2026.

The purpose of the Data Institute, a new measure in Germany's roadmap, is to make data more accessible and usable in Germany under the current legal framework for society as a whole. It is designed to be a powerful national body that pools know-how and provides targeted assistance, especially in inter-sectoral exchanges. It will build on the many existing initiatives to improve data usefulness, to share data, and avoid duplicating structures. In order to ensure data protection compliance, data protection authorities should be closely involved in the work of the data institution. (Total allocation is EUR 50 million for 2023-2027).

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[34] As of 2023, Eurostat changed this indicator from 'big data' to 'data analytics', which means it is not possible to make direct comparisons with previous years.
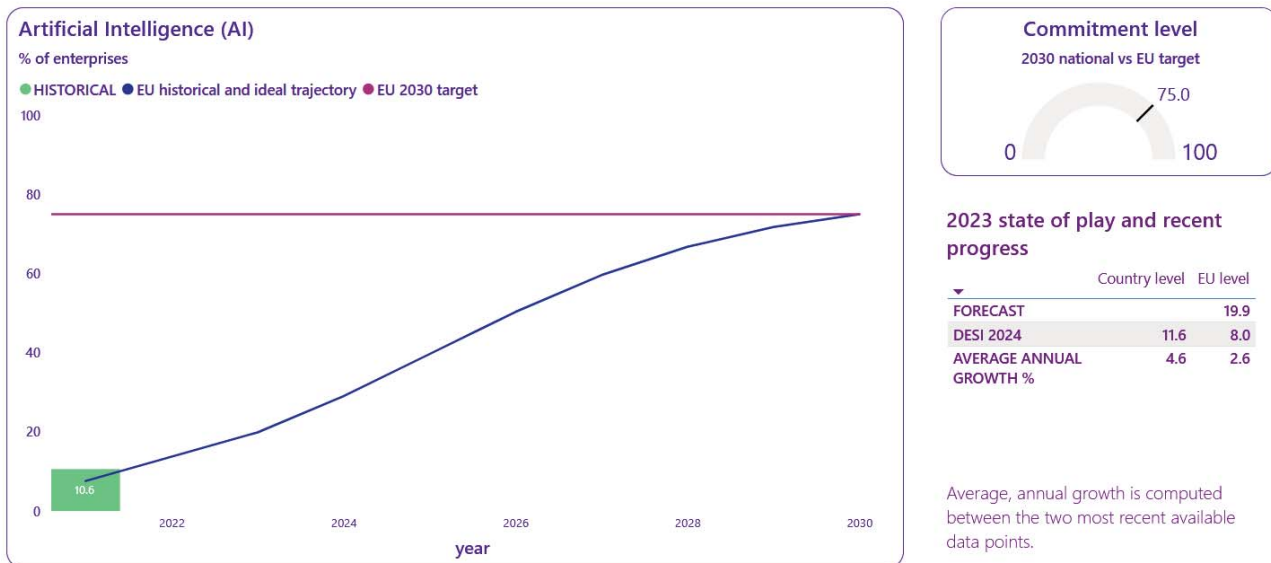
- **Artificial Intelligence (AI)**

Artificial Intelligence (AI)

% of enterprises

● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

Note 2: The source of national forecast values is the 2023 country roadmap

Commitment level

2030 national vs EU target

75.0

0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST		19.9
DESI 2024	11.6	8.0
AVERAGE ANNUAL GROWTH %	4.6	2.6

Average, annual growth is computed between the two most recent available data points.

Germany brings a very strong contribution to the EU's digital decade target on AI, and it demonstrates positive dynamic. At 11.6%, the take-up of AI solutions by German enterprises is above the EU average of 8%. The average annual growth rate is also much higher (at 4.6%) than the EU average growth (+2.6% per year).

The German economy increasingly uses artificial intelligence and faces two main challenges: limited awareness of AI among enterprises and the lack of capacity and skills to use it. Germany's roadmap proposes to step up action in this area to cover awareness raising, the application of AI in the world of work and tailormade advisory services for SMEs.

The aim of the 'AI Studios (EUR 4.1 million) of the AI Observatory' of the BMAS is to inform employees and the organisations representing their interests in all sectors throughout Germany about the opportunities, limitations and areas of use of AI and to raise awareness of the positive potential and of the specific risks and challenges posed by AI. It is expected to reach over 2 300 companies by the end of 2024 by running over 250 events.

As part of MISSION AI **(formerly the National Initiative for AI-based Transformation into the Data Economy (NITD)) (budget EUR 32.4 million) the BMDV supports businesses (by acquiring know-how and network support and better connecting data) with the aim of ensuring that AI business models are widely integrated into the German economy.** To provide planning certainty in the development of trustworthy AI applications and to increase trust in the use of AI applications, the project supports the development of uniform, trusted and scalable AI quality- and testing standards that meet the requirements of the AI Act. AI quality and innovation centres provide the necessary testing, experimentation and experience environment. The centres support businesses in developing legally compliant, trustworthy AI applications.

The 'AI experimentation space' projects (EUR 6 million allocated, EUR 600 000 planned for 2024) are part of the Federal Government's ongoing AI strategy. Innovative projects have received support for up to four years since 2021 to ensure the common good and responsible development and application of AI in the world of work. Around 50 establishments and businesses receive direct support under this strategy.

In addition, since autumn 2022, the BMBF has supported the development of four 'AI service centres' (EUR 75.7 million), which are developing tailor-made advice and services. The aim is to facilitate access to computing infrastructure and AI expertise and to transfer AI into practical uses. SMEs receive targeted advisory services for AI deployment.

The objective of the 'KI4SME' support measure (EUR 85 million planned, of which EUR 56.4 million already allocated) is to support high-risk industrial research and pre-competitive development projects of SMEs in Germany in the field of AI that could not be carried out without funding or could only be carried out significantly late. The aim is to ensure that significantly more SMEs, in particular in the ICT sector, develop their capacity to innovate to translate new scientific knowledge into their own research results and industrial applications, thus strengthening their growth and competitiveness. In particular, the measure will support SMEs in accelerating technology transfer from the pre-competitive sector to their practical application. The aim is to complete at least 100 SME R&D projects on AI.

In the framework of the Future Centres, innovative skilling approaches and in-depth consultations are used to raise awareness, inform, and train employees in SMEs of AI technologies in a holistic approach. The aim here too is to increase the level of acceptance. These Centres develop and experiment with tailor-made, innovative skilling approaches, in particular to teach digital and AI skills.

2.2.c Unicorns, scale-ups and start-ups

Germany lags behind other leading economies regarding its start-up ecosystem. While the size of the ICT sector in Germany (4.4% in 2020) is below the EU average (5.2%), venture capital investment in seed and start-up companies amounted to 5% of GDP in 2022[35], which is below other large economies (by comparison, United States (37%), Canada (17%), United Kingdom (8%) or France (6%)).

To strengthen the overall start-up ecosystem, the Federal Government continued in 2023 to implement the start-up strategy that it adopted in summer 2022. As of September 2023, it had already fully implemented 45% of the actions, including in key areas of funding and talent attraction (for details, see the first progress report on implementation of the Start-up Strategy). The Federal Government will also publish a report on further implementation of the strategy in 2024.

With new and expanded financing instruments and adjustments to the regulatory framework, Germany is creating the conditions for the number of German unicorns to double by 2030, assuming a general recovery in the venture capital market. This is aligned with the EU target.

Despite the difficult market environment, there were some large investments in 2023 contributing to the digital decade target. The EUR 500 million funding of Aleph Alpha shows how early public investments (in this specific case with ERP-SV[36] money via EIF[37] funds-of-funds and other funds-of-fund investments of KfW Capital) can contribute to the later mobilisation of private capital to finance innovation. In November 2023, the Growth Fund Germany came to a close, having reached its target of EUR 1 billion. The High-Tech Gründerfonds Opportunity is at the design phase and is expected to start investing in the second half of 2024.

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[35] OECD Going Digital Toolkit
[36] European Recovery Programm (ERP) Sondervermögen
[37] European Investment Fund (EIF)

The German government launched several financing schemes to support the start-up ecosystem with investment, as included in the roadmap. The Future Fund, which is the Federal Government's central measure, will grow to EUR 10 billion by 2030. It will help to sustainably strengthen the venture capital market and the financing conditions for innovative, technology-driven start-ups, especially in their growth phase, through various instruments. It will mobilise substantial private capital across multiple sectors for key future technologies. Each of the modules in the Future Fund focus both on Germany and Europe. They are also part of the Federal Government's start-up strategy, which includes many other measures to strengthen the start-up ecosystem. To improve access to finance for AI start-ups and scale-ups, MISSION AI brings investors together with AI founders and businesses.

2.3 Strengthening cybersecurity & resilience

As German companies increasingly use digital technologies, their risk of exposure to cybersecurity incidents is increasing, as is their need for preparedness in this area. In 2022, 3.9% of enterprises in Germany reported ICT service outage due to cyberattacks (e.g., ransomware attacks, denial of service attacks), which is above the EU average (3.5%). German enterprises seem more prepared than their EU peers with 32.3% reporting being insured against ICT security incidents (above the EU average of 25.0%) and 96.3% using ICT security measures (EU average 91.8%).

The survey **carried out in 2023 by the German Chamber of Commerce identified that** cybersecurity is an issue**, as cyberattacks are everyday reality. On average, one in five German companies suffered one or more cyberattacks over the past year.** Large companies are more often targeted, affecting over 55% of them. Of the companies reporting an attack in recent months, 31% reported espionage, such as digital spying on their internal communications, 26% extortion, 25% attacks on infrastructure and 21% theft of digital data. German businesses are taking measures to protect themselves. The study concludes that employees must be involved in cybersecurity and cooperation between the Government and the economy is necessary.

In September 2021, the country adopted the Cybersecurity Strategy for Germany 2021. It provides the framework for cybersecurity for five years, up to 2026.

Germany participates in 12 multi-country projects on action to strengthen cybersecurity: SOCCER; Telemetry; CyberSecDome; Synapse; RESCALE; DOSS; Sec4AI4Sec; QUBIP; Custodes; PQ-REACT; Emerald; Cobalt. The projects will be supported by either the Digital Europe programme or the Horizon Europe programme and were signed in 2023. Two of these projects, SOCCER and Telemetry, coordinated by German organisations, are particularly noteworthy.

The Signal Iduna life insurance company launched the project Security Operation Centres Capacity building for European Resilience – SOCCER **with partners from France, Hungary and Romania to develop new technologies for European Security Operation Centres (SOCs).** Over 36 months, it will use state-of-the-art technologies, including AI and machine learning, to promote secure data exchange and networking of SOCs in Germany, Hungary, and Romania. The aim is to increase resilience at national and EU level. To this end, the project develops training, improves, and standardises best practices and works on a human-centric AI solution to ensure trustworthiness, technological sovereignty and create a global competitive advantage. The initiative builds on European cybersecurity strategies and national standards such as the NIS Directive, the regulation on critical infrastructures according to the *Act on the Federal Office for Information Security* (BSI-Act - BSIG), the Cybersecurity Act, the GDPR and ISO standards. SOCCER

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allocations by country are EUR 644.9 million - Germany, EUR 419.4 million - France, EUR 310.57 - Romania and EUR 252.25 million - Hungary.

Telemetry **– Trustworthy Methodologies, open Knowledge & Automated tools for Security Testing of Internet of Things (IoT) software, Hardware & Ecosystems – will provide trustworthy tools that enable the continuous assessment of heterogenous, interlinked components and systems that constitute IoT ecosystems.** TELEMETRY will leverage three exemplary use cases representing diverse, complex IoT ecosystems and IoT supply chains in aerospace, smart manufacturing, and telecommunications sectors to drive the design and validation of the proposed tools and methodologies.

The Initiative for Cybersecurity in SMEs, which has been in place since 2011, promotes IT and cybersecurity in SMEs. Since July 2023, a new Transfer Centre for Cybersecurity in SMEs promotes IT and cybersecurity for SMEs, crafts and start-ups. In addition to prevention, it strengthens other aspects of cybersecurity, such as detection and response. Complementary focus projects should develop specific tools and materials for these target groups. The Transfer Centre for Cybersecurity in SMEs and focus projects will also tackle the current regulatory challenges faced by the German economy, in particular to implement the NIS 2 Directive and its National Implementation Act or the Cyber Resilience Act (CRA). In addition, the projects will support SMEs in KRITIS (i.e., critical infrastructure) sectors, which are not considered KRITIS due to their small size.

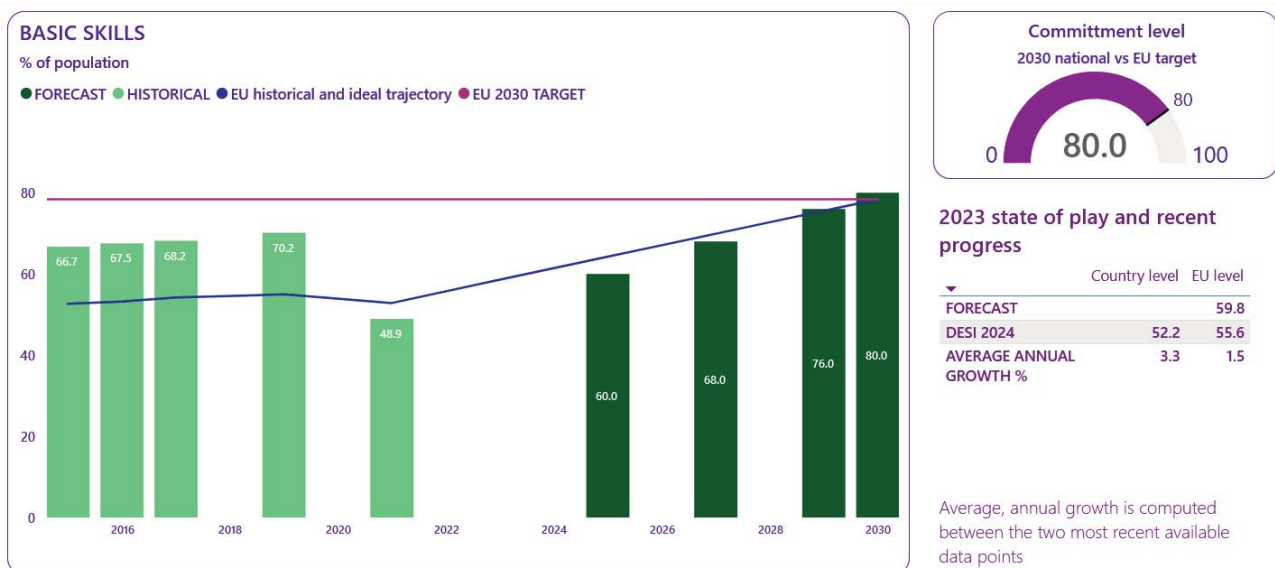# 3 Protecting and empowering EU people and society

3.1 Empowering people and bringing the digital transformation closer to their needs

Inclusiveness is one of the priorities set in Germany's Digital Strategy. The foundation for a connected and digitally sovereign society is lifelong learning, protection in the digital space and empowerment, inclusiveness and accessibility. Germany has developed several specific inclusion programmes, such as the programme Strengthening the participation of older people - countering loneliness and social isolation (2022-2027), the project Digitaler Engel PLUS (2022-2025) and the project DigitalPakt Alter (2023-2025).

According to the Digital Decade Eurobarometer survey, only 70% of the German population consider that the digitalisation of daily public and private services make their life easier. This is below the EU average (73%). Digital public services, including the digitalisation of the health sector, have become the centre of attention in recent years with many measures implemented at all levels of administration. Germany is very committed to protecting children online and is fighting online hatred and hate speech with the Central Intelligence Unit for Criminal Content on the Internet.

3.1.1 Equipping people with digital skills

3.1.1.a Basic digital skills

BASIC SKILLS
% of population
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 TARGET

Values shown: 66.7, 67.5, 68.2, 70.2, 48.9, 60.0, 68.0, 76.0, 80.0

Committment level
2030 national vs EU target
80.0

2023 state of play and recent progress

	Country level	EU level
FORECAST		59.8
DESI 2024	52.2	55.6
AVERAGE ANNUAL GROWTH %	3.3	1.5

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Germany has untapped potential to contribute to the EU's digital decade target on basic digital skills but shows a very strong dynamic over the last two years. Germany's rate is 52.2%, below the EU-level average of 55.5%. The gap between Germany and the rest of the EU is significant when considering the youngest generation, as only 56% of people in the age group 16-24 have at least basic digital skills compared to the EU average of 70%. However, when it comes to the generation in the age group 55-74, Germany, with 39%, is just above the EU average of 37%. On gender balance, more men (28%) than women (25%) have at least basic digital skills. Another digital skills indicator, above basic digital skills, indicates a similar performance: at 19.8%, Germany is below the EU average of 27.3%, which places the country in the last quartile of

performance across the EU. On internet use, Germany is above the EU average (91% against the average of 90.3% of individuals), as well as on at least basic digital content creation skills (71.3% versus 68.3%).

As target for 2030 on basic digital skills Germany's aims to reach 80%, which is in line with the EU level target. Considering the current rate of progress, this is a very ambitious target. Underpinning this goal, and in line with last year's Digital Decade recommendation for Germany to accelerate efforts in this area, Germany's roadmap lists 17 measures relevant to digital skills with a total allocation of EUR 7.5 billion.

The Digital Pact for Schools (DPS) is the project with the highest budget. It supports the Länder in providing schools with a minimum level of digital infrastructure and teaching-learning technology. The total federal budget is EUR 6.5 billion, of which EUR 5.73 billion have already been allocated. At least 650 million are financed by the Länder (min. 10% on top of federal funds). The DPS is also financed by the DARP in the amount of EUR 420 million (measure 3.1.1 Investment programme for teacher devices). At the cut-off date of 30 June 2023, EUR 2.32 billion had been allocated to the Länder, which were included in the EUR 5.73 billion projects approved by the Länder by that date. The Digital Pact for Schools (duration 2019-2024) runs until 16 May 2024 according to the current planning status of the coalition, and is not due to be replaced.[38] Under the coalition agreement, the Government announced that it would launch a follow-up digital pact, a Digital Pact 2.0, together with the Länder, to run until 2030. This was still being negotiated at the time of writing of this report (March 2024).[39] The Progress Report on the Digital Pact for Schools 2022–2023[40] provides some insights into specific projects implemented, but it does not provide hard facts on the results achieved, and only details the allocated amounts. 28 000 schools have received funding under this programme across Germany.[41] The results and impact of the DPS can only be assessed once its implementation has been completed.

The following are new measures that give a boost to action on promoting digital skills in Germany.

The BMBF OER strategy is financed with EUR 150 million up to 2032. Under the OER strategy, the BMBF promotes the digital transformation of education through actions that support the provision and development of Open Educational Resources (OERs) and Open Educational Practices (OEP). The aim is to support a new teaching and learning culture that focuses on developing the skills needed for the 21st century. The objectives are to embed OER and OEP competences and further develop an OER and OEP-supported digital ecosystem of technologies (infrastructure, tools) and services, in order to co-create digital learning spaces of the future. The strategy also includes accompanying application-oriented research to link up science and practice.

The Funding Guideline on Cultural Education in Societal Transformations, which is financed from national sources (BMBF) with a total funding EUR 10 million, of which EUR 2 million have already been allocated. The Funding Guidelines aim to generate new knowledge through close cooperation between science and practice. It will swiftly focus on the practice of cultural education and on the challenges of societal transformation, while ensuring modern theoretical education. These effects are likely to occur during the lifetime of the Funding Guidelines and will spread further over time.

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[38] Drucksache 20/9657 (bundestag.de)
[39] Stark-Watzinger: Fördergelder aus Digitalpakt Schule noch nicht aufgebraucht (faz.net)
[40] Fortschrittsbericht DigitalPakt Schule 2022–2023
[41] Drucksache 20/9657 (bundestag.de)

An important action in 2023 was the launch of the 'Transfer Hub Data Literacy'. The aim is to bring together different bodies working on data literacy (researchers, providers, funders), exploit synergies, improve the visibility of services and data, and further strengthen data literacy in the administration. In the BMBF-funded vhs-learning portal a new section for basic digital skills 'Digital World' has been created.

In addition, the completion of the BMBF-funded *project Unexpectably successful schools in digital transformation – a qualitative in-depth study on ICILS 2018 (*UNES-ICILS 2018*) building on the international comparative study, International Computer and Information Literacy Study (ICILS), is worth a mention. This project, which ended in 2023, developed guidance to promote digital skills in five strands of school development.

In 2023, the Länder contributed to implementing the Education in the digital world strategy of the Conference of Ministers of Education (KMK) with a wide range of measures. The measures cover several areas: curriculum development, design of teaching-learning processes, further development of the examination culture, promoting digitalisation-related school development processes, development of digital learning environments, further development of cross-phase approaches to teacher education and training, development of training and skills opportunities in the field of digitalisation, development of support and advisory systems in the field of digitalisation, the development and development of digital IT and educational media infrastructure, and lastly to increase the availability of digital content and digital learning environments.

3.1.1.b ICT specialists
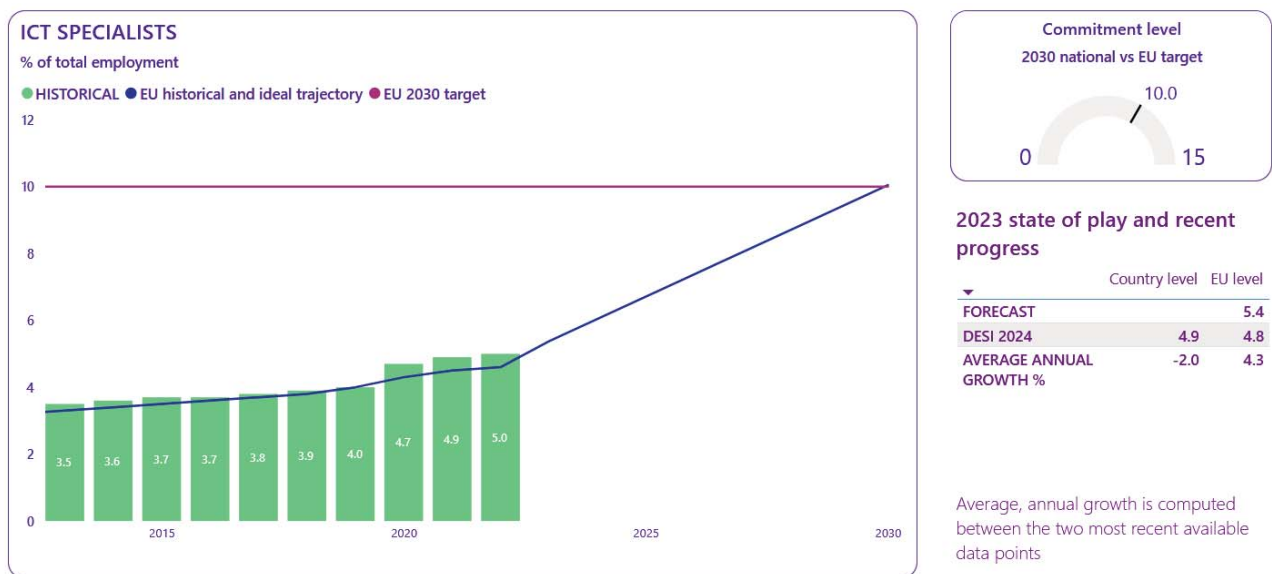
Note: The source of national forecast values is the 2023 country roadmap

Germany brings a positive contribution to the EU's digital decade target on ICT specialists while demonstrating a limited dynamic since the previous year. ICT specialists account for 4.9% of total employment, above the EU average of 4.8%. There was a slight decline since previous year from 5.0%. The share of ICT graduates increased from 5.1% in 2021 to 5.5% in 2022 and is above the EU average of 4.5%. However, only one in five ICT graduates are women (1.2% female versus 4.3% male ICT graduates), which points to a significant gender gap.

Germany aims to increase the number of ICT specialists, especially women, but it does not set a specific target in the roadmap. In 2023, around 2.1 million ICT specialists were employed in Germany, 19% of whom were women (just slightly below the EU average of 19.4%). In view of demographic change and the marked decline in the number of first-year students[42] in the education system, as well as high needs for skills in other occupations, both maintaining the current level of ICT specialists (e.g., graduates) and any further increase will require significant efforts.

Germany's roadmap contains four measures[43] that support both digital skills and ICT specialists (no programme dedicated to ICT specialists separately), both running until 2029, and the other two ending in 2025 and 2026, respectively.

The project building digital connectivity infrastructure education, My Education Area, receives EU funding (via DARP), amounting to EUR 529 million[44]. My Education Area, a digital connectivity infrastructure, creates the technical conditions for a seamless digital learning journey from primary school to old age. It helps people find suitable education in the digital space and can also support skills development for ICT employment. In addition, the digital connectivity infrastructure facilitates access to education for all, including the target group aged 16-74. The project will enable self-determined management and the sharing of learning stands, educational certificates and credentials with educational institutions and administrations. The first application scenarios have already been tested as a minimum viable product since October 2023. More functionalities will be made available in the course of 2024.

The BMBF funding priority, Digitalisation in education, is a research funding programme run by the BMBF since 2018, under the umbrella of the Framework Programme for empirical education research. EUR 47.5 million has already been allocated to the project, and a further EUR 15 million is planned. The programme explores the opportunities and implications of new digital education technologies for education and develops practical ways to shape education processes. It looks at both educational institutions, teachers, and teaching, as well as individual and collective education processes outside formal education institutions. The funded projects will explore the conditions under which digital education technologies can be used to the best possible extent in educational institutions. So far, the focus has been on two funding lines: Digitalisation I (Principle and conditions of success) and Digitalisation II (Shaping education processes in the context of digital transformation).

The STEM action plan 2.0 continues, expanding the holistic and networked approach to STEM education. The STEM action plan 2.0 strengthens basic digital skills, in particular by providing educational opportunities for children and young people, running student competitions such as youth research/informatics beacons and STEM clusters, which coordinate and expand STEM opportunities for children and young people in local settings, often in close cooperation with schools. The aim is to create at least 60 STEM clusters that enable children and young people (diverse and inclusive) aged 6-18 to have low-threshold access to extracurricular STEM education in their regions. This should also contribute to strengthening digital skills, in particular algorithmic thinking, coding, and media literacy.

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[42] CHECK – Entwicklung der Studienanfänger*innen in Deutschland

[43] Building digital connectivity infrastructure education: 'My Education Area' (i.e., measure 3.1.2 Education platform in the DARP); Project Funding: Long-term monitoring of digital and data-related skills of the German population; Project funding under the BMBF funding priority 'Digitalisation in the education sector'; STEM Action Plan 2.0

[44] This amount excludes VAT. The full amount allocated in the DARP is EUR 630 million.

In addition, measures such as the nationwide STEM networking centre, STEM campus and practice-oriented STEM research support the wide range of voluntary, non-formal STEM education bodies in networking and professionalisation. This includes direct training to use digital tools and learning.

Although Germany's roadmap does not contain measures to specifically support gender convergence, there are several initiatives and programmes that support women in the digital economy. The initiative *FrauMachtDigital!* is committed to tapping the potential of digitalisation for women, by providing support, networking and visibility for women in the digital economy.

The online platform YouCodeGirls.de, which aims to inspire girls in particular with a wide range of creative learning opportunities on coding and on IT topics, will receive further funding of EUR 5 million from the BMDV. The free service is a flagship project of the German government's digital strategy. It aims to inspire girls and young women from primary school age until the start of their careers with coding.

Germany's IT sector also supports women with the following programmes: Women in Tech e.V, Bitkom – Working Group Women in the Digital Economy (*Arbeitskreis Frauen in der Digitalwirtschaft*), TECH4GIRLS and #'LiT – Ladies in Tech. The Third Gender Equality Report issued by the Federal Government sheds light on how digitalisation can promote equality between women and men.

3.1.2 Key digital public services and solutions – trusted, user-friendly, and accessible to all
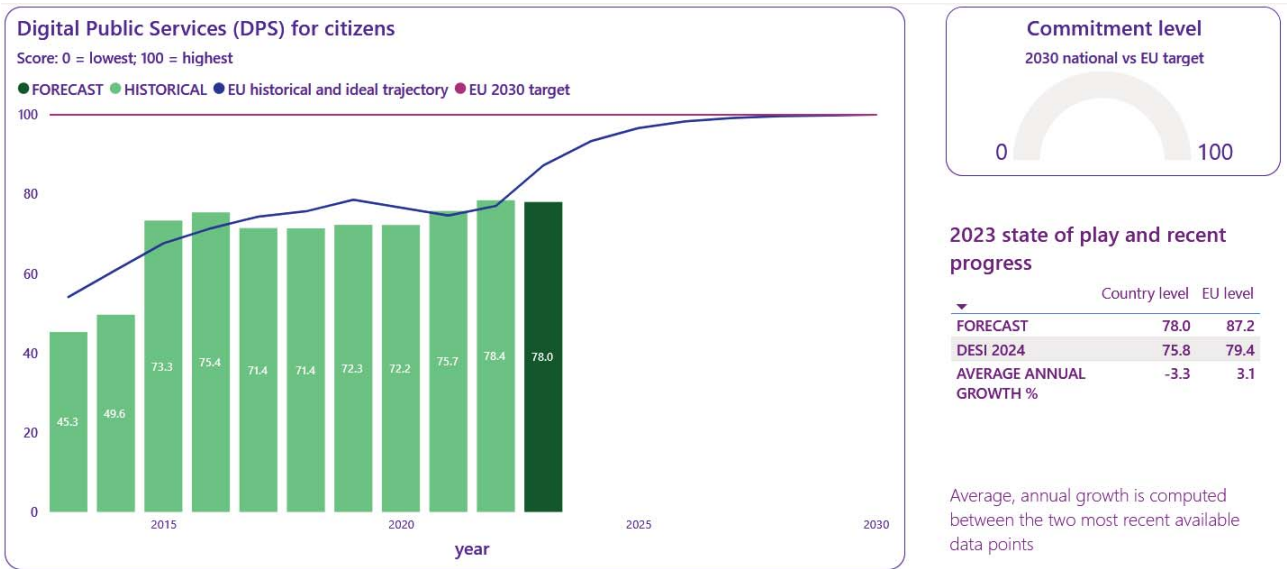
3.1.2.a e-ID

Germany brought in the identity cards with an electronic identity function (e-ID) in 2010, which are available to all German citizens (aged 16 years and over). EU citizens living in Germany can also apply for a German e-ID card. The e-ID is notified with a high level of assurance, as defined in Regulation (EU) 910/2014 on electronic identification (eIDAS Regulation). Therefore, no further transposition measures were required in 2023.

To further increase market penetration, Germany is analysing the feasibility of an evolutionary approach focusing on the user's perspective and temporarily accepting lower levels of trust. This solution is planned to be implemented by mid-2025, independently of the shifted roll-out schedule of smart e-IDs.

2023 saw a massive increase in the use of the e-ID system, partly due to the subsidy scheme of flat-rate energy price for students that could be requested via the e-ID infrastructure. In addition, new use cases have developed in the private sector. For example, several banks and mobile network operators have implemented the e-ID to open bank accounts or register prepaid SIM cards. The health sector has also adopted the e-ID.
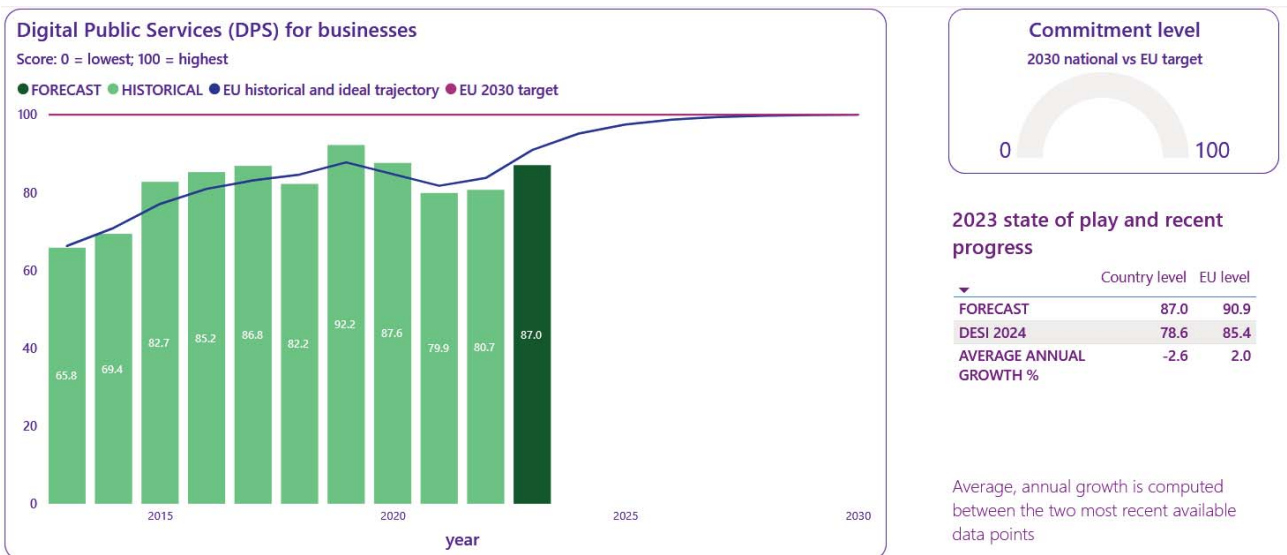
Germany is involved in four pilot projects: POTENTIAL, EWC, NOBID and DC4EU. The country is the technical coordinator of POTENTIAL **(PilOTs for EuropeaN digiTal Identity wALlet)**. This project aims to collaboratively test interoperable national digital wallets in view of the deployment of the European Digital Identity Wallet to simplify and secure online transactions for European citizens, to facilitate the processing of procedures by government services, and to combat identity theft. It involves 19 EU Member States and Ukraine, including 38 ministries, 34 state operators, 9 research centres, 51 large companies and 12 start-ups. The development and testing of the European Digital Identity Wallet will run for 26 months, divided in two phases: a first phase to test national solutions until October 2024 and a second phase with cross-border tests to ensure the different solutions are interoperable. The consortium receives EUR 16 million of EU subsidies.

3.1.2.b Digitalisation of public services for citizens and businesses

Digital Public Services (DPS) for citizens

Score: 0 = lowest; 100 = highest

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Bar values: 45.3, 49.6, 73.3, 75.4, 71.4, 71.4, 72.3, 72.2, 75.7, 78.4, 78.0

Commitment level

2030 national vs EU target

0 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	78.0	87.2
DESI 2024	75.8	79.4
AVERAGE ANNUAL GROWTH %	-3.3	3.1

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Digital Public Services (DPS) for businesses

Score: 0 = lowest; 100 = highest

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Bar values: 65.8, 69.4, 82.7, 85.2, 86.8, 82.2, 92.2, 87.6, 79.9, 80.7, 87.0

Commitment level

2030 national vs EU target

0 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	87.0	90.9
DESI 2024	78.6	85.4
AVERAGE ANNUAL GROWTH %	-2.6	2.0

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Germany has untapped potential to contribute to the EU's digital decade target on digital public services for citizens, while demonstrating a very limited dynamic. At 75.8, Germany ranks below the EU average of 79.4 in absolute value. The forecast for this year in Germany's roadmap was 78.0, above the score actually achieved. Germany's annual growth rate for this indicator is below the EU average. It ranks third last in the EU on the use of e-government over the last 12 months (62.2% against the EU average of 75.0%). This low usage reflects the low availability of digital public services, suggesting the need to speed up development.

On digital public services for businesses, Germany has scope to improve its performance to contribute to the EU's digital decade target while demonstrating a very limited dynamic. Germany scores below the EU average on this indicator. Germany's roadmap forecast a score of 87 in 2023, but it actually scored 78.6, far below the expectations and the EU-level score of 85.4.

The key legislation underpinning the digitalisation of public services in Germany is the Online Access Act (Onlinezugangsgesetz (OZG)), adopted in 2017. Germany receives EUR 2.5 billion EU funding for this measure via the DARP. On 23 February 2024, the Bundestag voted for amending this legislation (Online Access Amendment Act, *Onlinezugangsänderungsgesetz***,** 20/8093**) to further promote the process of developing user-friendly digital services.** The new regulations are designed to consolidate the structures of federal-state cooperation and enable simple, modern and digital handling of procedures in the portal network. To this end, the Federal Government aims to roll out central basic services that replace state-specific developments handling citizens' accounts and mailboxes. In addition, it plans to bring in a qualified electronic seal replacing written seals and a regulation to make company services digital-only.

Germany has not set a national target for these two indicators in its roadmap and has not specified related trajectories. Implementation of the digitalisation programmes related to the Online Access Act, the OZG Bund and OZG Föderal continues in 2024. The Federal Ministry of Interior and Community (BMI) continues to coordinate the work, with responsibility for implementation at federal level in the departments and for federal administrative services in the Länder. As of 31 January 2023, 122 services were available on a nationwide basis (i.e., in all the Länder and their more than 11 000 communities) out of the 575 public services that Germany had proposed to digitalise by the end of 2022, based on the Online Access Act. By April 2024, this had increased to 157[45]. These 157 digital services cover the most frequent use cases. This especially holds true for the federal level where all frequently used public services (e.g., services with more than 1 million users per year) are digitized while services with little usage are still to be digitized.

In this context, ongoing evaluations and adaptations to ensure high user-friendliness are essential to maximise the efficiency and uptake of digital services in Germany. In February 2023, the government selected 16 key administrative services (focus services)[46] that will be digitised as a particular political priority at an accelerated pace, with the aim of making them available at a high quality nationwide. To gain the trust of citizens and businesses, work also continued to provide safe and user-friendly online platforms, such as the Federal portal. Over 150 000 users per month are currently registered in the Federal Portal. Almost 100 application procedures are currently available online via the portal and others are constantly added. Extensive developments have been implemented in the portal, including new information pages. These provide users with practical information on a specific topic at a glance. In particular, user-friendliness has been improved and the application has new follow-up functions.
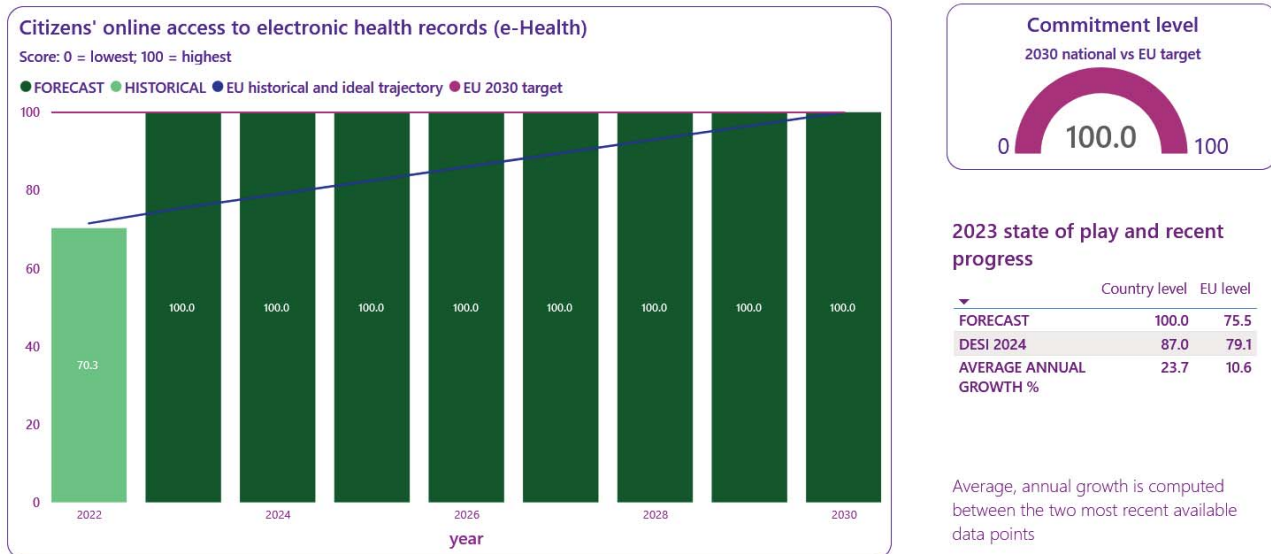
A priority objective in Germany is to make the administration free from digital media disruptions and thus significantly more efficient. To this end, it launched the project to create the OZG framework architecture with binding standards, uniform interfaces and core basic components. An accompanying consultation process on the OZG framework architecture between the Federal Government, the Länder and external stakeholders was set up via OpenCoDE. This consultation process factors in different perspectives with the aim of creating an effective, sustainable and usable OZG framework architecture. Over 400 feedback contributions indicate the strong level of involvement of 124 organisations from academia, the

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[45] https://dashboard.digitale-verwaltung.de/

[46] Re-registration (*Ummeldung*); Housing allowance; Driving licence; Parental Allowance; Registration, re-registration, and deregistration of a car; Civic allowance; Permit and approval of installations; Citizenship acquisition; Public procurement; Building ruling and building permit; Company registration & authorisation; Identity card; Marriage; Advance on maintenance (*Unterhaltsvorschuss*); Start-up of crafts; Flat-rate energy price for students.

private sector, policy and administration, and civil society organisations. The consultation process was completed at the end of January 2024. A final report on the consultation process is under preparation.

3.1.2.c e-Health

Citizens' online access to electronic health records (e-Health)
Score: 0 = lowest; 100 = highest

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Commitment level
2030 national vs EU target

0   **100.0**   100

2023 state of play and recent progress

	Country level	EU level
FORECAST	100.0	75.5
DESI 2024	87.0	79.1
AVERAGE ANNUAL GROWTH %	23.7	10.6

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

With an overall e-Health maturity score of 87 in 2023, Germany brings a positive contribution to the EU's digital decade target and shows very strong dynamic. This compares to a maturity score of 70 in 2022. In 2023, the EU-27 average was 79. However, 46.3% of German citizens sought health information online, below the EU average (56.3%).

Germany stepped up its work to speed-up digitalisation in the health sector, supported by four measures set out in the German roadmap. The measures respond to two challenges: tackling the low level of awareness and take-up of the electronic health record and empowering its usage. In March 2023, Germany presented the [Digitalisation strategy for health and care](#), setting out a range of measures to help achieve the electronic health records target of the Digital Decade.

Additionally, the DARP includes important measures to digitalise public health offices and hospitals, in component 5.1 ' Strengthening of a pandemic-resilient healthcare system'. There are EUR 3 billion earmarked from the DARP to fund the 'Programme to future-proof hospitals'. This will be complemented by the Länder and hospital owners. The measure 'Strengthening of the digital and technical resources of the public health service' is funded with EUR 684 million via the DARP.

Two laws focused on digitalisation in healthcare were adopted in December 2023. The Act on Accelerating the Digitalisation of Health (Digital-Gesetz – DigiG) was adopted by the German Bundestag on 14 December 2023 with a central feature element being the creation of the Electronic Health Record (EHR) for all. Anyone who does not want to use the EHR can object (opt-out). For privately insured persons, private health insurance companies can also offer an opt-out-based EHR**.** The Digital Act will make it easier for doctors and patients to access treatment using digital solutions. It will promote the exchange and use of health data and provide targeted support for care. In addition, the e-prescription will become a binding standard. Between 2024 and 2027, investment in measures regulated by the Digital Act is estimated to reach EUR 870 million.

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The Health Data Use Act (GDNG) aims to promote the public use of health data by (i) providing the basis for improving the availability of health data in the short term (for research, care and innovation) and (ii) paving the way for the European Health Data Space (EHDS). In addition, between 2020 and 2025, the Federal Ministry of Health (BMG) funded, with a total of over EUR 180 million, 38 projects involving 180 beneficiaries. The projects test where AI can be used meaningfully and usefully to improve care for patients, for example to optimise personalised treatments. Of these, 12 projects were successfully completed in 2023. Germany plans to invest EUR 710 million are planned for the redesign of the EHR (from 2024 to 2027). In addition, it will invest around EUR 440 million in the EHR's initial filling with data in 2025 and 2026.

The fourth measure in the roadmap is the awareness-raising and information campaigns on the EHR as well as stakeholder management to enable its use. EUR 4 million is planned for this measure.

Germany has improved access to secure health data infrastructure ('telematics infrastructure') to enhance performance, flexibility and central administrative capacity. In addition, the EHR's new security architecture will improve speed in the future. Industrial companies are involved at an early stage in preparing the specifications through structured comment processes.

In December 2023, the Federal Chancellery, with the support of the BMG, carried out an online research study with doctors of various disciplines to help transition the EHR successfully to an opt-out solution. The qualitative study identified expectations in terms of the benefits, reservations, requests for information and support for doctors. The evaluation of the results is expected to be available by mid-2024. Measures developed on the basis of the results will help increase doctors' acceptance of the EHR.

3.2 Building a safe and human-centric digital environment and preserving our democracy

On hate speech, Germany scores relatively well, since only 25.42% of the population were exposed to hostile or degrading online messages in the last 3 months according to a Eurostat survey, significantly below the EU average of 34%, and the fourth lowest in the EU.

One of Germany's top priorities is to protect consumers online and this is supported by several initiatives. The Federal Ministry of the Environment and Consumer Protection (BMUV) provides funds to support a wide range of projects that aim to involve non-governmental organisations in informing consumers. This includes awareness-raising and teaching of digital skills. The Ministry supports projects run by 16 consumer centres at Länder level, which provide practical information on digital security and consumer rights. Other projects focus on and promote digital skills for older people. Certain projects focus specifically on vulnerable and specific consumer groups. Another project (www.mobilsicher.de) deals with data protection, in particular with regard to re-used and remanufactured digital devices and provides technical assistance and advice to consumers.

Several German institutions are involved in consumer protection and provide support to consumers also in the online environment. The European Consumer Centre for Germany advises and informs consumers on all issues related to cross-border trade in goods and services, and also provides model letters online to help consumers. The Stiftung Warentest provides information to consumers independent from manufacturers and suppliers in the form of comparative testing of goods and services. The Federal Association of Consumer Centres (Bundesverband der Verbraucherzentralen (vzbv)) represents consumer interests independently vis-à-vis political and societal decision-makers.

On protection from illegal content and hate speech, the EU Regulation on combating the dissemination of terrorist content online (TCO Regulation) has been in force since 7 June 2021 and applicable in all EU Member States since 7 June 2022. In the context of the conflict in Israel/Gaza, the Federal Criminal Police Office (BKA) used this tool for the first time since 7 October 2023 as the competent authority to issue (cross-border) removal orders. The BKA has issued numerous removal orders to remove propaganda from the terrorist groups HAMAS, Palestinian Islamic Jihad (PIJ) and the military arm of Hizbollah. In addition to the removal orders, it sent over 2100 referrals concerning jihadist content to hosting service providers.

Together with its cooperation partners, the BKA is fighting online hatred and hate speech with the Central Intelligence Unit for Criminal Content on the Internet. In the context of the conflict in Israel/Gaza, the unit has received a large number of criminal reports since October 2023.

Germany is committed to protecting children online, with the services of the Länder being responsible for police prevention work. Out of many campaigns, two merit highlighting. At the end of March 2023, Brandenburg's Police Headquarters (PP) carried out a prevention campaign 'Don't be part of it – Campaign against the dissemination of child and youth pornography'. In May 2023, the police headquarters in Südhessen carried out another campaign to prevent sexual abuse 'Break your silence – there's a face behind every abuse'.

In 2023, the BKA carried out its own prevention posts/campaigns to prevent sexual offences against children and adolescents. They included the 'Stop – Children's images do not belong to the network!' and the press publication on cooperation with the German chat provider *Knuddels* (Cuddles). The BKA launched a prevention campaign '#dontsendit' to raise awareness among young people about the issue of sending self-made child and youth pornographic content and its social and criminal consequences. In a pilot project, all suspected cases of cyber grooming and child/youth pornography were sent directly to the BKA to make it clear to all users that criminal law borders are also enforced online. A combination of criminal, technical and preventive measures should lead to a sustained reduction in suspicious cases on the 'knuddels.de' platform. In 2023, the Police Crime Prevention Programme of the Länder and the Federal Government (Pro PK) re-launched a nationwide information campaign entitled 'sounds wrong' against the dissemination of content representing sexual violence.

Germany is committed to protecting children in other countries too. In cooperation with ECPAT Deutschland e.V., the Working Group for the Protection of Children against Sexual Exploitation, Violence and Trafficking in Human Beings and the Central Office for Police Crime Prevention of the Länder and the Federal Government (ProPK), the German Travel Association (DRV) raised awareness of sexual violence against minors by running a poster campaign shortly before the start of the main holiday period at German airports and at long-distance railway stations. The aim was to raise awareness among travellers about child protection before the start of their journey, while at the same time encouraging them to report suspicious observations of sexualised assault against children at their holiday destinations.

A wide range of authorities, victim protection associations, service providers and NGOs in Germany are committed to the protection of children (e.g. the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth (BMFSFJ), Independent Commissioner for Child Sexual Abuse Issues (UBSKM), National Council, Complaints Office, Federal Centre for Child and Youth Media Protection, Federal Centre for Health Education, Child Protection Bund, Internet ABC, Central Referral Office for Facts Abroad (link: not to see.de), Weisser Ring, state agencies of the Länder for media, etc.). They take high-profile measures to support child protection, such as providing general information on the prevention of child sexual abuse and child pornography, and online visibility measures.

Germany is contributing to the objective of promoting responsible and human-centric AI systems. BMUV provided support to the Centre for Trustworthy Artificial Intelligence (ZVKI) up to 2023. As a neutral interface between academia, civil society and politics, the Centre's main objective is to raise awareness of consumer-relevant aspects, to stimulate public debate and to develop a consumer-friendly certification scheme for AI. In addition, the cross-government initiative 'Civic Coding – Innovation Network AI for the Common Good' BMAS, BMFSFJ and BMUV pools their activities to promote the use and design of artificial intelligence in the public interest.

Work started in 2023 to set up the Advisory Centre for Artificial Intelligence ('BeKi'), which the Federal Ministry of the Interior and Community (BMI) created as a central start-up and coordination centre for AI projects in the federal administration. The aim is to coordinate the approach to the use of AI technologies and deploy relevant infrastructure at federal level. The BeKi enables a high level of coordination, cooperation, and re-use of technical applications. In parallel, in cooperation with the Federal Academy for Public Administration, the BeKi will significantly boost the federal administration's ability to use AI responsibly and competently.

In November 2023, the Federal Office for Information Security (BSI) launched a project on artificial intelligence use cases in the financial market with the aim of developing a standardised assessment framework for trustworthy AI. In addition, the Centre for European Research in Trusted AI (CERTAIN) was set up in September 2023. CERTAIN is a joint initiative by multiple partners (e.g., the Fraunhofer Institute, Max Planck Institute, University of Saarland) within the framework of the German Research Centre for Artificial Intelligence. The aim is to develop new technologies that provide technological guarantees of compliance with social and ethical standards. One of the project's areas of focus is on certificates or trust marks for AI.

In order to support the responsible use of AI systems in schools and to empower teachers and students to use technology in a sovereign way, the Länder have already developed extensive materials (e.g., guides) for schools. In a joint working group on artificial intelligence, the group identifies relevant topics, and areas of action for the school sector and clarifies issues in exchanges with academic experts. The Länder have agreed to develop a catalogue of topics relevant to education at the KMK on managing artificial intelligence in schools, in terms of issuing recommendations for action. In addition, guidelines and school practical recommendations have been and will be published by other stakeholders, which feed into further work by the Länder on the subject.

Germany is contributing to the objective of promoting and preserving our democracy in the online world. Since 2015, the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth (BMFSFJ) has supported democracy promotion, diversity building and preventing extremism at local, regional and federal level through the federal programme Living Democracy! Work continued to combat hatred online under the federal programme, expanding in 2023 to include a fifth partner, which has a strong media educational perspective on the topic. The work of the Federal Working Group against Hate on the internet could also continue, to put the work against hatred online on a more evidence-based basis.

Strengthening digital citizenship education and addressing hatred online is also a central task of the Federal Centre for Political Education (BpB) within the remit of the Federal Ministry of the Interior and Community. This aspect of work has been strengthened with the creation of a new section on 'Political Education and Social Media', by increasing both human and financial resources. By way of example, the 'Democracy in the Network' funding programme for prevention and intervention against far-right and

disguised communication, as well as digital participation. In 2023, the programme expanded the offer of training and networking opportunities (including training on online radicalisation, impact measurement and critical media literacy).

The private organisation HateAid **offered needs-based advice to victims of digital violence and carried out an information campaign on digital violence supported by the Federal Ministry of Justice.** The advice focused on the interplay between digital and analogue threats. It tackled this particular threat situation in psycho-social, communicative and technical terms in terms of security. The focus was primarily on people affected by group-related misanthropy, in particular racism, antisemitism, misogyny and discrimination based on LGBTIQ groups.

4 Leveraging digital transformation for a smart greening

In Germany, the green and digital twin transition is a top priority for the Federal Government. The action plan of the BMBF '[Natural. Digital. Sustainable.](#)' is the basis for the 'Digital Sustainability Innovations' initiative. This develops it further by creating a funding focus on the connection between digitalization and sustainability. The initiative is anchored in both the Digital Strategy and the Future Strategy for Research and Innovation[47].

German enterprises and citizens are generally sensitive to the need for the digital sector to be part of the green transition. In Germany, 50.9% of enterprises considered the environmental impact of ICT services, or ICT equipment, before selecting them and applied some measures, affecting the paper or energy consumption of the ICT equipment, which is above the EU average of 48.7%[48]. In Germany, people tend to recycle their ICT devices (8.7% for laptops or tablets, 12.1% for desktops) slightly less than the EU average (9.7% and 12.8%, respectively).

Germany has introduced a wealth of measures that aim to green the digital sector, ranging from the application of AI technologies, organising workshops to promoting implementation of the Blue Angel criteria. As part of the funding programme 'AI Lighthouses for the Environment, Climate, Nature, and Resources', the BMUV supports eight illustrative projects in developing resource-efficient AI technologies. The **initiative 'Civic Coding'** bundles several initiatives and projects across ministries, such as the **EcoAICollab** *('KI-Ideenwerkstatt für Umweltschutz')*, which is supported by BMUV. The EcoAICollab serves as a combined physical and virtual hub for civil society actors, assisting them in developing data-driven and AI-based solutions to address environmental challenges. It provides educational opportunities to impart skills in managing environmental data and, by using best practices, demonstrates how AI is benefiting environmental protection efforts. In the context of the 'GreenTech Innovation Competition' technology programme, the BMWK supports the development and application of digital technologies to increase resource efficiency, optimise circular value chains and sector coupling to minimise greenhouse gas emissions. With the SoftAWERE project, BMWK has promoted the development of tools for greater transparency in the software development community and on energy consumption of software. The BMUV organised a workshop series on green coding, in which software developers presented measuring tools and methods for energy- and resource-efficient software development.

In addition to these measures, implementation of the Blue Angel criteria is promoted in data centres and co-location data centres. The overall objective is to support data centre operators in Germany in implementing measures to ensure a more climate- and environmentally friendly data centre operation. Advisory services aim to increase the number of data centres awarded with the Blue Angel, which can demonstrably implement climate and environmental protection requirements. Since 2009, the Federal Administration in Germany has undertaken to reduce the energy consumption of information technology. The current obligation also implies that the Blue Angel criteria serve as guidance and obligation for data centres of the Federal Administration, which have an IT connection capacity of more than 100 kW and are required when awarding data centre services. This obligation already applies to data centre operators with an interest in public procurement.

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[47] [Digitalisierung und Nachhaltigkeit - BMBF](#)
[48] Eurostat

Germany is committed to monitoring the impact of ICT systems, as environmental information is the foundation of sustainable development. Against this background, the platform www.umwelt.info is currently being developed as a central access point for all publicly available information on environmental issues throughout Germany. The information should include environmental metadata, services, reports, research results, opinions, and educational materials, as well as information on laws, regulations, support programmes or practices of environmental and nature conservation administrations. In addition, with the new Act on increasing energy efficiency in Germany (Energy Efficiency Act – EnEfG), operators of data centres – above a non-redundant nominal power of 300 kW – will be required to report and publish their results annually against a set of efficiency indicators. The EnEfG also sets requirements for minimum energy efficiency, for increasing the share of renewable energy and on the use of waste heat. The project Sustain: The Sustainability Index for Artificial Intelligence, supported by the BMUV, analyses how sustainable AI can be defined and re-implemented.

In this context, the *Bundesnetzagentur* commissioned a study**, published in 2023, which resulted in a set of indicators assessing the environmental sustainability of the telecommunications infrastructure.** The indicators can show the impact of telecommunications infrastructure on certain sustainability objectives. Based on this, in the first half of 2024, the *Bundesnetzagentur* invited telecom network operators to report data on sustainability. The aim is to improve the situation on environmental data for the ICT sector. The aggregated data will subsequently be published, with the aims of increasing transparency for consumers and businesses on digital sustainability.

Four digitalisation measures were launched in Germany that directly support the green transition and will have a positive impact on the environment. Under the funding programme **AI lighthouses for the environment, climate, nature, and resources**, the BMUV supports 53 illustrative projects on the use of AI for biodiversity, water management, climate change adaptation, marine protection, sustainable consumption, sustainable tourism, resource efficiency and the circular economy. The BMUV **Sustainable Digitalisation Community** brings together people who deal with issues at the intersection of digitalisation and sustainability. The aim is to strengthen the links between politics, research, the start-up scene, business and local communities. As a driving force, the community creates spaces for discussion and structured exchanges of best practice to jointly explore ways to achieve sustainable digitalisation. By the end of 2023, the community had already grown to reach 1300 active members**. Since 2023, an innovation and experimentation space, the Artificial Intelligence and Big Data Application Laboratory (**AI Lab**)** at the Federal Environmental Agency uses AI and big data methods for environmental and sustainability applications.

In addition to these measures, the AI Lab identifies research questions on the sustainable use and operation of AI and big data applications. The AI Lab aims to support work on environmental and sustainability research and environmental monitoring at a time of transformation, both digitalisation and social-ecological and institutional transformation. **Last but not least, the project Specialised Information System Water-Soil (FIS WaBo),** currently under implementation, aims to achieve a significant improvement in the area of process management. It spans data provision, quality assurance, consultation and data aggregation right up to the final product (dataset, map, web service, EU report) for cross-administrative data management. To this end, it transfers data on watercourses, standing waters, groundwater and soil from separate systems to a single IT system. The system will link to the new information portal Umwelt.info, the Artificial Intelligence and Big Data Application Lab and other UBA data-related projects. The aim is to provide transparent and comprehensive data to the public, policy, and the scientific community.

Best practice: Green-AI SME Hub

The Green-AI SME Hub specifically supports SMEs in using AI to increase resource efficiency and material savings. It is designed to provide practical, solution-oriented and on-site support. AI is a toolbox that can be used in a wide range of areas. In this Hub, AI is used as a technological tool to optimise processes, save costs and resources for the benefit of the environment and increase competitiveness by reducing dependence on the use of raw materials.

Annex I – National roadmap analysis

Germany's National Digital Decade Strategic Roadmap

On 13 November 2023, Germany **submitted** its national strategic roadmap, in accordance with Article 7 of the Digital Decade Policy Programme Decision. Following feedback from the European Commission, it updated the roadmap and re-submitted it on 4 March 2024. The roadmap has been subject to a broad consultation process involving representatives from business and civil society. On 28 May 2024 the roadmap was published on BMDV's website**.**

The strategic roadmap includes **national target values** for 9 of the 14 targets of the DDPP. It does not set a target for 7 of the DDPP targets: ICT specialists, edge nodes, AI, cloud, big data, digital public services for citizens and for businesses and therefore no trajectory on these aspects. All the national target values provided **are comparable with the EU targets** (on the digital intensity of SMEs, Germany's target is even slightly above the EU target at 91%). The roadmap lacks complete national projected trajectories, i.e., yearly data points, for the following 5 KPIs: FTTP, VHCN, 5G, unicorns and basic digital skills. It provides a full trajectory (with datapoints for each year until 2030) for only 3 KPIs: SMEs with at least a basic level of digital intensity, the joint AI or Cloud or Data analytics indicator and e-health. In addition (although this is not required), Germany provided a full trajectory on quantum and on e-ID, with a very ambitious target on quantum to make available at least 16 systems for research and industrial applications by 2030. The trajectories provided (except for basic digital skills) do not use the baseline as published in the SDDR 2023 report, which is the agreed baseline (i.e., ICT specialists, VHCN, FTTP, 5G, DII, digital public services for citizens, digital public services for businesses, e-health and AI or Cloud or Big data).

The below table reflects a best-effort attempt at categorising the measures and budget as presented in Germany's roadmap.

Digital Decade Target/objective	Budget (EUR Million)	Number of measures
Connectivity Gigabit	59 458.5	4
Connectivity 5G	-	-
Semiconductors	17 000.0	2
Edge nodes	1 030.0	1
Quantum computing	1 365.0	3
SME take up	1 999.8	5
Cloud/AI/Big Data uptake	-	-
Cloud only uptake	119.6	1
AI only uptake	203.8	5
Big data uptake	50.0	1
Unicorns	10 000.0	1
Basic Digital Skills	7 667.3	13
ICT Specialists	382.8	4
e-ID	-	-
Key Public Services	394.3	3
e-Health	0.0	4
Objectives	-	-
Total	**99 671.1**	**47**

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Germany's roadmap describes **47 policies, measures and actions supporting each target and group of objectives.** *(Note: some measures support more than one target and the table above does not show duplications.)* Most measures (**17 measures**) in the roadmap support targets on digital skills and ICT specialists**, followed by 9 measures** designed to develop cloud/AI/big data and 7 measures for the digitalisation of SMEs, 4 measures for gigabit expansion and another 4 for e-health, 3 measures to support quantum and another 3 to support digital public services. It does not include any measure on e-ID**. The timespan for the measures varies. Most of the considerable budget of almost EUR 100 billion set out in the roadmap comes from private funding (EUR 55.3 billion) and national public funding (EUR 39.3 billion), complemented with EU funding (over EUR 3 billion) and funding from the Länder (over EUR 2 billion).

The general objectives are also supported by specific measures. For example, the digital citizenship objective is underpinned by the Federal Transparency Act, the Open Data Strategy and the AI-Compass inclusive project. Leadership and sovereignty are promoted by the Digital strategy, Gaia-X, the Gigabit Strategy and the Cybersecurity Strategy. The objective to make a contribution to the green transition is underpinned by measures such as the IPCEI CIS, SME Digital Centres Network and the Future Centres ESF.

The measures set out in the national strategic roadmap tackle the main challenges facing Germany, such as fibre roll-out, digitalisation of public services, increasing the level of basic digital skills and the number of ICT specialists, all identified in the roadmap and covered under the DDP recommendations/CSRs. These measures are a step up in intensity compared with previous action, given the new measures introduced, both in terms of action to support the fibre target (see Gigabit promotion 2.0), the AI target (supported with 4 new measures: AI studies, AI experimentation space projects, AI service centres and Mission AI), the cloud and semiconductors targets with the two relevant IPCEIs, and in terms of support for the wider objectives of the programme (e.g. the 'Industrial IT security Initiative' supporting cybersecurity).

Annex II – Factsheet on multi-country projects (MCPs) and funding

MCP and EDICs
Germany participates in a number of multi-country projects and initiatives supporting prospective EDICs in a number of areas. It supports European Digital Innovation Hubs (EDIHs) (the total EU budget for the three-year support is EUR 321 million, for Germany 42.4 million). EDIHs receive funding through co-financing, with half of the funding coming from the European Union under the Digital Europe Programme and the other half from national funding. Alongside Czechia, France, Italy, Poland and Spain, Germany will be one of the sites to host quantum computers that the EuroHPC JU is currently in the process of acquiring. The Jülich Supercomputing Centre in Germany will host one of the two EU's exascale supercomputers, JUPITER. From the very beginning, Germany has been a member of the working group that aims to set up the Mobility and Logistics Data EDIC (Germany has approved EUR 13.8 million of national funding to finance the data exchange infrastructure under the German Mobility Data Space Project). As of end of May 2024, Germany is finalising membership negotiations with the Local Digital Twins towards the CitiVERSE EDIC (already set up). Germany is developing the Statute and other relevant documents of the possible future EDICs for Mobility and Logistics Data (see above) and the Genome, within the relevant informal Working Groups. Germany is engaging in discussions on the setup of possible future Digital Commons EDIC, of the Cancer Image Europe (EUCAIM) EDIC and the Agri-Food EDIC, within the relevant informal Working Groups.   Germany takes a leading role in the IPCEI Microelectronics and Communication Technologies and the IPCEI-Next Generation Cloud Infrastructure and Services. Germany coordinates the latter together with France. Ten other Member States are involved in this latter IPCEI with direct participants and/or indirect partners.

EU funding for Digital in Germany
The EU funds action on digitalisation in Germany and across the EU. As highlighted in a JRC analysis, most of the funding comes from the Recovery and Resilience Facility, followed by Cohesion Policy.   The German Recovery and Resilience Plan (DARP) allocates EUR 13.5 billion (48% of the total allocation) to the digital transformation of the country, of which EUR 12 billion directly contribute to achieving the Digital Decade targets[49]. From the digital part of the DARP the largest amount is dedicated to the digitalisation of public services (EUR 3.6 billion), followed by the modernisation of hospitals (EUR 3 billion). The IPCEI on microelectronics (EUR 1.5 billion) supports the development and production of semiconductors. Over EUR 1 billion is allocated to action on basic digital skills. In December 2023, Germany submitted a first payment request which led to the disbursement of EUR 4 billion in March 2024 with no missed targets or milestones.   According to the same mapping study, Germany also received EUR 1.1 billion of Digital Decade-relevant budget from cohesion policy funds with an accent given to digitalisation of enterprises, including fostering the growth of unicorns.

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[49] Based on an estimation of the possible contribution to the Digital Decade (Joint Research Centre report 'Mapping EU level funding instruments to Digital Decade targets - 2024 update' (Signorelli et al., 2024)).

State of the Digital Decade 2024

Greece

1 Executive summary

Greece has scope to improve its performance to contribute to the European Union's (EU) Digital Decade objectives and targets, in view of a successful digitalisation that fosters competitiveness, resilience, sovereignty, European values and climate action.

In 2023, Greece made notable progress in rolling out Fibre to the Premises (FTTP) connectivity infrastructure, and digitalising public services. However, **important challenges** persist in the share of ICT specialists in employment and in the basic level of digital intensity of SMEs.

Although Greece still has a relatively low level of digital maturity, it has reversed the trend over the last 5 years. Greece's digital transition draws on a strong political commitment and an overall digital transformation strategy spanning 2020-2025. It started by focusing specifically on digitalising public services for people and businesses, and sustained efforts are yielding tangible results. Ongoing action is also directed towards digitalising other crucial public sectors such as education, justice, healthcare, and to economic sectors that still have great untapped potential. Overall, these initiatives, in line with the European Semester's country specific recommendations, benefited from funding under the Recovery and Resilience Facility at a crucial moment. However, since Greece started its digital transition late, some structural challenges are still pending. In particular, the lack of progress on digital skills of the population is a hurdle for digitalisation to steadily drive the country's competitiveness and prosperity, despite high investments in digital education and training.

According to the **special Eurobarometer survey 'Digital Decade 2024'[50]**, 75% of respondents in Greece said that the digitalisation of daily public and private services makes their life easier, slightly above the EU average of 73%.

Greece is very active in collaborating at EU level. Greece is a member of the Alliance for Language Technologies EDIC (ALT-EDIC) and of the EUROPEUM-EDIC on blockchain (both already set up). Greece is expected to be the hosting Member State of the possible future Connected Public Administration EDIC and of the possible future Cybersecurity Skills Academy EDIC. Greece is developing the Statute and other relevant documents of the possible future Genome EDIC, within an informal working group. It is also engaging in discussions on the setup of possible future Cancer Image Europe (EUCAIM) EDIC, within an informal working group[51]. Greece also participates in the IPCEI Microelectronics and Communication Technology (ME/CT) and in the EU Digital Wallet consortia: POTENTIAL, EWC, DC4EU.

Greece's Recovery and Resilience Plan (RRP) allocates 22.1% of its total budget to the digital transition (EUR 7.78 billion)[52] with a strong priority on the transformation of the public administration and on digitising the economy, particularly SMEs. It is also investing significantly in increasing the digital skills of the population. Under Cohesion Policy, an additional EUR 2.7 billion (13% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[53].

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[50] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351

[51] Information last updated on 31 May 2024.

[52] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.

[53] This amount includes all investment specifically aimed at or substantially contributing to digital transformation in the 2021-2027 Cohesion Policy programming period. The source funds are the European Regional Development Fund, the Cohesion Fund, the European Social Fund Plus, and the Just Transition Fund.

Digital Decade KPI [1]	Greece			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	EL	EU
Fixed Very High Capacity Network (VHCN) coverage	27.9%	38.4%	37.9%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	27.9%	38.4%	37.9%	64.0%	13.5%	100%	-
Overall 5G coverage	85.7%	98.1%	14.5%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		12		1 186		95	10 000
SMEs with at least a basic level of digital intensity	37.7%	43.3%	7.2%	57.7%	2.6%	79.7%	90%
Cloud	15.2%	18.1%	9.1%	38.9%	7.0%	56%	75%
Artificial Intelligence	2.6%	4.0%	24.0%	8.0%	2.6%	32%	75%
Data analytics	NA	25.0%	NA	33.2%	NA	40%	75%
AI or Cloud or Data analytics	NA	33.5%	NA	54.6%	NA		75%
Unicorns		3		263		20	500
At least basic digital skills	52.5%	52.4%	-0.1%	55.6%	1.5%	70.2%	80%
ICT specialists	2.5%	2.4%	-4.0%	4.8%	4.3%	4.5%	~10%
eID scheme notification		No					
Digital public services for citizens	64.6	75.9	17.5%	79.4	3.1%	98.2	100
Digital public services for businesses	73.7	86.2	17.0%	85.4	2.0%	100	100
Access to e-Health records	60.7	73.8	21.6%	79.1	10.6%	100	100

[1] See the methodological note for the description of the indicators and other descriptive metrics

National Digital Decade strategic roadmap

With respect to **Greece's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating a **very high ambition** and, based on this document, intends to allocate **significant effort** to achieve the Digital Decade objectives and targets.

The roadmap is mostly complete and presents 14 national trajectories and targets to be achieved by 2030. The national targets set for connectivity, digital transformation of public services and e-health match the EU's 2030 targets, but the targets for digital skills and for the digital transformation of businesses are below the EU's 2030 targets. The roadmap contains a detailed analysis of the current state of play, and a comprehensive set of measures and initiatives designed to meet the objectives and targets of the Digital Decade to transform the country into a digitally advanced and inclusive society by 2030. It is based on the Digital Transformation Bible 2020-2025, the country's current national digital strategy. Funding for the digital transformation relies heavily on EU funds (RRF and cohesion policy funding).

The total public funding for the 104 measures in the roadmap is estimated at EUR 5 230.2 million (about 2.37% of GDP). The priorities are on the digital transformation of the public sector including the health sector, the digital transformation of the economy, and the uptake of advanced digital technologies by businesses. The roadmap also gives a rough estimate of private investments for the coming years in data centres and gigabit connectivity of EUR 6 900 million.

Recommendations for the roadmap

When adjusting the roadmap in accordance with Article 8(3) of the Digital Decade Policy Programme (DDPP) Decision, Greece should:

- **TARGETS:** Consider in due time reviewing all the national targets that are not aligned with the EU's 2030 targets, and in particular **the take up of cloud, data analytics and AI** by enterprises, the target for which is currently low on ambition**.**

- **MEASURES:** Review and reinforce the strategy and measures to contribute to the targets (i) that are the most challenging to reach, such as **digital infrastructure**, **ICT specialists;** and (ii) that have a low level of ambition, the **take up of cloud, data analytics and AI by enterprises.** Provide additional details on how existing and planned measures for the digitalisation of SMEs will contribute to reaching the target for 2030; (iii) Provide **more information on the implementation of digital rights and principles**, including the national measures that contribute to it.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' provides insights into Greeks' perceptions of digital rights. Only 33% of Greeks believe that the EU protects their digital rights well, although this figure has increased by 1 point since last year, it remains significantly below the EU average of 47%. Concerns are escalating, with 62% worried about children's online safety, up 2 points, and 51% about control over personal data, while overall respondents seem to be more worried about their digital rights and principles than the EU average. On a positive note, 85% of respondents value digital technologies for connecting with friends and family, which is above the EU average of 83%. The monitoring of the Declaration on Digital Rights and Principles shows that increasing the profile of the Declaration at national level and fostering better stakeholder engagement could help improve outcomes in the years to come[54].

A competitive, sovereign and resilient EU based on technological leadership

With significant support from EU funds, Greece is taking action to start upgrading its digital and research infrastructure and to develop ecosystems for innovation in cutting-edge technologies, which are currently in their infancy. The country still faces several challenges. It lags behind on the deployment of fibre networks to deliver gigabit connectivity for all, although its National Broadband Plan 2021-2027 is starting to bear fruit. Moreover, all the indicators on the digitalisation of enterprises indicate a below EU average performance. Many SMEs have a relatively moderate level of innovation and a low level of digital maturity. In 2023, only 43.3% of SMEs had at least a basic level of digital intensity, below the EU average (57.7%). Businesses in Greece also have a low level of take up of advanced technologies such as AI, cloud, and data analytics in general. However, the dynamic start-up ecosystem is a positive sign of a digital ecosystem in development.

Recommendations – Greece should:

- **CONNECTIVITY INFRASTRUCTURE:** (i) closely monitor the progress on the gigabit coverage to identify early enough any remaining investment gaps to reach the target for 2030; (ii) ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment

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[54] See SWD 'Digital Decade in 2024: Implementation and perspective' with annexes, SWD(2024)260: https://digital-strategy.ec.europa.eu/en/news-redirect/833325, Annex 4.

of 5G stand-alone core networks.

- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

- **SEMICONDUCTORS, QUANTUM TECHNOLOGIES, EDGE NODES:** Develop additional measures in due time to accelerate the deployment of digital and data infrastructure and promote the use of digital capabilities and the access to digital technologies.

- **DIGITAL TRANSFORMATION OF BUSINESSES**: Consider reinforcing the framework conditions to enable (i) less digitally mature SMEs to adopt digital transition; and (ii) all enterprises to benefit from the data economy by a rapid adoption of advanced technology (AI, cloud, data analytics) as a competitive advantage; (iii) stimulate the adoption of next generation cloud infrastructure and services by companies of all sizes, including by liaising with the Cloud IPCEI Exploitation office and/or the coordinators and the Member States participating in the IPCEI-CIS.

Protecting and empowering EU people and society

The concerted efforts made on digital transformation in recent years have resulted in a demonstrable and significant improvement in the public digital services available to citizens and businesses. This is expected to make a significant contribution to the country's resilience and competitiveness. However, in terms of empowering people to benefit from opportunities created by an increasingly digitalised society and economy, Greece has not yet met the challenge of training its population in the level of digital skills needed, despite several recent measures, investments and reforms. In 2023, only 52.4% of the population had at least basic digital skills (EU average 55.5%), indicating no progress since the previous data collection in 2021. The number of ICT specialists in terms of the share of employment is 2.4%, far below the EU average (4.8%). However, in 2023, information technology was reported to be the business sector in Greece with the highest score on intention to hire new professionals, with employment prospects reaching 27%.

Recommendations – Greece should:

- **DIGITAL SKILLS**: Review and consider whether additional targeted measures to train the population are sufficient to reach the target, boost the resilience of the economy and society and achieve inclusive growth.

- **ICT SPECIALISTS**: Reinforce the strategy and the measures to increase the number of ICT specialists and retain the best talents.

- **e-ID**: Greece should notify to the Commission an e-ID scheme under the eIDAS Regulation.

- **e-Health**: (i) Make the data types of medical imaging reports and medical images available to people through the online access service, (ii) Ensure that the online access service complies to web accessibility guidelines.

Leveraging digital transformation for a smart greening

Greece national roadmap mentions some measures related to the green transition in addition to the measures related to establishing more sustainable, energy- and resource-efficient digital infrastructure and technologies (e.g., sovereign cloud, edge nodes and 5G infrastructure). Greece also set goals in its national energy and climate plan and in the RRP for which digital technologies can be used as smart agents to trigger the green transition (e.g., smart meters). In 2023, a programme supported by cohesion policy funding has been launched for the 'green transformation of SMEs' to support projects aiming at developing and using modern technologies to upgrade their products, services and processes in terms of energy

upgrading, the circular economy and the adoption of clean energy sources. However, a more comprehensive approach to make the digital sector more environmentally friendly and sustainable is missing. According to the Eurobarometer 2024 survey, 86% of respondents in Greece said that ensuring that digital technologies serve the green transition should be an important action for public authorities (above the EU average of 81%). In this regard the Data Centre that is operated by the General Secretariat of Information Systems and Digital Governance of the Ministry of Digital Governance has adopted and implemented the European Code of Conduct for Energy Efficiency in Data Centres

Recommendations – Greece should:

- Develop a coherent approach to twinning the digital and green transitions. First, promote improvements in energy and material efficiency of digital infrastructure, in particular data centres. Second, support the development and deployment of digital solutions that reduce the carbon footprint in other sectors, such as energy, transport, buildings, and agriculture, including the uptake of such solutions by SMEs.

- Monitor and quantify the emission reductions of the deployed digital solutions in line with the relevant EU guidance and with the support of the methodology developed by the European Green Digital Coalition, in view of future policy development, as well as of attracting relevant financing.

2 A competitive, sovereign and resilient EU based on technological leadership

Greece is focusing increasingly on the digital transition of the economy, while facing several challenges on its path to competitiveness and technological leadership. In 2020, the ICT sector accounted for 3.23% of Greece's GDP (EU average is 5.23%). The prolonged financial crises restrained public and private investments. With significant support from EU funds, Greece is carrying out several initiatives, reforms and investments, to upgrade its digital and research infrastructure and create ecosystems for innovation in cutting-edge technologies. The objective is to enhance the digital transformation of the economy to boost the country's competitiveness and resilience. The dynamic start-up ecosystem is a positive sign of a digital ecosystem in development. Over the last 12 months, Greece also tackled the pressing need to step up action to protect public institutions and businesses from cyberthreats with the creation the National Cybersecurity Authority as a separate public law body.

2.1 Building technological leadership: digital infrastructure and technologies

Greece lags behind on the deployment of fibre networks to provide gigabit connectivity for all. However, the National Broadband Plan 2021-2027 is starting to bear fruit, achieving a 10-percentage point increase in VHCN/FTTP coverage over the past year. Current market trends, with new fibre operators, will also contribute to reinforce this positive trend over the coming years. Broad investments projects to deploy fibre (100 Mbps, readily upgradeable to 1 Gbps) started in 2023 to cover the white areas, and measures were also launched in 2023 to provide for in-building cables.

### 2.1.a Connectivity infrastructure (gigabit)

Very High Capacity Network (VHCN)
% of households
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Values: 7.1 (2020), 10.2, 19.8, 27.9 (2022), 28.0, 42.0 (2024), 51.0, 70.0 (2026), 79.0, 88.0 (2028), 97.0, 100.0 (2030)

Commitment level
2030 national vs EU target
0 — 100.0 — 100
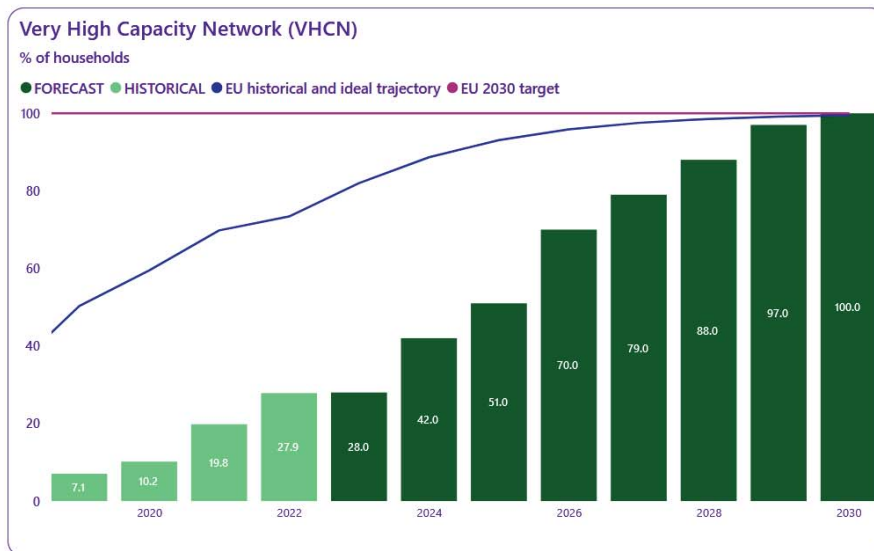
2023 state of play and recent progress

	Country level	EU level
FORECAST	28.0	82.0
DESI 2024	38.4	78.8
AVERAGE ANNUAL GROWTH %	37.9	7.4

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Fibre To The Premises (FTTP)

% of households

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory

Commitment level

2030 national vs EU target

0 — 100.0 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	28.0	70.3
DESI 2024	38.4	64.0
AVERAGE ANNUAL GROWTH %	37.9	13.5

Average, annual growth is computed between the two most recent available data points
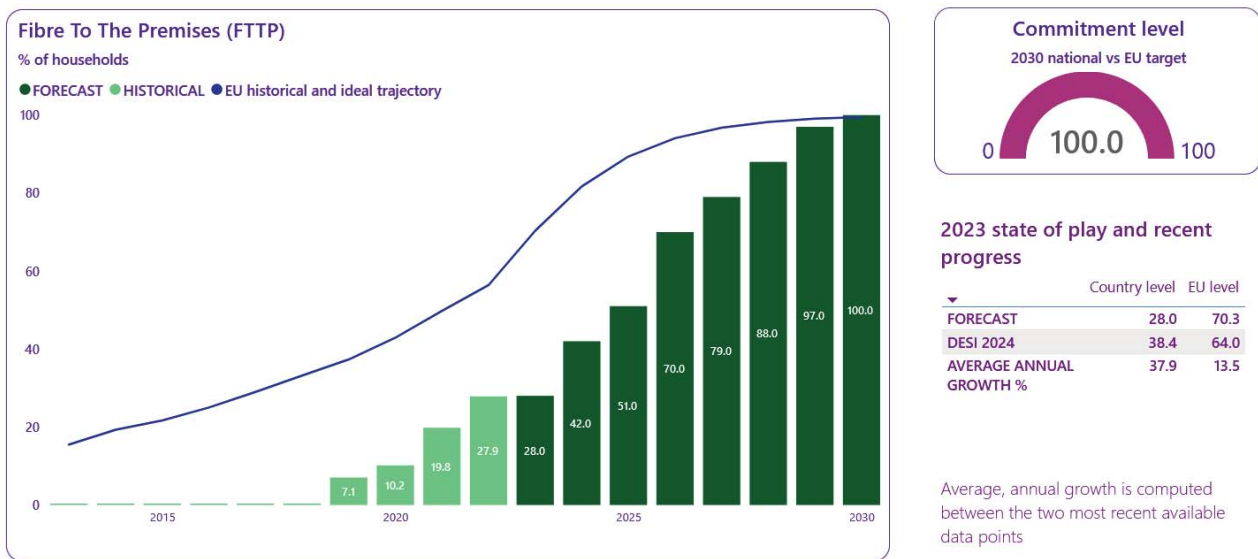
Note: The source of national forecast values is the 2023 country roadmap

Greece has scope to improve its performance to contribute to the EU's Digital Decade target with 38.4% of households' coverage for very high-capacity network (VHCN) which in Greece is Fibre to the Premises (FTTP) in the absence of coaxial networks. Although the recent annual growth for VHCN (37.9%) demonstrates a very strong dynamic compared to the EU average annual growth (7.4%), current coverage in Greece at 38.4% remains far below the EU average of 78.8% for VHCN and 64% for FTTP. On a different perspective, looking at broadband coverage by speed, in 2023 60.7% of Greek households have access to a broadband speed above 100 Mbps. However, the share of fixed broadband subscriptions of at least 100 Mbps services (29.5%) is significantly below the EU average (65.9%), while 0.0% of households had a broadband service providing at least 1 Gbps.

Greece's roadmap sets out the aim to reach 100% gigabit connectivity coverage by 2030, in line with the EU target. The trajectory pursues a high level of ambition, considering the current level of coverage and the lag behind the EU average. To reach its national targets by 2030 would require making substantial investments to maintain a high level of annual growth over the coming years.

In 2023, Greece carried out a detailed mapping exercise for private investment plans 2023-2027. The data collected are still being evaluated by the Ministry of Digital Governance and the NRA to identify remaining investment gaps. Over the last 12 months two new operators entered the Greek market for fibre deployment and two significant projects supported by the Recovery and Resilience Facility (RRF) and the European Regional Development Fund (ERDF) have started.

A very large project started to deploy fibre infrastructure. The 'Ultra-Fast Broadband' project will contribute to the deployment of fibre infrastructure in semi-urban and rural areas. Overall, it will cover 830 000 households and businesses (18% of the country) in areas that were not covered by the private investment plans by 2025. The total amount is EUR 870 million, with EUR 265 million from the EU structural funds.

Another major project launched in 2023 is the 'Smart readiness' programme to provide fibre infrastructure in buildings (in-building cabling) and up to the termination point. Funded by the RRP, the

target is to connect 120 000 buildings by end of 2025 (budget EUR 100 million). In December 2023, a joint ministerial decision[55] was published, including technical specifications for FTTH in-building work, which should facilitate the installation work. In 2023, broadband take-up of at least 1 Gbps in percentage of households remains very low (less than 0.1% of households), although Greece's current observed growth rate of coverage is noticeable. In its roadmap Greece envisages additional action to stimulate the demand.

Greece has a geo-strategic location in South-East Europe and is key to a resilient and secure EU connectivity. In the framework of the Connecting Europe Facility (CEF) Digital, the EU will co-finance the project '[High-speed Submarine Backbone for islands of the Aegean Sea](#)' to build a new submarine backbone infrastructure to provide high-capacity connectivity infrastructure to digitally under-served Greek islands in the Mediterranean. It will also contribute to increasing traffic protection through link redundancy and multiple path-based impact mitigation in the event of link failures, in line with the objectives of the EU Digital Global Gateway Strategy.

2.1.b Connectivity infrastructure (5G)
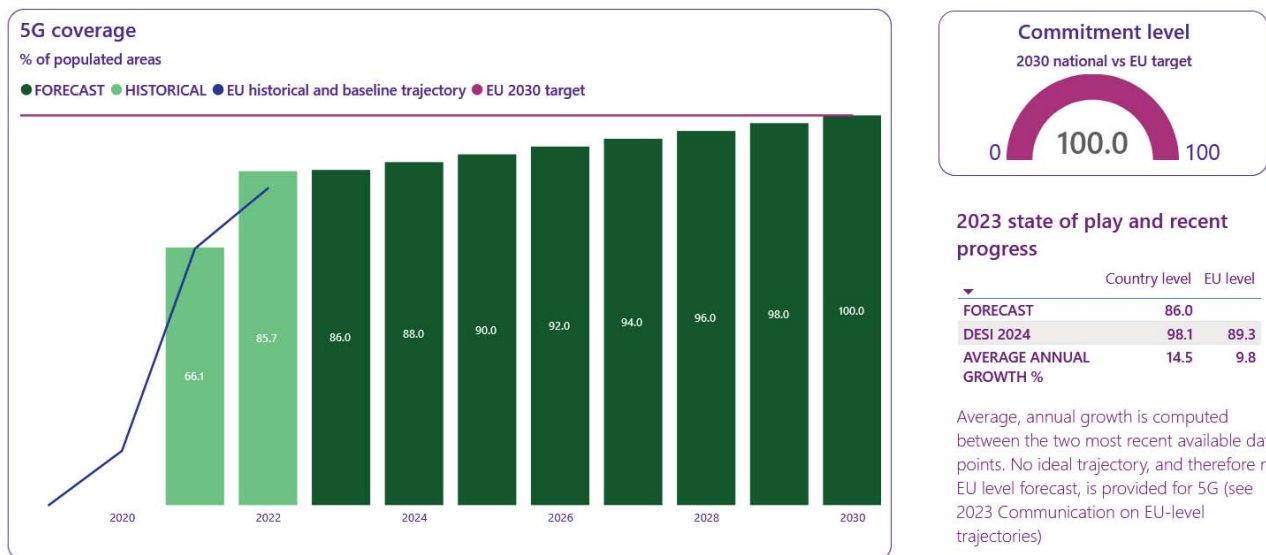
Note: The source of national forecast values is the 2023 country roadmap

Greece brings a positive contribution to the EU's Digital Decade target on 5G coverage and demonstrates a positive dynamic. In 2023, 5G coverage in Greece (98.1%) was well above the EU average (89.3%) with an annual growth of 14.5%. 58.8% of populated areas in Greece are covered by the 3.4-3.8 GHz band, which enables advanced applications requiring a wide spectrum bandwidth, above the EU average (50.6%). Furthermore, in rural areas, 5G coverage reached 92.1%, far above the EU average (73.1%), and a remarkable increase on the previous year, when rural 5G coverage was 57.8%. However, overall mobile broadband take-up in Greece is 83.5% below the EU average (89.9%).

Greece's roadmap also includes the aim to reach 100% of 5G coverage by 2030, aligned with the EU target. The trajectory pursues a high level of ambition and given the sustained level of growth recorded recently, Greece's contribution to the EU target will continue to be significant.

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[55] 53538 ΕΞ 2023

On mobile networks, three operators are actively deploying 5G coverage, well above the minimum coverage planned into the 5G licenses. Greece was one of the first countries in the EU to make available all the relevant spectrum 5G bands.

A Connecting Europe Facility (CEF) Digital project started on 1 January 2024, for 5G Infrastructure and Services for public interest and social inclusion in Greece. The 5G-TERRA project will provide high-quality, leading-edge 5G connectivity to end users of remote and sparsely populated areas in Greece to enable efficient, state-of-the-art Services of General Interest (SGIs) in the sectors of healthcare, education, and civil protection.

In terms of ex-ante regulation in Greece, the Greek regulator was asked to implement the obligations imposed on the provider designated as having significant market power without delay[56].

2.1.c Semiconductors

Greece does not have yet a vibrant ecosystem of semiconductor technology, although entities from both the private and public sectors are participating in several cutting-edge projects. In 2023, a call for applications, funded by the RRF, was published for participation in the European Key Digital Technologies Joint Undertaking (KDT-JU), which included semiconductor technologies. The Foundation for research and technology Hellas (FORTH) participates in a series of projects with a budget of EUR 19.1 million funded by the European High Performance Computing Joint Undertaking (EuroHPC JU).

Greece participates in the IPCEI Microelectronics and Communication Technology (ME/CT) approved in 2023 to create innovative microelectronics and communication solutions. The projects will contribute to technological advances in many areas, including communications (5G and 6G), autonomous driving, artificial intelligence, and quantum computing.

Under the Chips Act, Greece set up a Semiconductor Expert Group to map companies in the semiconductor value chain on the national market. 63 companies working at various stages in the semiconductor value chain, responded to the mapping exercise, of which nine are considered as large enterprises.

The roadmap also mentions a private sector initiative to mobilise public and private sector funds to develop an ecosystem for innovation in integrated circuits in the coming years in Greece. HETiA is an alliance of 47 industrial members and 28 universities and research institutes in Greece promoting digital technology proliferation and entrepreneurship in emerging technology domains. The first action planned by HETiA is to set up a competence centre for microcircuits to provide a design platform for integrated circuits and training to develop talent to support the ecosystem.

2.1.d Edge nodes

The Edge Observatory's first data report has estimated the number of edge nodes deployed in 2023 in Greece to 12. The total estimation for the EU is 1186. The national roadmap of Greece presents a target value for Greece of 95 edge nodes in line with the **estimation** done by the Edge Observatory of 92 edge nodes in Greece by 2030.

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[56] EL/2024/2492

In 2023, public sector and industry players in Greece are mainly at the testing and piloting phase regarding edge nodes. In its roadmap, Greece plans to perform a needs analysis and to develop actions to support the deployment of climate-neutral highly secured edge nodes in 2024-2025. The results should play a significant role in their deployment by providing the required data and scientific basis to ensure optimum distribution and performance.

2.1.e Quantum technologies

The Institute of Quantum Computing and Quantum Technology was established in 2023 in the National Centre for Scientific Research NCSR Demokritos. It aims to apply research to a wide range of industry sectors (e.g., energy, telecommunication, shipping, and biotechnology) to spur economic development through research activities. It also offers graduate-school programmes in quantum technologies.

An estimated EUR 48 million in public investment will contribute to the target on quantum computing, with the most important developments being HellasQCI and DAEDALUS HPC. The national Greek QCI (HellasQCI) aims to boost the resilience of critical infrastructure in Greece. The national HPC (DAEDALUS) and ARIS HPC will contribute to the development of a world class supercomputing ecosystem in Europe. Greece is member of the EuroQCI and an important player in the co-creation of the EuroQCI as one of the few countries on south-east of Europe having Optical Ground Station (OGS) systems for satellite quantum key distribution (QKD). DAEDALUS will be a mid-range supercomputer, able to perform more than 30 petaflops or 30 million billion calculations per second with a large part of its performance devoted to accelerators. It can and will support AI (Artificial Intelligence) - ML (Machine Learning) applications. This new supercomputer will be managed and operated by GRNET (the National Infrastructures for Research and Technology S.A.) and installed at the historical 19th century Electric Power Station building in Lavrion Technological and Cultural Park of the National Technical University of Athens.

HellasQCI also has the objective to create a community from all national stakeholders, collect expertise and share knowhow on the application of quantum technologies to actively contribute to the EU's technological sovereignty.

2.2 Supporting EU-wide digital ecosystems and scaling up of innovative enterprises

Greece lags behind on the digital transformation of enterprises, with many SMEs having relatively moderate levels of innovation and a low level of digital maturity. It also has a low uptake of advanced technologies such as AI, cloud and data analytics by enterprises in general, but a dynamic start-up ecosystem. In 2023, Greece continued its action, in both the public and private sectors, to support the development of competitive digital ecosystems and innovative businesses, recognising the critical role of digital technologies in the survival and viability of enterprises, in particular SMEs.

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2.2.a SMEs with at least a basic level of digital intensity

SMEs with at least basic level of digital intensity (DII)
% of Small and Medium Enterprises (SMEs)
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Historical values: 2022 = 37.7, 41.2
Forecast values: 46.0, 50.8, 55.6, 60.5, 65.3, 70.1, 74.9, 79.7

Commitment level
2030 national vs EU target

79.7 | 90.0

2023 state of play and recent progress

	Country level	EU level
FORECAST	46.0	71.6
DESI 2024	43.3	57.7
AVERAGE ANNUAL GROWTH %	7.2	2.6

In the case of DII, the average, annual growth is computed between 2023 and 2021 due to data comparability reasons.

Note 1: DII 2022 is version IV that is not comparable with DII 2021, that was version III. The EU-level ideal trajectory refers to DII version IV, as published in the 2023 Communication on EU-level trajectories
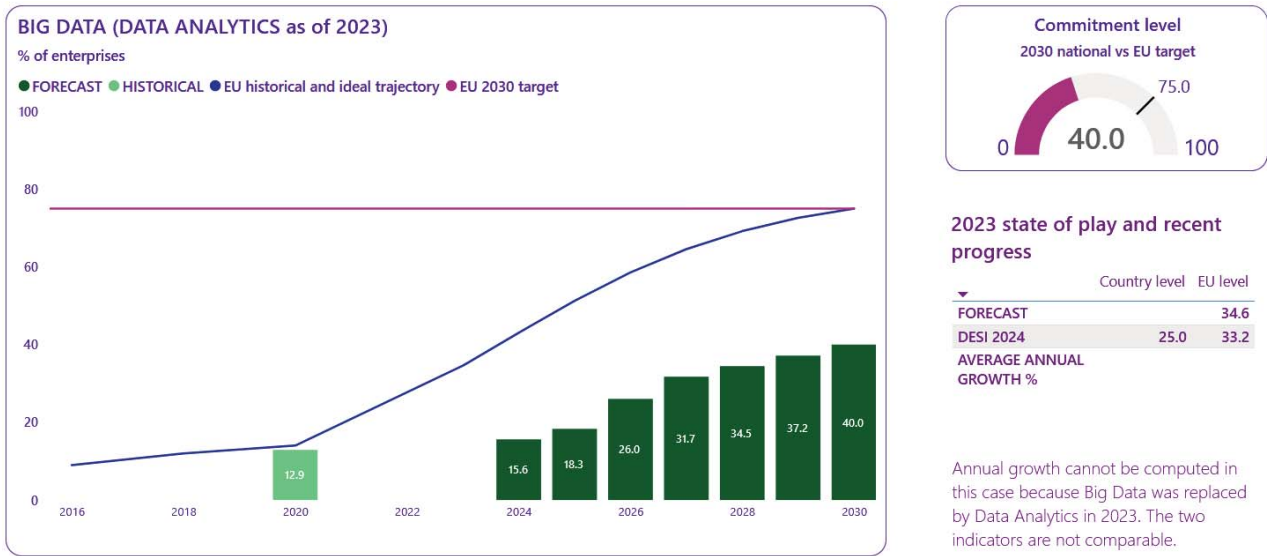
Note 2: The source of national forecast values is the 2023 country roadmap

Greece has scope to improve its performance to contribute to the EU's Digital Decade target on digitalisation of SMEs while showing a very strong dynamic. In 2023, with 43.3% of SMEs having at least a basic level of digital intensity, Greece performs below the EU average (57.7%). Nevertheless, it recorded an average annual growth of 7.2% since 2021, the last comparable year in terms of methodology for measuring the basic level of digital intensity of SMEs. This is more than two and a half times the average annual growth rate in the EU (2.6%), which demonstrates an upward trend.

In its roadmap, Greece aims to reach 79.7% of SMEs with at least a basic level of digital intensity by 2030 below the EU target (of 90%). Based on the current situation and recent average annual growth although the national target would not represent a significant contribution to the EU target 2030, it can be explained by the structural and economic challenges faced by enterprises in Greece.

In 2023, Greece continued to implement the main programme for digital transformation of SMEs under the RRF. The goal is to increase the digital maturity of the country's small and medium enterprises (SMEs), by modernising their production, commercial and administrative functions, and supporting them in the purchase and use of digital products and services.

In the private sector, the Hellenic Federation of Enterprises (SEV) is very active in supporting enterprises in all sectors and all sizes in their digital transformation. The SEV offers its members schemes to develop a digital mindset and help Greek enterprises integrate digital tools and new technologies into their operation and management processes. The SEV works with the public authorities to provide feed-back on the needs and challenges faced by enterprises in order to design instruments adapted to the different level of digital maturity of enterprises.

Greece has also become attractive for investment and initiatives from very big international tech companies, and this will contribute to the digital transformation of the economy. In 2023, a project was announced to transform the Elefsina shipyard into Greece's first smart shipyard.
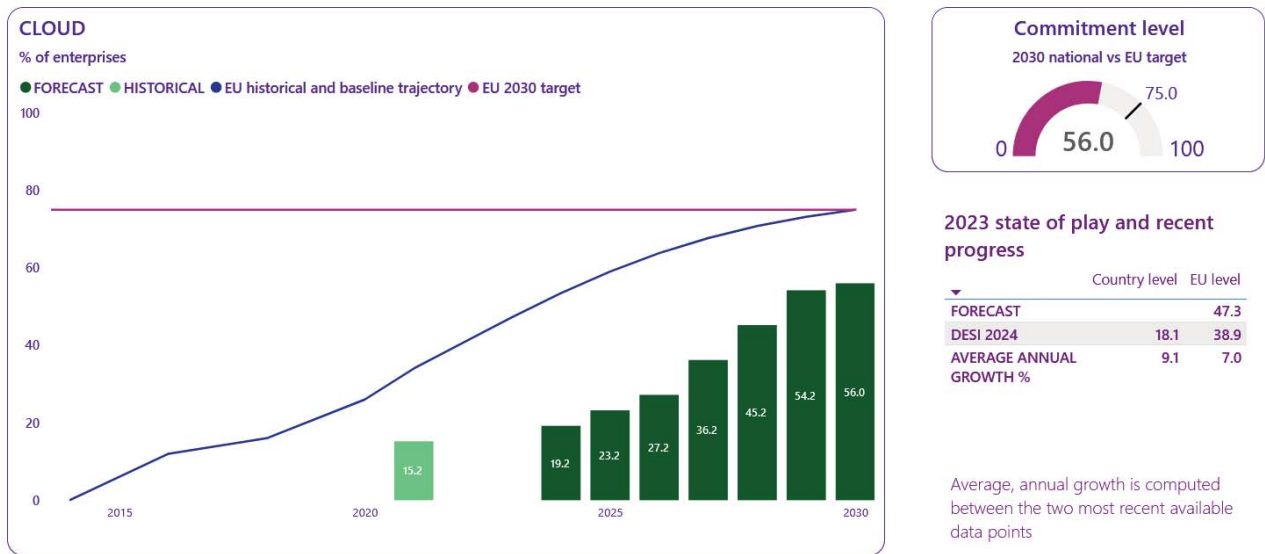
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2.2.b Take up of cloud / data analytics / AI

- **Cloud**

CLOUD

% of enterprises

● FORECAST ● HISTORICAL ● EU historical and baseline trajectory ● EU 2030 target

Values shown in chart: 15.2, 19.2, 23.2, 27.2, 36.2, 45.2, 54.2, 56.0

Commitment level

2030 national vs EU target

75.0

0   56.0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST		47.3
DESI 2024	18.1	38.9
AVERAGE ANNUAL GROWTH %	9.1	7.0

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Greece has scope to improve its performance to contribute to the EU's Digital Decade target while showing a positive dynamic. The take-up of cloud services by enterprises in Greece progressed in 2023 to reach 18.1%, showing an annual progress growth of 9.1%.

Greece's national target 2030 is to have 56% of enterprises having adopted cloud services, being less ambitious than the EU 2030 target of 75%. This is linked to the current point, far below the EU average of 38.9%. In absence of intensification of efforts in the coming years, Greece's contribution to the EU target will remain limited.

Greece's roadmap does not refer to specific measures to foster the adoption of cloud. However, it plans broad measures to support the digital transition of SMEs, as well as measures for digitisation of the manufacturing which include advanced digital technologies such as AI, cloud, and data analytics.

- **Data analytics (Big data)[57]**

BIG DATA (DATA ANALYTICS as of 2023)
% of enterprises
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Commitment level
2030 national vs EU target
75.0
0   40.0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST		34.6
DESI 2024	25.0	33.2
AVERAGE ANNUAL GROWTH %		

Annual growth cannot be computed in this case because Big Data was replaced by Data Analytics in 2023. The two indicators are not comparable.

Note: The source of national forecast values is the 2023 country roadmap

Regarding the use of data analytics by enterprises, Greece has scope to improve its performance to contribute to the EU's Digital Decade target while showing a very strong dynamic. In 2023, 25% of enterprises in Greece reported using data analytics, below the EU average (33.2%). Progress cannot be assessed as the indicator definition evolved since the previous data collection in 2020.

Greece's roadmap sets the national target for 2030 at 40% of enterprises using data analytics, which is below the EU 2030 target (75%).

Greece's roadmap does not refer to specific measures to foster the use of data analytics by enterprises, but the broad measures to support the digital transition of SMEs and the digital transition of manufacturing enterprises described above include advanced digital technologies such as AI, cloud, data analytics. Greece also plans to develop a national data strategy, under an RRP measure, which will contribute to promoting the use of data analytics by enterprises.

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[57] As of 2023, Eurostat changed the Big Data into a Data Analytics indicator, thus disabling comparison with previous years.

- **Artificial Intelligence (AI)**

Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

Note 2: The source of national forecast values is the 2023 country roadmap

Greece has scope to improve its performance to contribute to the EU's Digital Decade target while showing a very strong dynamic. The take-up of AI by enterprises in Greece progressed in 2023 to reach 4% (an annual growth of 24%).

Greece sets the national target for 2030 at 32% of enterprises adopting AI, far below the EU 2030 target of 75%. The low level of ambition on this target for 2030 reflects the current situation which is half the EU average (8% of enterprises adopting AI). The overall low level of digital maturity of enterprises hinders the adoption of advanced technologies. A lack of understanding on how AI could have a positive impact on business operations by SMEs is another barrier to adoption.

In its roadmap, Greece does not refer to specific measures to foster the adoption of AI by enterprises. However, broad measures to support the digital transition of SMEs and the digital transition of manufacturing enterprises as described above include advanced digital technologies such as AI, cloud and data analytics.

In October 2023, in response to the emergence of generative AI, Greece set up a High-Level Advisory Committee for Artificial Intelligence (AI) under the Prime Minister. This Committee aims to prepare Greece for the diverse applications of this technology while ensuring the country's active participation and resilience: adapting and thriving alongside AI advancements, boosting competitiveness, leveraging AI to gain a competitive edge, sustainable development and prosperity, and utilising AI responsibly to achieve long-term growth that benefits all.

The Committee will provide data-driven recommendations for the national AI strategy, focusing on key areas critical to Greece's success: fostering innovation, improving productivity and creating quality jobs, strengthening infrastructure, addressing climate challenges and promoting social cohesion, securing national digital sovereignty, ensuring control over digital resources and efficient government operation, shaping a global role by identifying Greece's strengths in AI and contributing to international discussions on ethical and regulatory frameworks.

In this context, the national strategy for AI has been temporarily put on hold, to adapt it to new challenges emerging from generative AI. However, the AI Observatory[58] established within the Ministry of Digital Governance is currently in preparation. The aim is to collect data on the national AI strategy's implementation, report on Greek AI activities, and assist stakeholders in setting priorities and finding growth opportunities, develop Key Performance Indicators (KPIs) and also track the impact of AI on individual rights. It will receive the support of the operational programme 'Digital Transformation' under the National Strategic Reference Framework (NSRF) 2021-2027.

- **Take-up by enterprises of cloud or AI or data analytics**

Greece scores at 33.5% on this indicator, measuring the adoption of either AI, cloud or data analytics, which is significantly below the EU average (54.6%). It reflects the current low rate of adoption of these three technologies, as mentioned above and spotted in Greece's roadmap.

2.2.c Unicorns, scale-ups and start-ups

In 2023, Greece had three unicorns[59]. To align with the EU's Digital Decade target of doubling the number of unicorns, Greece's ambition is to create 20 unicorns in the country by 2030.

Greece's start-up ecosystem is making significant progress. The platform Elevate Greece brings together over 820 start-ups[60] (100 more than last year). Created by the Ministry of Development and Investment in 2020, Elevate Greece operates as a national registry of start-ups to monitor progress and provide support to the national start-ups. The objective is to have over 1 000 start-ups registered by the end of 2025. The platform also serves as a dashboard of metrics to inform potential investors from Greece and abroad.

In 2023, according to the 'Startups in Greece, Venture Financing report 2023-2024', **13 Greek venture capital funds totalled EUR 545 million** (assets under current management), primarily concentrating on start-ups. In 2023, those funds invested in 62 start-ups (or 85% of all deals made). In addition, there is growing interest from international investors. In 2023, 33% of the venture capital funds taking part in investment rounds were American. Angel investors also participated in 42% of investments rounds. The top three sectors for investment in Greece in 2023 were RetailTech, Artificial Intelligence (AI), and AgriTech, in line with global trends.

2.3 Strengthening cybersecurity & resilience

National cybersecurity policy is becoming more prevalent in Greece. Since companies rely increasingly on digital technologies, the risk of exposure to cybersecurity incidents is growing, highlighting the need for better preparedness. In 2022, 5.6% of enterprises in Greece reported ICT service outage due to cyberattacks (e.g., ransomware, denial of service attacks), which is above the EU average (3.5%). Enterprises in Greece appear to be less prepared than their EU counterparts as only 14.2% of enterprises reported being insured against ICT security incidents, while the EU average was 25% in 2022.

On 14 February 2024, a new National Cybersecurity Authority (NCSA)[61] was established as a separate public law body under the auspices of the Ministry of Digital Governance. This Authority serves as the single point of contact under the NIS Directive (the Directive on network and information systems). It is

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[58] Law 4961/2022
[59] Source: Dealroom (date of extraction 29/01/2024)
[60] On 01/04/2024
[61] Law 5086/2024

responsible for ensuring the correct application and, where necessary, the enforcement of the rules outlined in this Directive at national level. Additionally, the NCSA is currently assigned as the National Cybersecurity Certification Authority and appointed as the National Coordination Center under the European Cybersecurity Competence Center's (ECCC) framework.

The creation of the NCSA is a critical component of the national cybersecurity strategy aimed at enhancing the cyber resilience of national critical infrastructure and public administration. This initiative marks significant reforms and investments supported by the Digital Europe Programme, under the National Cybersecurity Strategy 2020-2025. As part of this effort, the Authority coordinates co-funded projects currently under development and most notably the Consolidated SOC (EL-SOC), which will serve as a hub for sectoral and other SOCs on a national basis. Additionally, the NCSA is participating in the development of a cross-border SOC platform with other EU-Member States. Also monitors the overall level of cyber security in the country and prevents, protects, coordinates and contributes to countering threats and cyber-attacks, as well as managing security incidents, including by operating the EL-SOC, the National SOC Network and the Incident Response Team in cyberspace (CSIRT).

The NCSA is also spearheading an initiative with other member state authorities to establish a European Digital Infrastructure Consortium (EDIC) to support the implementation of the **Cybersecurity Skills Academy** policy framework, as outlined in the Communication of the Commission 'Closing the cybersecurity talent gap to boost the EU's competitiveness, growth and resilience'[62].

In terms of research and innovation, several of the seven EDIH set up in Greece provide services and technologies related to cybersecurity solutions in various policy domains (healthcare, energy, and environment).

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[62] COM(2023) 207 final, 18.4.2023

3 Protecting and empowering EU people and society

3.1 Empowering people and bringing the digital transformation closer to their needs

The digital transformation of public services and administration at the core of Greece's digital transformation strategy shows significant progress, but also requires that people have the level of digital skills needed to benefit from the services. Although Greece has already taken action to develop the digital skills of the population, it has not yet yielded results, as 52.4% of the population in Greece (age 16-74) had at least basic digital skills. The number of ICT specialists in terms of the share of employment is also very low (2.4%).

3.1.1 Equipping people with digital skills
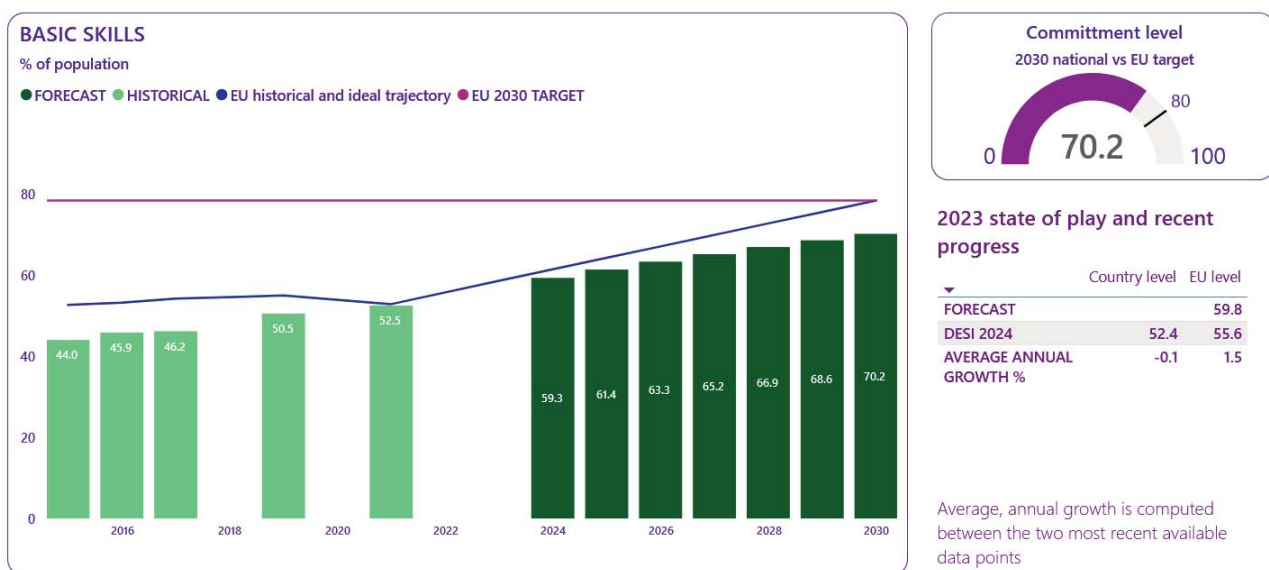
3.1.1.a Basic digital skills

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Greece has untapped potential to contribute to the EU's Digital Decade target on basic digital skills, demonstrating a limited dynamic. In 2023, 52.4% of the population in Greece (age 16-74) had at least basic digital skills below the EU average (55.6%), showing no progress since 2021, the last year of data collection (52.5%).

In its roadmap, Greece set a target for 70.2% of the population to have at least basic digital skills by 2030, below the EU target of 80%. The roadmap sets out a substantial number of measures to develop the digital skills of the population. Since most started less than 2 years ago, it is too soon, to measure their impact.

In 2023, Greece launched several initiatives to train the population. It launched a five-step learning path, hosted on the Greek digital skills and jobs platform, leading to the development of basic digital skills, under the programme 'Digital citizen learning sequence'. It created 'Community of Good Practice for Digital Skills' to exchange know-how and good practices in view of strengthening the ecosystem of digital skills training in Greece. Greece is also working on the development of a National Digital Competency Framework and certification system based on DigComp 2.2.

In the framework of the digital transformation of the education system, Greece launched a project for teacher' training schemes in 2023. The plan is to train 120 000 teachers over the period 2023-2025.

The project 'Digital skills for conscripts', funded by the RRP started preparatory work in September 2023. It aims to support conscripts in developing the digital skills needed to effectively use the technology embedded in the armed forces and to boost their digital skills to enter the job market after military service.

Private sector initiatives launched by big digital enterprises present in Greece are also contributing to this goal, by providing training courses in digital technologies for all groups of the population.

3.1.1.b ICT specialists
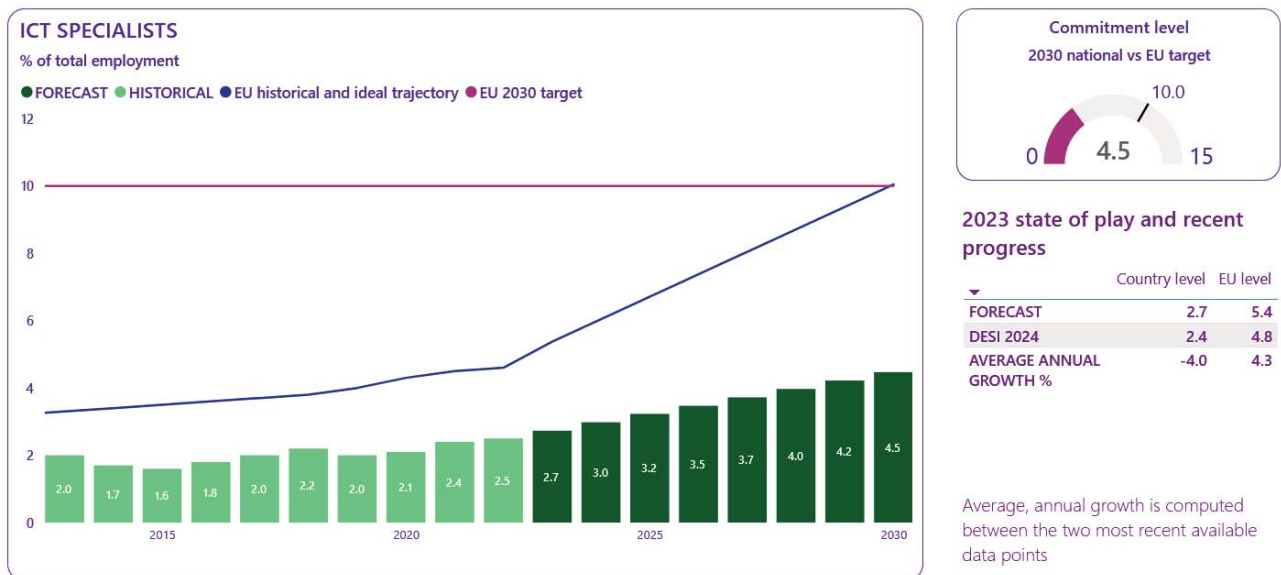
Note: The source of national forecast values is the 2023 country roadmap

Greece has scope to improve its performance to contribute to the EU's Digital Decade target and the indicator demonstrate a very limited dynamic. The number of ICT specialists in Greece in terms of the share of employment is 2.4%, far below the EU average of 4.8%, showing no progress since 2022 (2.5%). In terms of gender balance, 19.8% of ICT specialists are women, above the EU average (19.4%).

In its national roadmap, Greece set a target of 4.5% of ICT specialists in total employment by 2030. The national target is below the EU target of 10%. On the basis of past data and the current result, unless Greece steps up its action in this front over the coming years, it will continue to make a limited contribution to this EU target.

In a recent Flash Eurobarometer, 'European Year of skills: skills shortage, recruitment strategies in SMEs', responses to the question 'to what extent are the following skills becoming more or less important for your company', in the majority of the Member States, indicate that digital skills (i.e., the skills required for adopting and/or using digital technologies) are becoming 'somewhat' or 'much more important'. 81% of respondents in Greece share this view. SMEs in Greece are also the most likely to 'strongly agree' or 'somewhat agree' that skills shortages hold their company back from adopting and/or using digital technologies (67%).

In this context, the programme for upskilling and reskilling workers launched in Greece by the Public Employment Service (DYPA) at the end of 2022, with RRF support, will benefit enterprises trying to recruit

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ICT specialists. The aim of the programme is to upgrade the knowledge, skills and abilities of private-sector employees to meet the modern trends in skills for the workplace and to improve both the productivity of beneficiary employees and their prospects for job retention. The DYPA is also cooperating with the OECD in view of developing a Hellenic quality assurance system for non-formal learning.

Measures dedicated to promoting ICT training and careers for women are also planned in Greece. In 2023, the region of Central Greece participated in the European project 'FEMINA'. The project implemented an educational seminar for women (employees, entrepreneurs and prospective entrepreneurs) in science, technology, engineering and mathematics (STEM). The seminar cover topics such as: (i) design, development and deployment of green ICT; (ii) use of e-commerce platforms; (iii) mobile application development tools and practices; (iv) marketing and digital communication skills.

3.1.2 Key digital public services and solutions – trusted, user-friendly and accessible to all

3.1.2.a eID

Greece has not yet notified the European Commission of an electronic identification scheme under the eIDAS Regulation. However, it is constantly upgrading the number of services available on the Gov.gr Wallet application, available since 2022, for Greek citizens.

In 2023, Greece started issuing a new type of national identity card for Greek citizens. It creates the basis for rolling out the national eID scheme. Currently, Greece has developed the eIDAS node, and already tested the connections with 17 countries in the testing environment as well as 14 countries in the production environment. It also launched the 'Know Your Customer' (KYC) service. This service offers a digital alternative to producing documents for banks in order to verify personal or professional details under the Anti-Money Laundering Regulation.

Greece is active in the POTENTIAL**,** EWC **and** DC4EU **consortia leading large-scale pilot projects to test the European Digital Identity Wallet launched in 2023.** Several Greek public and private entities participate in more than six-use cases such as financial account opening, mobile driving licence, remote qualified signatures, and e-prescriptions. Entities also work on projects related to digital travel credentials, educational and professional qualifications and the European health insurance card.

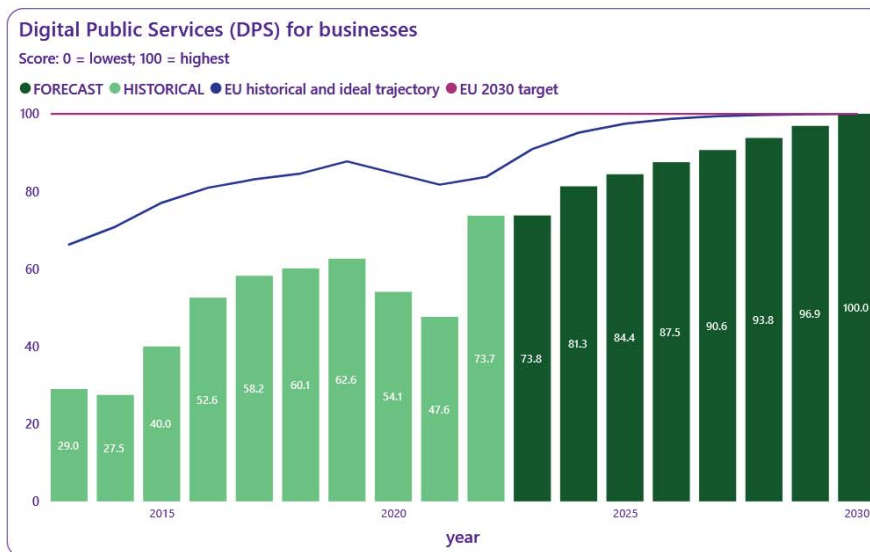## 3.1.2.b Digitalisation of public services for citizens and businesses

Digital Public Services (DPS) for citizens
Score: 0 = lowest; 100 = highest
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Historical values: 25.3, 30.5, 34.9, 41.1, 61.3, 62.4, 63.4, 53.9, 52.4, 64.6
Forecast values: 64.6, 71.8, 76.2, 80.6, 85.0, 89.4, 93.8, 98.2

Commitment level
2030 national vs EU target
0 — 98.2 — 100
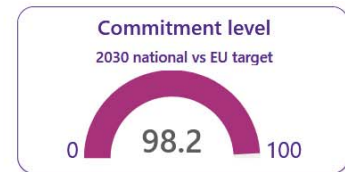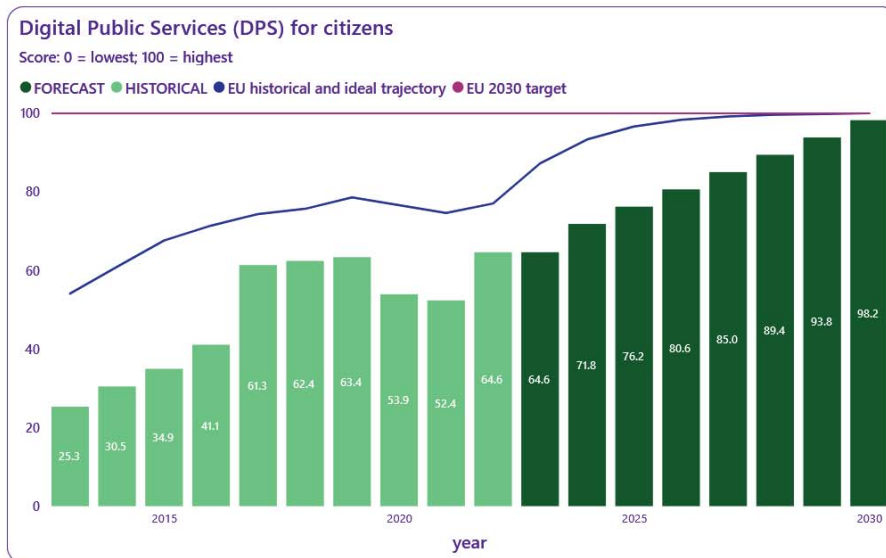
2023 state of play and recent progress

	Country level	EU level
FORECAST	64.6	87.2
DESI 2024	75.9	79.4
AVERAGE ANNUAL GROWTH %	17.5	3.1

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Digital Public Services (DPS) for businesses
Score: 0 = lowest; 100 = highest
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Historical values: 29.0, 27.5, 40.0, 52.6, 58.2, 60.1, 62.6, 54.1, 47.6, 73.7
Forecast values: 73.8, 81.3, 84.4, 87.5, 90.6, 93.8, 96.9, 100.0

Commitment level
2030 national vs EU target
0 — 100.0 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	73.8	90.9
DESI 2024	86.2	85.4
AVERAGE ANNUAL GROWTH %	17.0	2.0

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

On digital public services for citizens, Greece has untapped potential to contribute to the EU Digital Decade target, while demonstrating a very strong dynamic. With a score of 75.9 Greece performs below the EU average (79.4), but records a recent annual growth of 17.5%, while the EU average growth is 3.1%.

On the digital public services for businesses, Greece brings a positive contribution to the EU's Digital Decade target and demonstrates a very strong dynamic. With a score of 86.2, Greece performs above the EU average (85.4), presenting a recent annual growth of 17.0%, while the EU average growth is 2.0%. Other indicators of the digitalisation of public services confirm the progress made since last year. Its score on the mobile friendliness indicator is 98.3, up 13.7 points since the previous year (84.6), and above the EU average (95.3). On the availability of user support, Greece scores 85.2, slightly below the EU average (86.2),

but up 11.1 points compared to last year (74.1). On the indicator on prefilled forms, Greece scores 79.0, above the EU average (70.8), and up 24.7 points since the previous year.

In its roadmap Greece set targets for both public services for citizens and businesses at 100, in line with the EU target for 2030. Given the current positive results, which surpassed the forecast made in both trajectories for the year 2023, and assuming Greece will maintain the ongoing action, it seems to be on track to reach both targets by 2030. Beyond that, the digital transformation of the public administration will continue to be implemented by major programmes under the RRP, such as the digitalisation of the archives, interoperability of systems, etc.).

Greece has considerably improved the provision of digital public services to people and business since 2021 by bringing and developing the Gov.gr **portal**. Every year additional services for people and businesses are put online, from all parts of the public administration. In 2023, the new services available on Gov.gr include a file for consumer complaints, the National Broadband Map, the certificate of family's status, vehicle registration and enrolment in VET schools. This is possible only with increasing interoperability between systems and data, and with interoperability in the design of public services. A measure funded by the RFF has started to develop a comprehensive framework and roadmap for the interconnection and interoperability of registries and services for data exchange between national public organisations, in line with the new European Interoperability Framework (EIF).

The upward trend observed for digital public services is also because the availability of cross-border services on Gov.gr improved considerably. In 2023, a digital assistant chatbot mAIgov was launched on Gov.gr. It uses artificial intelligence technologies to facilitate interactions with the administration. People can communicate with the digital assistant mAIgov in the 24 official languages of the European Union and in Albanian, to be informed about services and administrative procedures.

In 2023, Greece started implementing the project 'Open data and enhancing inclusiveness'. Funded by the RRF, the aim of the project is to strengthen open governance through a consultation mechanism and to support implementation of Law 4727/2020 on open data. Developing digital tools to support open government enhances the building of effective democratic institutions and enables inclusive citizen participation.

3.1.2.c e-Health
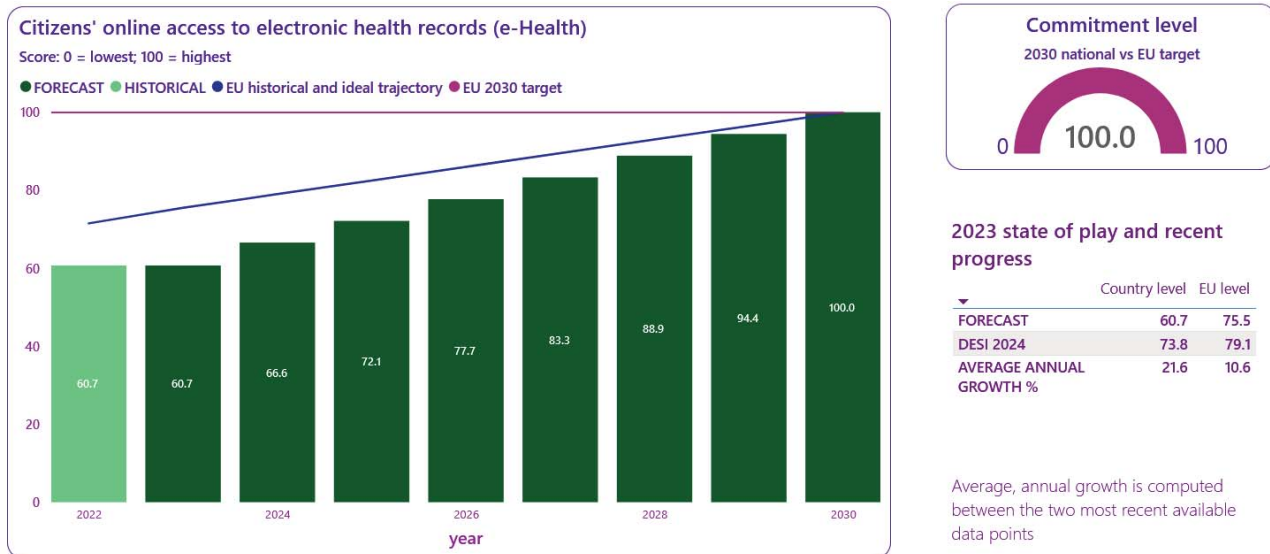
Note: The source of national forecast values is the 2023 country roadmap

Greece has untapped potential to contribute to the EU Digital Decade target on e-health, while showing a very strong dynamic. With a score of 73.8 in 2023, Greece is below the EU average of 79.1, but it shows a remarkable annual growth rate (21.6%) much higher than the EU average annual growth (10.6%).

In its national roadmap, Greece set a target for e-health at 100, in line with the EU target 2030. The trajectory shows that Greece surpassed its national yearly forecast set at 60.7 for 2023.

The digital transformation of the health sector is one of the priorities in Greece's digital transformation strategy to optimise healthcare quality and patient safety. Greece's roadmap sets out measures to be implemented with support from the RRF. The measures are currently on going.

Since 2023, all citizens can access their electronic medical records using a mobile application myHealth. This application provides modern health services to people in Greece and at the same time reduces bureaucracy, ensures transparency, and lays the foundations to develop new health and social security digital services.

Greece is also active on a cross-border project on 'roaming' for health services. In June 2023, the e-government Center for Social Security (IDIKA), the national contact point for e-health successfully completed the 'end2end' test for cross-border services of electronic prescriptions and patient summary exchange. The trials were carried out with two Member States, Spain for the exchange of the patient summary and with Poland for the electronic prescription of medicines. During the trials, Greek prescriptions registered in the Greek Electronic Prescribing System were executed by a Polish pharmacist and Polish prescriptions by a Greek pharmacist. IDIKA, in collaboration with the Ministry of Health, also completed the design and implementation of the National Registry of Patients with Spinal Muscular Atrophy, as well as the HIV Infection Information System.

The 'Health Hub', an EDIH, was set up in 2023 in Thessaly for 'Healthcare & Pharmaceutical Industry Transformation through Artificial Intelligence Digital Services'. The Hub will be a reference point for digital health at regional, national and European level. It will provide digital transformation services to SMEs and

public administrations of the health and pharma sector and supports them in boosting their outreach, precision, innovation capacity, and networking efforts.

3.2 Building a safe and human-centric digital environment and preserving our democracy

Greece has recently taken a series of actions to build a safe and human-centric digital environment which are directly related to the Declaration of digital rights and principles. The Digital Transformation Bible adopts all the principles set out in the Declaration: putting people at the centre of the reforms, ensuring transparency and a (re-)design of digital services to democratise access, promoting the provision of digital public services through a multitude of channels. Law (4961/2022) on emerging technologies also provides the framework for the ethical development of AI, rules on data and network security, and on the just and transparent utilisation of advanced technologies.

On the inclusion and accessibility of digital services, in 2023, the Ministry of Digital governance published the first edition of the Digital Accessibility Guide for websites and mobile applications of the Greek public administration. The draft went to public consultation and received feedback from both Greece's National Accessibility Authority and the National Confederation of Disabled People (NCDP). It reflects the initial work carried out by the Greek Public Administration to create a comprehensive, organised, and concise manual on digital accessibility in Greek. This was accompanied by work to update and expand the training programme 'Websites and Mobile Apps Accessibility' for civil servants, with several modules presenting the accessibility goals and projects outlined in the Digital Transformation Bible (Greece's current national digital strategy). The training course also covered the National Action Plan for Disabled Persons and the current European Standard and the Web Content Accessibility Guidelines (WCAG).

In 2023, Greece took measures to reinforce privacy and safety online by signing a Memorandum of Agreement between the Hellenic Data Protection Authority and the Law School of the National and Kapodistrian University of Athens to cooperate on training, research, and scientific activities on personal data protection law. It signed another Memorandum of Agreement between the Hellenic Data Protection Authority and the National Transparency Authority in 2023 to exchange information and know-how for the benefit of people and the economy, while safeguarding the freedoms and rights of the individual and in particular data protection.

In line with the objective to promote a responsible and human-centric AI systems, Greece published, in 2023, a first empirical strategic foresight research on the use of Generative Artificial Intelligence. Conducted by the Special Secretariat of Foresight with the National Centre for Social Research (EKKE) and the NCSR Demokritos, it presents four scenarios for possible alternative future images of generative AI in Greece by 2030. The legal basis for further developing its policy is Greece's Law (4961/2022) on emerging information technology and communications, strengthening digital governance and other provisions, adopted in 2022. The Law includes the following provision: 'create the adequate institutional framework for the legitimate and safe utilisation of the possibilities of artificial intelligence technology by public bodies and to strengthen the resilience of public administration against cyber threats'.

In line with the objective of the Digital Decade to strengthen the rights and protection of users online, Greece adopted the law for the transposition and implementation of the Digital Services Act (DSA) on 3 April 2024. The Hellenic Telecommunications & Post Commission (EETT) becomes the National Digital Services Coordinator, responsible for supervising and checking compliance with the rules in the Digital Services Act in Greece. This is an important step since, in 2023, according to Eurostat, 25.7% of people in

Greece who used the internet in the last 3 months had been exposed to messages online considered hostile or degrading to groups of people or individuals. The EU average is 33.5%.

Best practice: the third e-age: digital empowerment of the older population

The aim of the project: 'Third e-age: Digital Empowerment of people aged 60+', launched by the National Academy for Digital Skills is to tailor individual training and customised support to the older population provided by Digital Assistants-Trainers, with the goal of enabling participants to perform basic digital tasks.

The older people participating in the project get the opportunity to explore how to use their personal ICT equipment, create and exchange information and data, learn to request and receive digital services and be empowered to communicate online and share with their loved ones with a basic level of security and a fair amount of digital citizenship.

The initiative is inspired by the social ambition to reach out, motivate and provide digital literacy services to the older population drawing on the local government network. The sessions are held in selected civic amenity sites, open care centres for older people, and in 'Digital Corners', in areas that are fabric of daily life to foster social membership. In this context, integrating ICT equipment in the daily activities with the guidance of Digital Assistants-Trainers transforms the upskilling sessions into a vibrant experience to help people develop new habits. The Digital Assistants-Trainers play an important role in the success of the initiative by creating customised learning and support tailored to the age and the wide variety of backgrounds in the group.

As regards participation and inclusion, the initiative has been welcomed by the older population in rural areas without any gender, education, or occupation disparities. Over 1 400 beneficiaries with an average age of 71.5 years, have participated in over 7 000 digital skills development sessions. The demographics breakdown shows that the majority of participants were women (71.6%), retired (88.7%) and between 55-80 years of age (91%).

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4 Leveraging digital transformation for a smart greening

Greece's national roadmap mentions some green transition measures related to the broad objective under the Digital Decade of having more sustainable, energy- and resource-efficient digital infrastructures and technologies of ensuring coherence and coordination when implementing measures for the twin transitions. These are additional to the measures related to establishing a sovereign cloud, edge nodes and 5G infrastructures. Greece's national energy and climate plan and the RRP also plan measures for which digital technologies will be a smart agent that triggers the green transition.

In the RePowerEU chapter of the RRP, a reform of the regulatory framework for smart grids is expected to accelerate implementation of smart and digital technologies in the electricity distribution network in Greece. In addition, investments to roll out the installation and use of electricity smart meters are expected to boost the efficiency of electricity distribution and the future expansion of renewable energy.

In 2023, Greece passed a new piece of legislation on data centres[63] establishing a framework of the operation of the data centres including a provision on energy regulations. Greece also supports the European Code of Conduct for energy efficiency in data centres and the subsequent environmental, economic and energy supply security impacts they create. In general, the projects supported by the Ministry of Digital Governance provide recommendations on implementing Energy Efficient Systems.

Last year, Greece also launched a programme on the 'Green transformation of SMEs', supported by cohesion funds, to encourage investment projects. The aim of the projects is to develop and use modern technologies to upgrade their products, services and process in terms of energy upgrading, circular economy and adoption of clean energy sources.

Six Greek cities have been selected in the framework of the EU Mission for 100 Climate Neutral and Smart cities **in the fields of energy, transport and urban areas**. All cities will develop a Climate City Contract to plan and implement concrete actions based on innovation and experimentation to reach climate neutrality by 2030. In 2023, the Ministry of Environment created a larger network of green cities including 85 Greek cities to help the country achieve climate neutrality.

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[63] Law 5069/2023 (A'193)

Annex I – National roadmap analysis

> ## Greece's national Digital Decade strategic roadmap
>
> **Greece's national strategic roadmap, submitted to the Commission at the end of November 2023, is mostly complete. It sets out 14 national trajectories and targets to reach by 2030**. The national targets set for connectivity, digital transformation of public services and e-health match the EU 2030 targets, but the targets for digital skills and for digital transformation of businesses are set below the EU 2030 targets. Greece's national strategic roadmap for the Digital Decade has been published https://digitalstrategy.gov.gr/en/sectors/digital-decade. Consultations of stakeholders, public and private sector, on the different targets and objectives took place during the process of drafting the roadmap. Greece also consulted partners on the Executive Network of Digital Transformation set up in 2022 to consolidate the whole-government approach taken in the country's digital transformation strategy.
>
> The below table reflects a best-effort attempt at categorising the measures and budget set out in Greece's national roadmap.
>
> | Digital Decade Target/objective | Budget (EUR Million) | Number of measures |
> | --- | --- | --- |
> | Connectivity Gigabit | 400.0 | 3 |
> | Connectivity 5G | - | 0 |
> | Semiconductors | 27.3 | 4 |
> | Edge nodes | 2.4 | 4 |
> | Quantum computing | 48.9 | 7 |
> | SME take up | 532.0 | 6 |
> | Cloud/AI/Big Data uptake | 1 744.5 | 11 |
> | Cloud only uptake | 145.0 | 1 |
> | AI only uptake | - | - |
> | Big data uptake | - | - |
> | Unicorns | 394.9 | 4 |
> | Basic Digital Skills | 512.3 | 14 |
> | ICT Specialists | 168.4 | 8 |
> | eID | 119.1 | 5 |
> | Key Public Services | 741.1 | 13 |
> | e-Health | 394.8 | 5 |
> | Objectives | 0.0 | 19 |
> | **Total** | **5 230.2** | **104** |
>
> Greece's roadmap encompasses a detailed analysis of the current state of play, and a comprehensive set of measures and initiatives designed to meet the targets and the objectives of the Digital Decade to transform the country into a digitally advanced and inclusive society by 2030. The roadmap is built on Greece's digital transformation strategy, the Digital Transformation Bible 2020-2025. Funding of the digital transformation relies heavily on EU funds (RRF and cohesion funds). In addition to the 104 measures for an amount of EUR 5 230.2 million, the roadmap also gives a rough estimate of private investments for the coming years in data centres and gigabit connectivity of EUR 6 900 million.
>
> In terms of overall expected impact, Greece has embraced the vision of the Digital Decade and had already taken a certain number of significant measures designed to digitally transform the country in almost all the areas covered by the Digital Decade. In recent years, there has been a noticeable acceleration of legislative,

support and investment measures and significant progress, especially in the digitalisation of key public services, where the results are already tangible. However, the measures vary in terms of performance and intensity in making a contribution to specific targets. Activities and strategy related to cutting-edge technology infrastructure, including ICT specialists, present significant weaknesses to have a transformative effect and contribute positively to Digital Decade targets and objectives. Synergies between the measures and actions in the roadmap are expected to reinforce their impact, given the limited budget available for digital transformation.

Annex II – Factsheet on multi-country projects (MCPs) and funding

MCPs and EDICs

Greece is active in 6 EDICs already set up or in the making.

Greece is a member of the Alliance for Language Technologies EDIC (ALT-EDIC) and is also member of the EUROPEUM-EDIC aiming to deploy and operate the European Blockchain Services Infrastructure (EBSI), both EDICs are already set up.

Greece is expected to be the hosting Member State of the possible future EDICs: Connected Public Administration EDIC and of the Cybersecurity Skills Academy EDIC. Greece is developing the Statute and other relevant documents of the possible future Genome EDIC, within an informal Working Group. It is also engaging in discussions on the setup of possible future Cancer Image Europe (EUCAIM) EDIC, within an informal Working Group.

Greece also participates in the IPCEI Microelectronics and communication Technology (ME/CT) and in the EU Digital Wallet consortia: POTENTIAL, EWC and DEAEU

EU funding for digital policies in Greece

EU funds support the digitalisation efforts in the Member States. Greece's Recovery and Resilience Plan allocates 22.1% (EUR 7.78 billion) of its total RRP budget to the digital transformation. According to the Joint Research Centre's study 'Mapping EU level funding instruments to Digital Decade targets', EUR 6.85 billion of Greece's RRP directly contribute to achieving the Digital Decade targets. Out of the Cohesion Policy funds received by Greece, EUR 1.7 billion is expected to contribute directly to the Digital Decade targets according to the same mapping study[64].

Greece's RRP gives a strong priority to reforms and investments related to the transformation of the public sector. It allocates 34% of the digital budget to e-government, digital public services, including digitalisation of transport, and local digital ecosystems. The digitalisation of businesses, in particular SMEs, is the second priority with 25% of the digital budget. Investments to develop the digital skills of the population represent 10% of the budget. In December 2023, the third payment was disbursed for an amount EUR 3.64 billion (EUR 1.69 billion in non-repayable financial support and EUR 1.95 billion in loans) covering 39 milestones and 4 targets. So far about 41% of the total funds have been disbursed.

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[64] Based on an estimation of the possible contribution to the Digital Decade (Joint Research Centre report 'Mapping EU level funding instruments to Digital Decade targets - 2024 update' (Signorelli et al., 2024).

State of the Digital Decade 2024

Hungary

1 Executive summary

Hungary has untapped potential to contribute to the European Union's (EU) Digital Decade objectives and targets, in view of a successful digitalisation that fosters competitiveness, resilience, sovereignty, European values and climate action.

In 2023, Hungary made notable progress in the area of broadband connectivity, enhancing basic 5G coverage, and in digitalisation of SMEs, in particular adoption to Cloud and Data Analytics. However, particularly important **challenges** persist in the area of digital skills, especially for the older generations, and in the adoption of advanced technologies such as AI at Hungarian enterprises.

Hungary has the very ambitious and challenging objective to be among the 10 leading EU economies in terms of digitalisation by 2030. This is reflected in the National Digitalisation Strategy 2022-2030, which is aligned with the EU Digital Decade Policy Programme. Although, there have been several changes to the Hungarian institutional system responsible for implementing the Digital Decade (transformation of ministries and their background institutions in the field of ICT), the responsibility for coordinating the initiatives led by different ministries is below ministerial level, in the hand of the Digital Hungary Agency.

According to the '**Special Eurobarometer survey 'Digital Decade 2024'**[65], 83% of respondents in Hungary said that the digitalisation of daily public and private services makes their life easier. This is the second highest score in the EU and significantly above the EU average of 73%.

Hungary is involved in 3 **European Digital Infrastructure Consortia** (EDICs) already set up or in development, including the already established Alliance for Language Technologies (ALT EDIC, already set up), the Local Digital Twins towards the CitiVERSE (already set up) and the Connected Public Administration (IMPACTS-EDIC in development).

The Hungarian **Recovery and Resilience plan** allocates EUR 1.7 billion (29.1% of the total allocation) to the digital transformation[66], with priority given to e-Health and digital skills. Under Cohesion Policy, an additional EUR 2.5 billion (12% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[67].

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[65] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351

[66] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.

[67] This amount includes all investment specifically aimed at or substantially contributing to digital transformation in the 2021-2027 Cohesion Policy programming period. The source funds are the European Regional Development Fund, the Cohesion Fund, the European Social Fund Plus, and the Just Transition Fund.

Digital Decade KPI [1]	Hungary			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	HU	EU
Fixed Very High Capacity Network (VHCN) coverage	80.3%	84.1%	4.8%	78.8%	7.4%	95%	100%
Fibre to the Premises (FTTP) coverage	70.1%	76.2%	8.7%	64.0%	13.5%	X	-
Overall 5G coverage	57.9%	83.7%	44.6%	89.3%	9.8%	99%	100%
Semiconductors		NA					
Edge Nodes		5		1 186		X	10 000
SMEs with at least a basic level of digital intensity	34.5%	53.2%	24.2%	57.7%	2.6%	89%	90%
Cloud	20.6%	37.1%	34.2%	38.9%	7.0%	60%	75%
Artificial Intelligence	3.0%	3.7%	11.1%	8.0%	2.6%	24%	75%
Data analytics	NA	53.2%	NA	33.2%	NA	30%	75%
AI or Cloud or Data analytics	NA	65.6%	NA	54.6%	NA		75%
Unicorns		0		263		2	500
At least basic digital skills	49.1%	58.9%	9.5%	55.6%	1.5%	60%	80%
ICT specialists	4.1%	4.2%	2.4%	4.8%	4.3%	8.3%	~10%
eID scheme notification		No					
Digital public services for citizens	67.9	73.4	8.1%	79.4	3.1%	96.3	100
Digital public services for businesses	76.3	74.9	-1.8%	85.4	2.0%	97.2	100
Access to e-Health records	79.9	86.0	7.6%	79.1	10.6%	100	100

[1] See the methodological note for the description of the indicators and other descriptive metrics

National Digital Decade strategic roadmap

With respect to **Hungary's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating a high **ambition** however, based on this document, intends to allocate **some effort** to achieve the Digital Decade objectives and targets.

The roadmap is overall realistic and comprehensive, but rather cautious when setting targets. It sets 2030 **targets and trajectories for 12 KPIs** (VHCN, 5G, digital intensity, cloud, big data, AI, unicorns, digital skills, ICT specialists, digital public services for citizens and for businesses, and e-Health). The roadmap includes 2030 targets for all KPIs except for edge nodes. Two national targets (e-health, unicorns) fully correspond to the EU 2030 targets, while 4 national targets are very close to and overall line with the EU target (5G, digital public services for citizens and for businesses, SMEs with at least basic digital intensity). 6 targets are, however, below the EU targets (VHCN, digital skills, ICT specialists, Cloud services, data analytics and AI). In terms of measures, Hungary's roadmap, which was adopted and published in December 2023, presents a comprehensive overview of the nation's digital strategy. The total budget of measures amounts to EUR 2.4 billion (around 1.2% of GDP) with priority given to digital skills and digital infrastructure. In addition, some of the DDPP's objectives, such as those relating to the green transition, competitiveness, sovereignty, leadership, and resilience, including cybersecurity, were also reflected in the document.

Recommendations for the roadmap

Hungary should, when submitting adjustments to its national roadmap in accordance with Article 8(3) of the DDPP Decision:

- **TARGETS:** (i) Propose national target values and trajectories for **edge nodes,** and formalise the trajectory for **FTTP**; (ii) Increase the **VHCN target, to be closer to the EU's target**, given the country's good starting point and its current rate of progress; (iii) Consider more **ambitious targets for the cloud and data analytics technologies take-up by enterprises to be closer to the EU's targets**, as the current performance of these indicators are already above the targets defined in the roadmap of Hungary; (iv) Define a more **ambitious target for digital skills** closer to the EU's target, as the current national target is almost achieved according to the 2023 value.

- **MEASURES:** Provide **more information on the implementation of digital rights and principles** (and Digital Decade general objectives), including what national measures contribute to it.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' offers key insights into Hungarians' perceptions of digital rights. 60% of Hungarians believe that the EU protects their digital rights well, significantly above the EU average of 47%. While some concerns have grown, notably regarding the freedom of online association and online safety for children (both by 5 percentage points), Hungarians remain overall more confident compared to the EU average. On the positive side, a significant 70% is satisfied with the level of digital skills, and 68% appreciate aspects such as access to affordable high-speed internet or environmentally friendly online services. The monitoring of the Declaration on Digital Rights and Principles shows that increasing the profile of the Declaration at national level and fostering better stakeholder engagement could help improve outcomes in the years to come[68].

A competitive, sovereign and resilient EU based on technological leadership

To underpin its technological leadership and competitiveness, Hungary is equipped with strong digital infrastructures and is making good progress on deployment. It should, however, focus more on the digitalisation of its businesses. On infrastructures, Hungary is above the EU average for VHCN and is also very close to the EU's average for 5G. Thanks to the strategic agreements with the major telecommunication service providers, committing to coverage figures corresponding to the National Digitalisation Strategy of Hungary, the country is on track to reach the VHCN and 5G targets defined for 2030. Despite the significant increase in the take up of advanced technologies, most businesses, in particular SMEs, are not yet reaping all the benefits of these digital technologies, due to a lack of digital skills. This in turn has a negative impact on the competitiveness of the economy, however the favourable results in Data Analytics can potentially be a breakout point for the economy. Significant progress has been made in the digitisation of SMEs as a 24.2 % improvement can be seen approaching the EU average. The initiatives planned in the strategically important defence industry and cybersecurity will unfortunately not yield results in the next years.

Recommendations – Hungary should:

- **CONNECTIVITY INFRASTRUCTURE**: (i) Sustain and increase efforts to ensure full gigabit and 5G coverage, in line with the EU level of ambition. (ii) Ensure sufficient access of new players to

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[68] See SWD 'Digital Decade in 2024: Implementation and perspective' with annexes, SWD(2024)260: https://digital-strategy.ec.europa.eu/en/news-redirect/833325, Annex 4.

spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.

- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

- **SMEs:** Continue its efforts through initiating new supporting programmes and incentives- to support the digital transformation of SMEs and increase resources for existing schemes, including a focus on cloud adoption by SMEs.

- **AI/CLOUD/DATA ANALYTICS/EDGE NODES:** (i) Provide further support for capital investment in cloud computing, artificial Intelligence, data analytics, and other cutting-edge technologies; (ii) Ensure the broad uptake of the next generation of cloud infrastructure and services under development in the IPCEI-CIS by companies of all sizes, including by developing a country-specific dissemination strategy (complementing what has already been committed under IPCEI-CIS); contributing to the additional dissemination activities led by the Cloud IPCEI Exploitation Office; (iii) Consider measures specific to edge nodes deployment, supplementary to the IPCEI-CIS participation.

Protecting and empowering EU people and society

Digital skills are increasingly becoming a requirement for people seeking employment in industry and services. However, the gap is widening between routine users of digital tools and those who are not interested in taking courses to upskill, with the latter group accounting for almost half of the workforce. Although businesses have been focusing on optimising operations and retaining their talents, demand for specific ICT specialists is still huge, especially in the area of AI, Cloud and Cybersecurity. On the other hand, significant progress has been made in at least basic digital skills, showing a 9.5% increase, surpassing the EU average: 58.9% of people in HU have at least basic digital skills (EU average is 55.6%). Gaps remain significant, however, among the older generations and vulnerable groups.

Although over 70% of the Hungarian population already possesses an e-ID, its use is limited to within the country. Hungary's roadmap sets out several measures aimed at accelerating the transition to the new mobile e-ID solution, which should bring results by 2026, and which will be the key to cross-border use as well.

As regards the availability of key digital public services for citizens and businesses, Hungary remains below the EU average. On access to electronic health records, instead, Hungary is already well advanced. Its new mobile application, which provides access to Health records, has become the county's most widely used mobile digital public service. The main gaps in Hungary's eHealth maturity are the inability to authenticate with a (pre)notified e-ID and the fact that the access service does not follow guidelines on web accessibility.

Recommendations – Hungary should:

- **BASIC DIGITAL SKILLS:** Accelerate its efforts to bridge the digital divide through developing and investing in inclusion policies focusing on vulnerable groups, such as the low-skilled, the unemployed, people over 55, persons with disabilities and the Roma.

- **ICT SPECIALISTS:** (i) Keep up their high rate of ICT graduates but focus more on attracting women to the study field; (ii) Monitor closely the implementation of existing measures to boost the number of ICT specialists in the shorter term and continue measures to increase the percentage of women in ICT careers; (iii) Increase efforts to reduce the cybersecurity skills gap.

- **KEY DIGITAL PUBLIC SERVICES:** Accelerate its efforts to digitalise public services for citizens and

businesses.

- **e-ID:** Notify to the Commission an e-ID scheme under the eIDAS Regulation.
- **e-Health:** (i) Make the data type of medical images available to citizens through the online access service. (ii) Enhance the authentication method for logging in to the online access service by using a (pre)notified e-ID. (iii) Ensure that the online access service complies to web accessibility guidelines.

Leveraging digital transformation for a smart greening

The green transition and sustainability are key trends within the digitalisation in Hungary, with the increased energy prices being the main forces behind the changes. As part of the modified Recovery and Resilience Plan submitted by Hungary in 2023, several measures set out in the **REPowerEU** chapter will address the challenges related to the green transition, including the digitalisation of the electricity grids.

Recommendations – Hungary should:

- Develop a coherent approach to twinning the digital and green transitions. First, promote improvements in energy and material efficiency of digital infrastructures, in particular data centres. Second, support the development and deployment of digital solutions that reduce the carbon footprint in other sectors, such as energy, transport, buildings, and agriculture, including the uptake of such solutions by SMEs.

- Monitor and quantify the emission reductions of the deployed digital solutions in line with the relevant EU guidance and with the support of the methodology developed by the European Green Digital Coalition, in view of future policy development, as well as of attracting relevant financing.

- Support digital players, including telecom service providers, to accelerate the transition of their network infrastructure to greener, less energy intensive solutions.

2 A competitive, sovereign and resilient EU based on technological leadership

Hungary performed strongly in digital infrastructure and has made good progress in the digitalisation of enterprises. It seems that the initiatives funded by national and EU budget in the ICT sector, which is currently around 6% of the GDP, start to bring preliminary results. However, the ICT sector's share of enterprise R & D expenditure is 12.7%, the fifth lowest in Europe. Further efforts on the digitalisation of enterprises can lead to gains in productivity, lower production costs, better-quality tech-intensive goods the creation of new ICT services and improve the competitiveness of the country overall.

2.1 Building technological leadership: digital infrastructure and technologies

Hungary has been a front runner in the development of digital infrastructure since 2018. Broadband connectivity is above the EU average and 5G coverage continues to increase. Fixed Very High Capacity Network (VHCN) coverage increased to 84.1%, above the EU average of 78.8%. 5G coverage in Hungary increased to 83.7% in 2023 (up by 45% from the previous year) as a result of the roll-out of the service providers. However, it is still lower than the EU average, of 89.3%.

On market developments, there is a consolidation trend among telecom operators. Following the acquisition of Vodafone and Digi by 4iG, Hungary has three major operators competing at national level (Magyar Telekom, 4iG and Yettel) and several regional and local providers. Retail prices for electronic communication services increased. Providers passed on inflation to their customers in line with the indexation clauses set out in their retail contracts.

2.1.a Connectivity infrastructure (gigabit)

Very High Capacity Network (VHCN)
% of households
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Historical values: 42.6 (2020), 48.6, 71.8, 80.3 (2022)
Forecast values: 84.0, 86.0, 87.0 (2024), 90.0, 93.0 (2026), 94.0, 94.5 (2028), 95.0 (2030)

Commitment level
2030 national vs EU target

0 — 95.0 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	84.0	82.0
DESI 2024	84.1	78.8
AVERAGE ANNUAL GROWTH %	4.8	7.4

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Fibre To The Premises (FTTP)
% of households
● HISTORICAL ● EU historical and ideal trajectory

Commitment level
2030 national vs EU target

0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST		70.3
DESI 2024	76.2	64.0
AVERAGE ANNUAL GROWTH %	8.7	13.5

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Hungary brings a positive contribution to the EU's digital decade VHCN target and shows positive dynamic. VHCN and FTTP coverages are both above the EU average. FTTP coverage is particularly high (76.2%) compared to the EU average (64.0%). In 2023, Hungary continued to progress towards the Digital Decade connectivity targets for 2030, as coverage of fixed VHCN increased to 84.1% (4 percentage points above the previous year). The increase in coverage corresponded to a similar increase in take-up by consumers, as the share of at least 1Gbps broadband lines reached 37.2%, which is significantly higher than the EU average of 18.5% and second highest in the EU.

Hungary aims to reach 95% Gigabit coverage by 2030, according to the National Digitalisation Strategy 2022-2030 of the country, where it is expected that network coverage capable of gigabit speed to be improved by 2-3 % per year. This will be mainly due to the service providers' commitments, and where development would not be commercially viable, around 400 000 endpoints could be covered through State-funded programmes. All three major telecom operators in Hungary have already signed a strategic agreement with the government, committing to coverage figures set out in the National Digitalisation Strategy. To achieve the objectives, the government abolished the public utility tax on telecommunications service providers (effective 1 January 2024), and will phase out the extra telecommunications tax as from 1 January 2025. Based on the memorandum of understanding, telecommunications service providers have committed to use these tax savings to invest into their domestic networks.

In its roadmap, Hungary presents three measures that support the Gigabit and 5G roll-out starting in 2023 and 2024, the most significant measure continuing to 2030. One funding measure will cover areas with no available Gigabit capable network and no commercial interest to deploy. This will require funding of EUR 200 million on top of the national funding, which will come from EU Cohesion Policyfunds.

Against the backdrop of a persistent urban/rural divide in the country, reaching full coverage with Gigabit connectivity is crucial to ensure that no one is left behind. Hungary's objective to reach 95% coverage by 2030 could be increased, given the country's good starting point and its current rate of progress.

2.1.b Connectivity Infrastructure (5G)
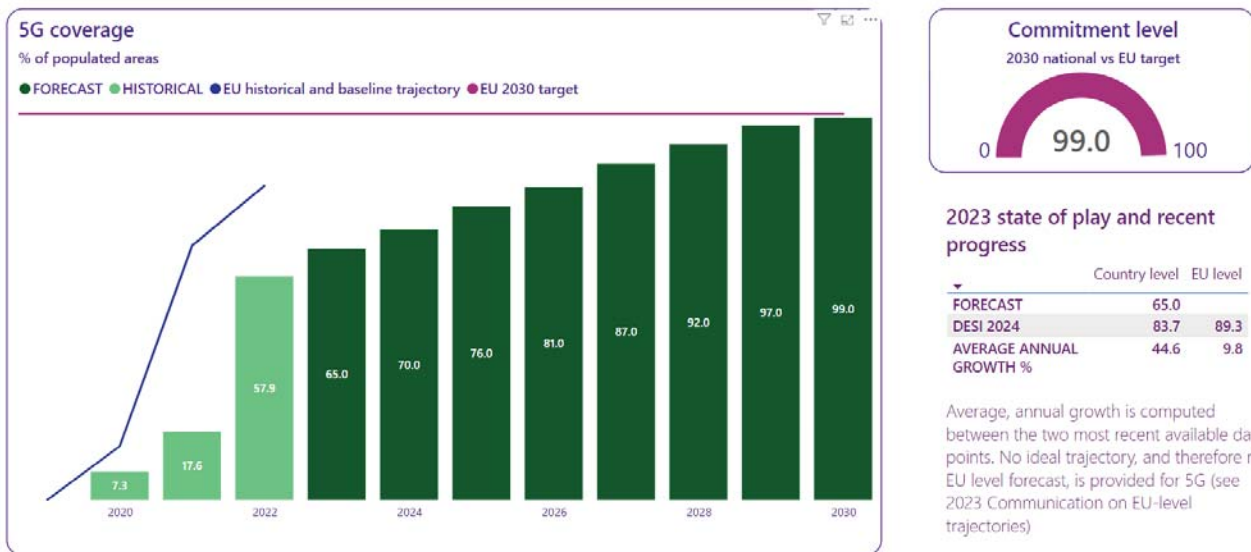
Note: The source of national forecast values is the 2023 country roadmap

Hungary has untapped potential to contribute to the EU's digital decade 5G target while showing a very strong dynamic. On 5G, Hungary has again made considerable progress in the last year. Its 5G coverage increased to 83.7% in 2023 (up by 45% from the previous year). However, it is still lower than the EU average of 89.3%. 5G in the 3.4-3.8 GHz band, an essential band for enabling advanced applications requiring large spectrum bandwidth, covers 37.7% of Hungarian households in 2023, below the EU average (50.6%).

Mobile broadband take-up is at 89.1% and is just below the EU average of 89.9%, thanks to the world-class 4G network and competition between service providers. However, the share of 5G SIM cards of population was only at 7.4% compared to the EU average of 24.6%.

The strategic agreements the Hungarian government made with key players in the telecom sector to develop the ICT sector and the domestic gigabit and 5G infrastructure will enable telecom operators to make significant private investments in the development of the domestic digital infrastructure. Magyar Telekom has announced the acceleration of 5G roll-out, which is expected to reach 99% of the population by 2026 (outdoor coverage), mainly based on the 700MHz spectrum, but also on the 3.6GHz spectrum in the capital city of Budapest and in county towns. 4iG plans to invest EUR 400 million in its mobile and wireline networks by 2028, Yettel (and CETIN Hungary) develops its digital infrastructure worth EUR 187.

Hungary completed its phase-out of 3G in 2023. The last mobile operator switched off its 3G network on 13 November 2023. In 2023, Hungary's national regulatory authority, the National Media and Infocommunications Authority (NMHH) supported the 3G sunset by facilitating the recycling of frequencies used for 3G. In addition, 120 000 people benefitted from NMHH's financial support to renew their residential devices, enabling them to use modern, digital services. NMHH also auctioned the 32 GHz band, which supports a better quality 5G service. During the procedure, the operators were able to bid for 24 duplex lots (2x28 MHz of frequencies) offered by the NMHH, of which 18 lots were awarded to Vodafone (now 4iG), Magyar Telekom and Yettel (CETIN Hungary).

2.1.c Semiconductors

Hungary plans to contribute to the development and production of the ceramic plate components for chips, to join the effort to build a sustainable and competitive chip manufacturing value chain in Europe. As Hungary has the know-how to develop and manufacture the ceramic tiles in three phases, in July 2023 the government granted EUR 2.5 million to the consortium that will carry out the project.

Regarding the country's semiconductor manufacturing, Hungary does not currently have a significant domestic industry from the front-end side. No measure has been presented by Hungary in its roadmap for semiconductors.

2.1.d Edge nodes

Hungary claims that based on the methodology provided by the European Commission, it is not yet possible to determine how many edge nodes they realistically require for sufficiently low-latency access. Targets and measures for edge nodes have therefore not yet been determined in Hungary's Roadmap.

As edge computing is a critical enabler of AI, future networks rollout, and IoT, to fully factor in the innovation that the deployment of edge nodes will bring to these areas, it would be relevant for Hungary to include edge node deployment in its roadmap and investment programmes in these areas. Hungary should take advantage of its involvement as direct partner in IPCEI-CIS to provide details on the actions being taken, with further specific projects (not directly participating in IPCEI CIS) addressing Edge infrastructures and AI Edge works.

2.1.e Quantum technologies

The EU large-scale Quantum Technologies Flagship initiative was launched under the Horizon 2020 programme and continues under Horizon Europe. Setting up pan-European quantum infrastructures under Horizon 2027 is also planned, such as the quantum internet network for quantum information (EuroQCI) and European quantum computers (EuroQCS). The country set up the Quantum Information National Laboratory (QNL) to support the participation of its R&D sector in joint R&D and innovation programmes. The QNL brings together the resources and competences of about 15 internationally recognised groups of universities and research institutes carrying out R&D in quantum technologies. The project is scheduled to run from 1 October 2020 until 30 September 2025, and has already significantly improved national competences in various quantum technologies. Examples of progress on quantum computing in 2023 include new benchmarks for quantum algorithms, the development of error correcting codes and the mastering front-line technologies for quantum bit operations exhibit the progress made in 2023. The QNL also managed to forge new international cooperations, e.g., in the form of European collaborative networks, repatriation of skilled labour and a greater focus on quantum science in higher education.
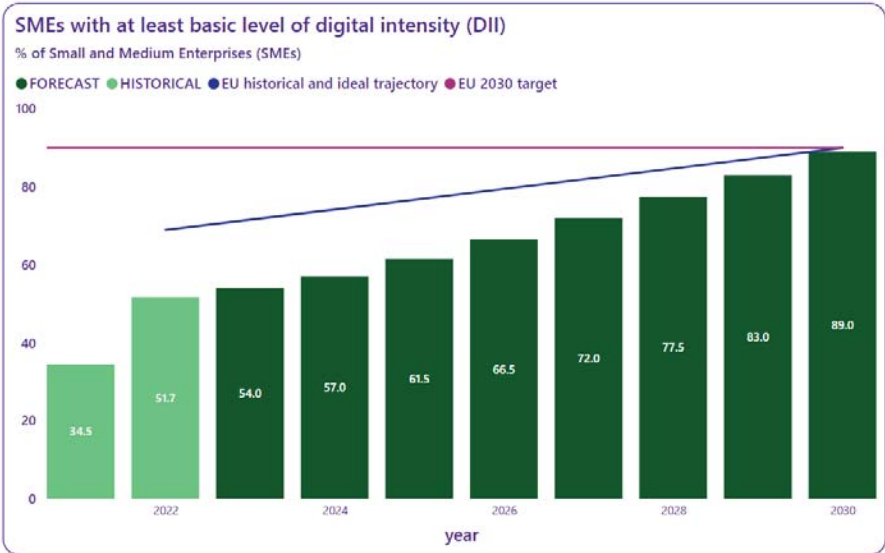
Hungary is involved in the preparation of the EuroHPC quantum computer development (EuroHPC levente tender) and national quantum communication network (QCIHungary). One measure presented in the roadmap strives to build a quantum computer by 2027, to support the Hungarian education, R&D and industrial activities. Under the Operational Programme EDIOP-3.1.5. a new supercomputer, 'Komondor' was launched in 2023. Komondor has AI and big data components which help SMEs make use of the latest digital opportunities.

Access to quantum computing technology in Hungary requires the provision of Gigabit and 100Gbps capacities among universities and research institutes, as well as active participation in EuroHPC work and national co-financing.

2.2 Supporting EU-wide digital ecosystems and scaling up innovative enterprises

The digitalisation of businesses remains a major challenge in Hungary, even though the fact that there was an improvement in several important business ICT indicators (e.g., digital intensity, cloud)**.** Despite a clear increase in the take up of advanced technologies, most businesses, in particular SMEs, are not yet taking full advantage of the opportunities offered by digital technologies. This in turn has a negative impact on the competitiveness of the economy.

2.2.a SME with at least basic digital intensity

SMEs with at least basic level of digital intensity (DII)
% of Small and Medium Enterprises (SMEs)
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

year	value
2022	34.5
2022	51.7
	54.0
2024	57.0
	61.5
2026	66.5
	72.0
2028	77.5
	83.0
2030	89.0

Note 1: DII 2022 is version IV that is not comparable with DII 2021, that was version III. The EU-level ideal trajectory refers to DII version IV, as published in the 2023 Communication on EU-level trajectories

Note 2: The source of national forecast values is the 2023 country roadmap

Commitment level
2030 national vs EU target

0 — 89.0 — 100 (90.0)

2023 state of play and recent progress

	Country level	EU level
FORECAST	54.0	71.6
DESI 2024	53.2	57.7
AVERAGE ANNUAL GROWTH %	24.2	2.6

In the case of DII, the average, annual growth is computed between 2023 and 2021 due to data comparability reasons.

Hungary has untapped potential to contribute to EU's Digital Decade target on digitalisation of SMEs while showing a very strong dynamic. Hungary performs below the EU average with 53.2% of SMEs having at least a basic level of digital intensity (EU: 57.7%). This represents an annual growth of +24.2% over 2 years compared to 2021, which is the last comparable year that used a similar methodology for measuring the digital intensity of enterprises. This progress is well above the EU average, demonstrating a significant improvement of the situation.

2.2.b Take up of cloud/AI/big data

- **Cloud**
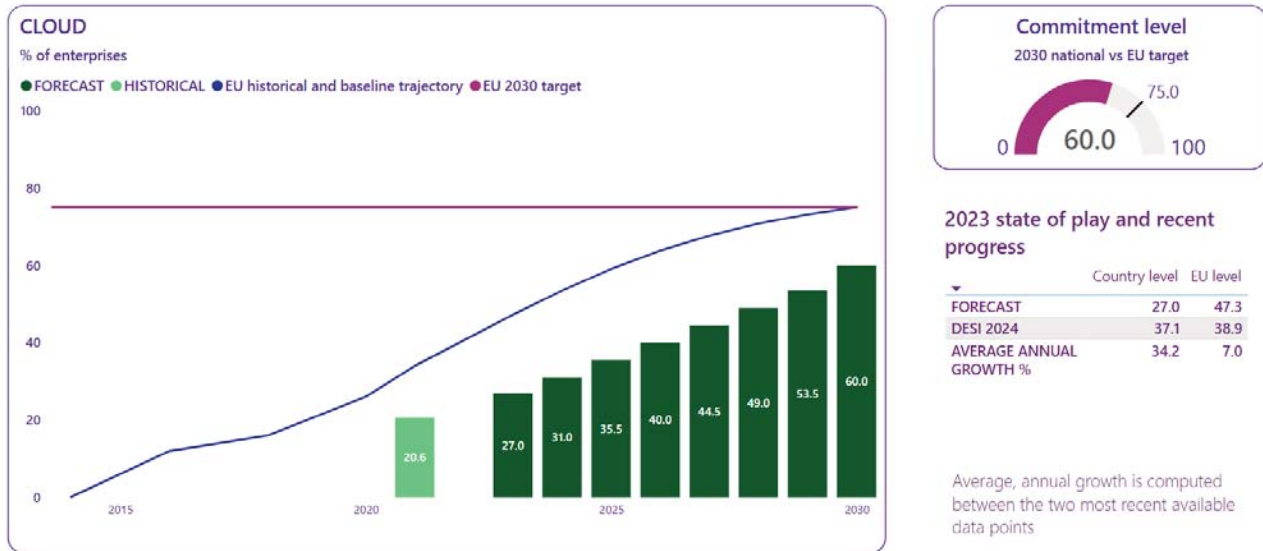
Note: The source of national forecast values is the 2023 country roadmap

Hungary brings a positive contribution to the EU's digital decade Cloud target and shows a very strong dynamic. The take-up of cloud solutions by enterprises (at 37.1% in 2023) is slightly below the EU average (38.9%). However, the improvement compared to 2021 was significant (34.2% annual growth) and far above the EU average improvement (+7% per year).

Hungary's 2030 target for enterprises adopting cloud, as presented in its roadmap, is below that of the EU (65% vs 75%). According to the Roadmap of Hungary, the digital transformation of enterprises will continue, and the use of some of the more basic ICTs, such as cloud solutions, is expected to grow steadily in the coming years among enterprises with more than 10 employees. However, Hungary had a very low starting value and many businesses are expected to not rely on cloud but to use simpler or on-site solution. Hungary therefore considers the EU target of 75 % to be too high, given the national context.

The roadmap presents cloud technology related measure which focuses on SMEs with a low level of digitalisation and fewer than 50 employees. It aims to educate these SMEs and increase their use of ICT services. The recent progress in this area should encourage Hungary to set a more ambitious target, closer to the EU target of 75%.

- **Data Analytics (Big Data)**[69]
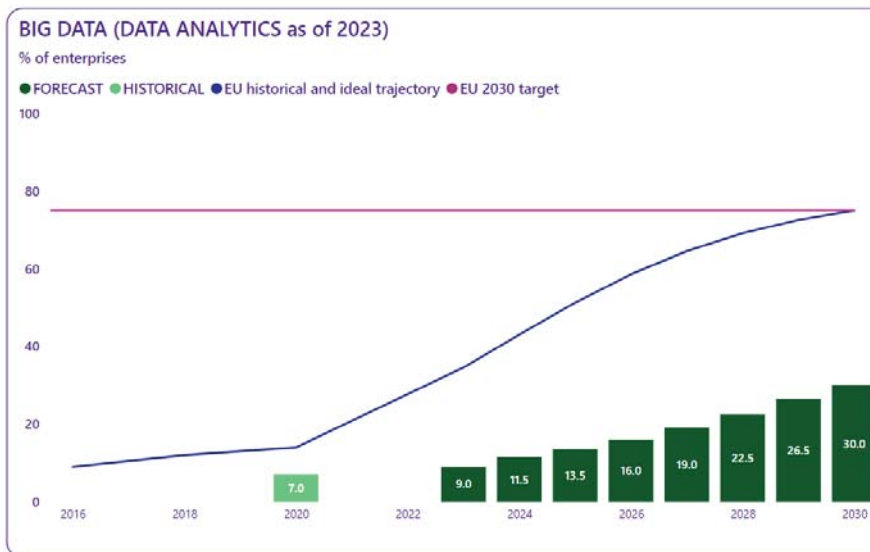
Note: The source of national forecast values is the 2023 country roadmap

Concerning the use of data analytics by enterprises, Hungary brings a very strong contribution to EU's Digital Decade target. Hungary's performance (53.2%) is far above both the EU average (33.2%) and the forecast. However, progress cannot be assessed since the indicator's definition has changed.

Hungary's 2030 target for enterprises adopting big data / data analytics, as presented in its roadmap, is significantly below that of the EU (30% vs 75%). Based on the latest indicator on adoption of these technologies by Hungarian enterprises, Hungary should consider aligning the target set out in the National Digitalisation Strategy and its Roadmap more with that of the EU.

Hungary' roadmap includes two measures to encourage the adoption of data analytics and AI. As a result of the DIMOP Plus, GINOP Plus and other (e.g. DEP, EDIH) programmes and organic market processes, the digital transition of enterprises, including the use of Data analytical and higher-level AI-based solutions by domestic enterprises, is expected to increase slowly, but in the coming years among. The 75% target could therefore be achievable for this indicator.

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[69] As of 2023, Eurostat changed the Big Data into a Data Analytics indicator, thus disabling comparison with previous years.

- **Artificial Intelligence**
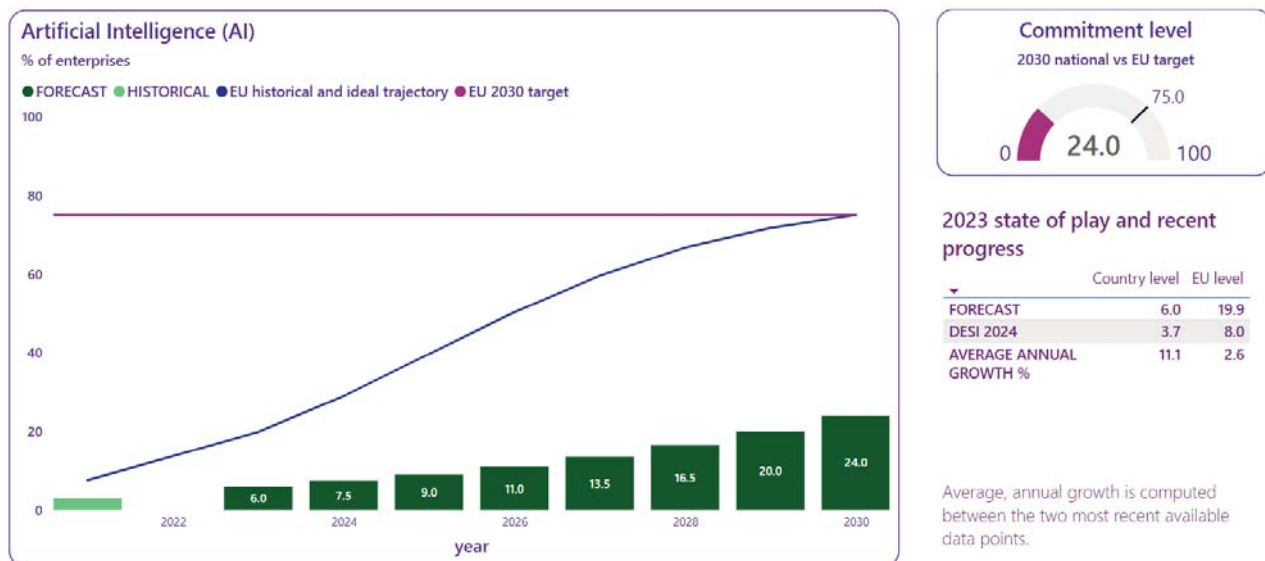
Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

Note 2: The source of national forecast values is the 2023 country roadmap

Hungary has scope to improve its performance to contribute to EU's AI Digital Decade target, while showing positive dynamic. Very few Hungarian enterprises have adopted AI solutions – only 3.7% in 2023 (below the EU average of 8%), but this represents an increase of 11% from 2021 (annual average growth).

Hungary's 2030 target for AI of 24% is significantly below that of the EU. Despite of the two measures planned in Hungary's Roadmap, this indicator will not exceed 24%, as, according to the Hungarian government, many enterprises in Hungary do not consider this technology to be useful for them. However, this will be an eight-fold increase compared with the latest figure. According to Hungary, the EU target of 75 % is unrealistic.

The Hungarian AI Coalition, which has over 400 members from all sectors (higher education, SMEs, corporates and public institutes), together with the Hungarian Chamber of Commerce and Industry launched a country wide programme and roadshow to demonstrate AI services to non-AI-using companies and connect these companies to AI providers. Furthermore, the revision of the government's AI Strategy is planned in 2024.

- **Take-up by enterprises of AI or Data analytics or Cloud**

Taking the three technologies together (adoption of either AI, Cloud, or Data analytics), Hungary stands at 65.6%, significantly above the EU average of 54.6%.

The improvement of the above presented indicators related to these technologies (Cloud, Data analytics) can be considered as a result of the Modern Enterprises Programme, the biggest and most comprehensive non-financial governmental measure related to SME (basic and advanced) digitalisation in Hungary in nearly 10 years, which was completed last year. Notable achievements of the project include 15 819 company (SME) digital audits, 8 521 'Digitally Qualified Enterprise' (DQE) classification and 305 online and in person events.

In 2023 DATA-EDIH and AI-EDIH started operating (with grants from Digital Europe Programme and the Hungarian state budget). These initiatives aim to enhance, encourage and accelerate the digital

transformation and the introduction of new emerging (big data, AI, and cloud) technologies (especially in the SME segment).

2.2.c Unicorns, scale-ups and start-ups

The size of the ICT sector in Hungary (6% in 2020) is above the EU average (5.2%) and the venture capital investments for seed and start-up amounted to 4% of GDP in 2022, which is in line with some large EU economies (e.g. Germany, Italy and Spain). The Hungarian government launched several financial actions to nurture the start-up ecosystem with investment.

The INPUT programme, aimed at supporting and mentoring ICT start-ups to help them enter international markets, ended in autumn 2023. INPUT helped more than 430 Hungarian digital start-ups (even potential unicorns) to enter the foreign market.

In October 2023, the Startup Factory programme was relaunched by the National Research, Development and Innovation Office for the fourth time since 2013. The government provides around HUF 5 billion to incubators that help Hungarian startups with mentoring and capital investment. So far, nearly 200 ideas have received funding in previous Startup Factory programmes, of which around 90 received further investment, mostly from private sources. Over 10 startups have already received foreign investment, and their total sales revenue exceeds HUF 10 billion

Based on statistics from Dealroom, there are two potential future unicorns under four or more stringent conditions. These are fast-growing start-ups with a current value of between USD 250 million and USD 1 billion. Against this background, the number of unicorns of Hungarian origin is likely to reach the targeted two by 2030.

2.3 Strengthening cybersecurity & resilience

As companies increasingly rely on digital technologies, their risk of exposure to cybersecurity incidents is increasing, just like their need for preparedness in this area. In 2022, 13.4% of enterprises in Hungary registered ICT security incidents leading to unavailability of ICT services, destruction or corruption of data or disclosure of confidential data, which is below the EU average (22.2%). However, enterprises in Hungary seem less prepared than their EU peers as 5.3% of enterprises reported being insured against ICT security incidents (EU average 25.0%) and 79.0% reported using ICT security measures (EU average 91.8%). According to the latest Eurobarometer survey, 82% of respondents said that improvements in cybersecurity, better protection of online data and safety of digital technologies would facilitate their daily use of digital technologies (above the EU average of 79%), which means that any improvements in this field will support digitalisation.

Hungary considers that continuously raising awareness among users is essential for improving cybersecurity. In 2023, the NCSC (National Cybersecurity Centre, NBSZ NKI) highlighted 400 vulnerabilities during vulnerability assessments conducted on information systems belonging to state or municipal bodies, covered by the Information Security Act and entitled to national security protection. In the reference year, 273 technical articles/publications, 32 IT-security tips and 12 monthly awareness-raising newsletters were published. These were distributed to the widest possible range of citizens and organisations through official Facebook and Instagram profiles. The NCSC 2023 organised several exercises for critical infrastructures to increase the cybersecurity level of organisations. In addition, the CyberSec Cybersecurity Conference took place in the framework of the European Cybersecurity Month, ECSM. The NCSC is working closely with the

Cyber Shield project launched by the National Bank of Hungary and the Hungarian Banking Association to increase online financial awareness/security. In 2023, new organisations joined the Early Warning System (EWS) operated by the NCSC, further expanding the scope of protected information systems. The expansion and fine-tuning of the government's trap system (HoneyPot) will also continue to contribute to the overall increase in cybersecurity. Under the MCP, EU-funded EDIH (European Digital Innovation Hubs) free training courses have been launched in Hungary to raise awareness among with free awareness-raising trainings.

3 Protecting and empowering EU people and society

3.1 Empowering people and bringing the digital transformation closer to their needs

In recent years, Hungary's biggest challenge has clearly been the slow development of digital competences, which are the basis for further digitalisation of both the economic sector and the public administration. In line with the objectives of the Digital Decade 2030 Policy Programme, the National Digitalisation Strategy 2022-2030 also underlines the importance of developing digital skills at all levels, in order to further digitalise the economic sector and the public sector. Thanks to initiatives of recent years, Hungary has improved significantly and scores slightly above the EU average on basic digital skills. The proportion of ICT specialists in the Hungarian workforce has also increased.

To improve the provision of digital public services, the government launched the National Digital Citizenship Programme. This programme introduced the digital citizen concept, which reinterprets the relationship between the state and citizens based on the EU's digital identity initiative and put in place user-friendly channels operating on a single platform, with a 'mobile first' objective.

3.1.1 Equipping people with digital skills

In Hungary, 58.9% of the population possesses at least basic digital skills. This is representing a 9.8 percentage points increase compared to 49.1% in 2021. However, people above 55 years of age lag behind the national average for this Digital Decade indicator. The proportion of ICT specialists in the Hungarian workforce has increased slightly in recent years, but remains relatively low at 4.2%, compared to the EU average of 4.8%. The Hungarian recovery and resilience plan (RRP) and cohesion policy programmes include several measures on digital skills.

3.1.1.a Basic digital skills
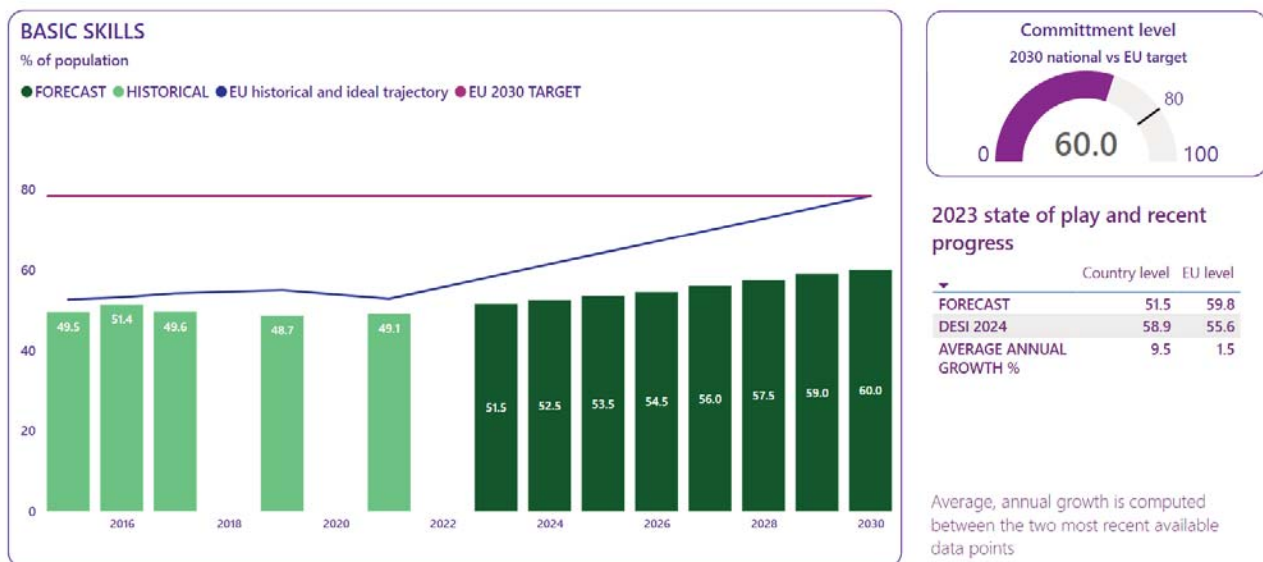
Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Hungary has untapped potential to the EU's Digital Decade target on basic digital skills, while showing a very strong dynamic. In 2023, 58.9% of the Hungarian population had at least basic digital skills. This places it above the EU average of 55.6%, but behind the front-runners. The indicator improved significantly

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compared to 2021 (9.5% annual increase), far more than the EU average (1.5%). Special attention should be given to the basic digital skills of people aged 55-64 (44%) and 65-74 (28%). In addition, vulnerable groups who face the most difficulties in accessing the labour market have benefitted the least from this progress. Only 33.4% of all adults with no or low formal education and 44.1% of unemployed people have at least basic digital skills[70]. In the recent Eurobarometer survey, 76% of the respondents in Hungary said that more education and training to develop their skills for using digital services would facilitate their daily use of digital technologies (above the EU average of 72%). This shows that there is a need for further education in this area.

Hungary has set its national target at 60% in this area, below the EU target of 80%. This target has almost been achieved according to 2023 figures. Hungary envisages a 7-9 percentage points increase by 2030, given the demographic impact, of having the current 65–74-year-olds moving out from the sample by 2030, replaced by the current 55-64 year-olds. A higher level of ambition for this national target could therefore be envisaged.

The national roadmap included a comprehensive list of efforts aimed at achieving the national target on basic digital skills. This area has been allocated the highest amount of investments, reflecting its importance. A central measure of the Hungarian government to support digital education is to provide notebooks for every pupil in grades 5-12. The distribution started in 2022, with 120 000 laptops provided to students and teachers. Efforts continued in 2023, with an additional 140 000 laptops distributed. Additional measures set out in the roadmap focus on disadvantaged groups and the aging population and makes use of cohesion policy funding.

The renewed National Core Curriculum, which entered into force in 2020, introduced a new subject called digital culture, which focuses on algorithmic thinking, programming skills and digital citizenship competences. The digital culture curriculum ensures that every pupil who finishes school has all the necessary digital skills, or at least basic digital skills. All teachers in public education were invited to participate in a training programme to improve their digital skills and their digital pedagogical skills. Along with the state-financed free textbook provision, the Educational Authority (Oktatási Hivatal) supports the public education by providing all their textbooks on the National Educational Portal (https://nkp.hu) in a digital way as smart textbooks. Additionally, from September 2023 every school has to use KRÉTA as an e-administration and education system, therefore paper-based administration is reduced to the minimum and supporting the digital skills of the teachers.

Digital experience centres, offset up in 2018 under the 'Programme your future' initiative, provide an opportunity for primary and secondary school students who lack opportunities to become acquainted with digital devices to do so in their own homes. The three digital experience centres welcomed groups from public schools in all regions of Hungary, thus helping the less developed regions to advance. The centres also provided travel for school groups and meals on the day of the visit. By the end of 2023, the experience centres had welcomed a total of 60 000 guests. Around 19 000 students from 240 secondary schools have benefited from activities organised by the centres (lectures by IT professionals, gamified programming lessons and study groups), and have received information about opportunities in the IT industry. Special attention was given to encouraging girls/women into the IT profession.
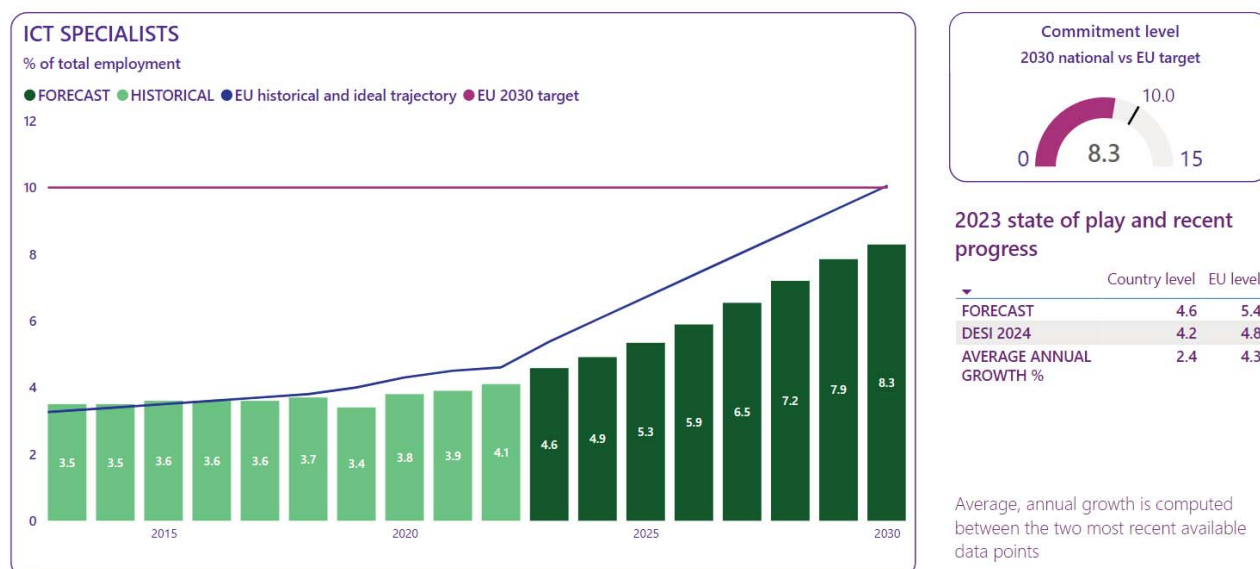
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[70] Commission SWD Country analysis on social convergence in line with the features of the Social Convergence Framework (SCF) at
https://ec.europa.eu/transparency/documents-register/detail?ref=SWD(2024)132&lang=en

In the area of adult training a key objective is to respond effectively and quickly to labour market needs and ensure that Hungarians can participate in training courses that are best suited to their skills and interests and that they can find suitable jobs. This also indirectly contributes to the Digital Decade targets. To meet this objective, several new features have been added to the previous strategic objectives in the legal and management framework for adult training in 2023, in terms of provisions on programme requirements and other regulatory elements. By 31 December 2023, 6 790 people had trained for a vocational qualification in the IT and telecommunications sector, with those who successfully completed the training receiving an intermediate vocational qualification. In 2023, employers applied for support under the related GINOP Plusz programme for a total of 20 587 employees.

Vocational and educational training (VET)now includes the provision of basic digital skills at state level to 16-74 years-olds. Based on the data of the Public Education Registration and Study Core System - KRÉTA (*Köznevelési Regisztrációs és Tanulmányi Alaprendszer – KRÉTA*) Examination Centre System, 45 323 VET participants passed this exam in 2023. The corresponding diploma or professional certificate includes information on the level of digital competences according to the Digital Competence Framework. Graduates have digital skills corresponding to at least level 3, but on average to level 4 or 5.

In 2023, the Hungarian AI Challenge, an online educational course, was organised by the Hungarian AI Coalition to increase AI knowledge among all age groups. Over 100 000 people have successfully completed the course.

3.1.1.b ICT specialists

	Country level	EU level
FORECAST	4.6	5.4
DESI 2024	4.2	4.8
AVERAGE ANNUAL GROWTH %	2.4	4.3

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Hungary has scope to improve its performance to contribute to the EU's Digital Decade target for ICT specialists while showing a positive dynamic. Hungary has set a target of 8.3% of its population being ICT experts by 2030. This target can be considered below the EU target for 2030 (as 20 million employed ICT specialists correspond to 10% of the EU population).

Hungary includes three measures on ICT specialists in its roadmap, which mainly run until 2029 and are supported by a national budget of around EUR 18 million. The measures focus on reducing the drop-out ratio from ICT higher education courses and on increasing the share of women with a degree in ICT.

The 'Programme Your Future!' project, aimed at increasing the number of people with IT qualifications relevant to the labour market and improving their skills, ended in autumn 2023. Its main results were providing more than 8 200 university IT students with professional courses and other services, and organising more than 4 000 career guidance sessions and other events for specific groups (for example girls).

The 'informatics and telecommunications' sector remains popular among VET students. In the 2023/2024 academic year, more than 10% of students are studying ICT. Based on the number of students, the sector ranks second in the list of VET courses. In 2023, a total of 1 142 VET students studying 'informatics and telecommunications' passed the vocational exam, increasing the number of ICT professionals in Hungary.

To support the skills development of the workforce the Hungarian government contributes to training costs and provides wage subsidies for enterprises. Employers who organise ICT training can apply for a higher contribution (HUF 350 000 /person instead of HUF 350 000 /person. In 2023, organisers of 754 ICT training courses applied for support under the project.

3.1.2 Key digital public services and solutions – trusted, user-friendly, and accessible to all

3.1.2.a e-ID

Hungary's roadmap sets out a 2030 target of 100% in terms of access to electronic identification, however Hungary has not yet notified an e-ID scheme to the Commission under the eIDAS regulation. Hungary presented seven measures that will support the development of e-ID, with a national budget of approximately EUR 160 million. The measures will focus on the development of the new Digital Citizenship Mobile Application.
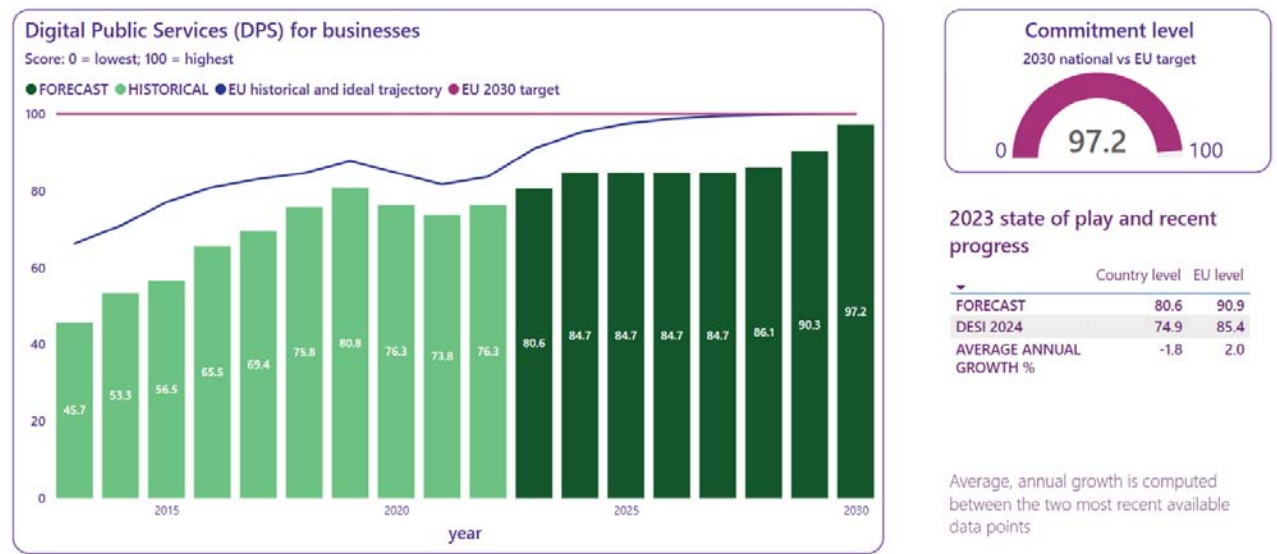
Despite over 70% of the population having national e-ID card, their use remains limited. They are only used for around 300 000 transactions per month as most users prefer the client gate trusted profile (basic authentication method involving a login and a password). In 2023, the main e-ID related measure in Hungary was to prepare the ground for the new, user friendly e-Identification framework service. In December 2023, new rules on the provision of digital public services were adopted (Act CII), in line with the objectives of the National Digital Citizenship Programme 2022-2026. According to the new legislation, the digital personal data wallet service, the e-Identification service, and the e-Signature will be available from 1 September 2024. Further plans include launching consent-based data provision in 2025, so that citizens will be able to access online services of some market service providers with the digital identification provided by the Digital Citizen Mobile App. Later on, in 2026 the new e-Post, e-Document management and e-Payment services will also be launched. The new mobile application will comply with the European Digital Identity Regulation, which requires that all citizens have a unique identifier that can be applied uniformly and will allow for an accurate and seamless flow of information. The basic principle is that the user will have control over the use of the data, and using the application will be voluntary.

3.1.2.b Digitalisation of public services and businesses

Digital Public Services (DPS) for citizens
Score: 0 = lowest; 100 = highest

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Historical: 22.9, 26.3, 32.3, 36.6, 45.6, 49.6, 56.0, 54.3, 64.4, 67.9
Forecast: 73.2, 76.8, 77.3, 77.3, 89.0, 93.3, 93.4, 96.3

year

Commitment level
2030 national vs EU target

0 — 96.3 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	73.2	87.2
DESI 2024	73.4	79.4
AVERAGE ANNUAL GROWTH %	8.1	3.1

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Digital Public Services (DPS) for businesses
Score: 0 = lowest; 100 = highest

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Historical: 45.7, 53.3, 56.5, 65.5, 69.4, 75.8, 80.8, 76.3, 73.8, 76.3
Forecast: 80.6, 84.7, 84.7, 84.7, 84.7, 86.1, 90.3, 97.2

year

Commitment level
2030 national vs EU target

0 — 97.2 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	80.6	90.9
DESI 2024	74.9	85.4
AVERAGE ANNUAL GROWTH %	-1.8	2.0

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Hungary has untapped potential to contribute to the EU's Digital Decade target for digital public services for citizens, with a score of 73 compared to the EU average score of 79 in 2023, while showing a very strong dynamic (an annual increase of 8%).

Hungary set targets of 96.3 for digital public services for citizens and 97.2 for digital public services for businesses in its roadmap, as the EU target of 100 for both cannot be achieved for legislative reasons. In certain cases, Hungarian law requires the individual to be present in person and there are no plans to change this in a near future. Hungary is planning 13 new measures on to the development of digital public services for citizens and business, which will run until 2030, with a national budget of approximately EUR

161 million. The measures will focus on upgrading the existing electronic interfaces, and improving the possibilities to manage public services on portable devices and to access public sector data and information.

Available public services are listed on the Magyarorszag.hu portal. More and more services that are available entirely online, such as driving licence renewal, address options, vehicle query on vehicle service platform and change of ownership with services related to life events due to be gradually introduced as from 2024.

Hungary has scope to improve its performance to contribute to the EU's Digital Decade target for digital public services for businesses, with a score of 75 compared to an EU average score of 85, and a very limited dynamic.

The primary goal for businesses is to make services as accessible and automated as possible. In addition, AI is playing ban ever greater role in making it easier for customers to navigate certain interfaces. Companies try to comply with EU security and other protocols in Hungary as well as abroad - they use and integrate the products of large manufacturers and use cloud-based solutions. Businesses are attracting an increasing number of foreign workers, which gives rise to new challenges as companies employing foreign workers will have significantly more contact with government agencies. Integrating workers from other EU countries is becoming increasingly seamless, however, due to evolving standards. From the point of view of companies, it is legitimate to expect that these processes will also be increasingly automated.

Hungary participates in the EU Digital Identity Wallet Consortium (https://eudiwalletconsortium.org), testing three use cases: (i) storage and display of digital travel credentials, (ii) organisation of digital wallets, and (iii) organisation of payments. It also participates in the DC4EU – Digital Credentials for Europe Consortium project (https://www.dc4eu.eu/) testing the use of European Digital Identity Wallets in the education sector and social security and the 'Potential– Pilots for European Digital Identity Wallet Consortium' project where it leads the work on the e-prescriptions use case.

3.1.2.c e-health

Citizens' online access to electronic health records (e-Health)

Score: 0 = lowest; 100 = highest

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

year	value
2022	79.9
2024	84.4
	84.4
2026	84.4
	84.4
	100.0
2028	100.0
	100.0
2030	100.0

Commitment level

2030 national vs EU target

0   **100.0**   100

2023 state of play and recent progress

	Country level	EU level
FORECAST	84.4	75.5
DESI 2024	86.0	79.1
AVERAGE ANNUAL GROWTH %	7.6	10.6

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Hungary has an overall e-health maturity score of 86 in 2023. This compares to a maturity score of 80 in 2022. In 2023, the EU-27 average is 79. A centralised, nationwide access service is technically available in Hungary. 80-100% of the national population is technically able to access the online access services for eHealth records through both native mobile application(s) and online portal(s), logging in using an eID based on two-factor authentication. **Hungary has set a target of 100 for this indicator, in line with the EU 'level target, which it will achieve by 2027.** The 2022 baseline of 79.4 for the electronic health record access indicator will rise by 5 points in 2023 to 84.4, thanks to the completion of the Health Window mobile application to facilitate public access to electronic health documents. Hungary's roadmap includes two measures for 2023 which will help achieve the targets by creating the legislative environment for access to electronic health records.

The National eHealth Infrastructure is the central IT system, which ensures communication and collaboration between healthcare service providers and patients. The Electronic Health Service Space (EESZT- Elektronikus Egészségügyi Szolgáltatási Tér) handled 8 622 201 transactions per day on average in 2023 (Hungary has a population of 9.6 million). The education of user groups of the EESZT system is carried out continuously both at the high school level and at the university level, in a comprehensive and partially compulsory manner. Regular trainings are also provided for healthcare workers (e.g., general practitioners, nurses, specialists) using the EESZT in their daily practice. A further significant progress could be achieved by expanding citizens' knowledge, which could also improve the quality of use by healthcare institutions – this is closely related to the topic of digital competences of the population.

Currently, the main objective of its development is to increase its structured contents and transform the supply documents generated so far in PDF into structured documents (e.g., machine readable format). The structuring of the data included in the EESZT began in the field of laboratory results, the doctors unanimously considered the processability of this data to be the most important. This will be mandatory for all relevant healthcare providers in 2024. Through the structured collection of data, the EESZT created the possibility that the results given by the health measuring devices used by patients at home (e.g., blood

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sugar meters, blood pressure meters, pulse oximeters) can also be uploaded to the central system (telemetry), through which all authorized users can access them.

New functions were developed in 2023 for the EgészségAblak ('Health Window') mobile application, which is based on the EESZT and supports users' access to their electronic health records, which led to an increase in the number of users. By the end of 2023, the application had been downloaded on more than 2.5 million mobile devices, making it practically the most widely used mobile digital public service in Hungary. The application is available in both Hungarian and English.

There are also healthcare data created in the healthcare sector and uploaded to the EESZT, whose end user is not the healthcare sector itself but other institutions (e.g., medical certificate required for a driver's license, medical certificate required for an increased amount of family allowance). The eDOC module has been developed for this need, which can transmit certain health documentation to other sectors using the appropriate secure channels. The assessment of potential new areas that can be included in the future is underway.

Hungary leads the PATHeD (Enabling patient access to their health data), a mobile application development project, aimed at international accessibility and the transfer of users' health data. Launched on 1 January 2023, PATHeD aims to develop a reference implementation of a mobile toolkit. The MyHealth@EU infrastructure will be expanded to allow users to access their patient summary in a translated format, utilising the newly developed mobile toolkit and the national eHealth infrastructure. The mobile toolkit was finalised in 2023, and by 30 June 2024 six Member States will have piloted it.

The major drawback in providing access to electronic health records for 100% of EU citizens is the lack of uniformity in the technological standards on imaging diagnostics, which makes storage and accessibility difficult. As Hungary places great importance on international standardisation, it participates in the Medical Imaging Guideline Working Group established by the European eHealth Network.

3.2 Building a safe and human centric digital environment and preserving our democracy

Hate speech is a growing problem in Hungary, with 44% of the population exposed to hostile or degrading online messages in the last 3 months of a Eurostat survey (EU average: 33.5%).

People in Hungary are extremely concerned with the impact of new technologies on their civil rights. According to the recent Eurobarometer survey, 89% of the respondents in Hungary said that shaping the development of AI and other digital technologies to ensure they respect people's rights and values is important for public authorities.

One of the biggest threats to data protection is financial frauds/threats. The number of financial fraud cases increases dramatically every year. Consequently, the relevant authorities pay special attention to raising the security awareness of users (account holders). The role of the Cyber Shield cooperation and the incident management platform is crucial in this respect.

In 2023, Hungary started to prepare for the application of the Digital Services Act. To that end, Act CIV of 2023 on Certain Rules for Internet Intermediary Services was adopted in December, which sets out the detailed rules for the activities and procedures of the National Media and Infocommunications Authority (NMHH) as the Hungarian Digital Services Coordinator (DSC). On 21 December 2023, Hungary enacted a new regulation (Act XCVI) amending the rules for blocking illegal online content by Internet Service

Providers. The amendment will help protect internet users from illegal online content and services in breach of customer protection, market competition, tobacco trade and online gambling.

The Internet Hotline (IH) legal advisory service, operated by NMHH has contributed to the objective of protecting users from illegal content and hate speech. It enables the public to submit reports on eight subjects: (1) child pornography/child sexual abuse material, (2) content published without consent, (3) online harassment, (4) racist content, incitement against a community, (5) content that promotes or encourages the use of illegal psychoactive substances, (6) content that incites or promotes illegal acts of violence, (7) phishing content, (8) other content that is harmful to minors. In 2023, the online form was made available in the English language, leading to more reports received in English. Members of IH provided several training sessions for children (aged 10 - 18) at schools and summer camps, including for the most vulnerable children, for example members of the SOS Children Village. Members of IH also provided training sessions for adults who work with children, such as teachers and school psychologists. In 2023, IH reached a total of 1 300 people with 50 sessions (workshops, lectures).

Best practice: EgészségAblak mobile application (e-Health)

The EgészségAblak application has been available to citizens since the COVID-19 pandemic, providing access to the Digital COVID Certificate and test results, however on 17 May 2023, it was relaunched with a new branding and expanded features. The application is free to download in the app stores. The mobile application allows citizens view their dispensable and previously dispensed ePrescriptions and provides possibilities to dispense multiple prescriptions easily at the same time. The application sends notifications about new and expiring prescriptions. Health documents (such as test results, outpatient records, etc.) are now downloadable within the application, and citizens can receive push notifications about them.

The key benefits and success factors of the application are the following:

- The number of users is above 2.5 million, based on application downloads on mobile devices. EHR-documents and ePrescriptions can be accessed in the application. The application is bilingual, apart from Hungarian, English language is also available.
- In November 2023, the EgészségAblak functionality expanded to display appointments published in the EESZT national eHealth infrastructure and now allows patients to view and cancel appointments if needed, freeing up capacity for others.
- More than 800 thousand of ePrescriptions are dispensed daily, which became available through the EgészségAblak mobile application as well, also helping pharmacists during the redemption process.
- The status of the social security number can be queried in real time, directly from the base registry, so the user can see whether their employer has actually notified the employment to the authority.
- Family members or any authorised individuals can also access documents and prescriptions through the mobile application with the appropriate authorisation, which can be a real help in the case of elder relatives with less digital competences or our children.

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4 Leveraging digital transformation for a smart greening

According to Eurostat (2022 data), only 18.7% of Hungarian enterprises with 10 employees or more considered the environmental impact of ICT services and devices before selecting them and applying some measures. This is significantly below the EU average of 48.7%. On recycling and reusing ICT devices, Hungary has some opportunity to improve with about 9% of the individuals recycling their mobile phones, 10% recycling their desktop computers and 7% their laptops or tablets, as opposed to the EU average of

about 10%, 13% and 10% respectively. However, according to the latest Eurobarometer survey, 87% of respondents in Hungary said that it was important for public authorities to ensure that digital technologies serve the green transition, above the EU average of 81%, showing the importance of this issue to Hungarians. Controlling energy use is one of the biggest issue for enterprises, and several IT SMEs are specialised in IOT tools, software and services that help optimise the energy consumption of different industries.

Although, none of the measures planned in the National Roadmap of Hungary are specifically aimed at the green transition, they can contribute indirectly to the uptake of greener technologies due to the nature of digitalisation. On public investment, investments and operating costs are assessed considering the total cost of ownership. Therefore, more efficient and thus greener solutions are likely to spread.

In 2023, Hungary submitted a modified recovery and resilience plan including an additional loan element which is almost entirely used for REPowerEU objectives. Several measures in the REPowerEU chapter are to upgrade the electricity infrastructure. The chapter also adds further investments into smart meters and increases the related targets significantly. The digitalisation of the electricity network will address the challenges stemming from the reliance on different energy sources, security of supply and cost-efficiency considerations, industry-wide monitoring and data management needs.

Work is also being done by several industry stakeholders to reduce the environmental footprint of telecoms networks and cloud applications. Thanks to good practice by service providers the use of renewable energy has increased and emissions of harmful substances have decreased. The energy consumption of service provider networks and systems has also decreased as a result of their move to renewable energy sources, including at their headquarters and other locations. Service providers consider the modernisation of their own equipment and networks to be key to Greening Digital objectives. For example, in 2023 DIGI significantly reduced the energy consumption of its network by switching DIGI mobile subscribers to the Vodafone mobile network and switching its own network to a reduced mode. Further reductions in energy consumption were achieved by service providers converting the copper networks to optics.

Another noteworthy initiative is the E-pack discount system for specific services, which provides discounts to subscribers who choose the electronic (i.e., paperless) invoicing option.

Best practice: Climate-gas database
The Climate-gas database is the National Climate Protection Authority's climate containing equipment, cooling circuit, data register, invoicing, and personal and company certification system. The database is also a tool for submitting permits for monitoring the greenhouse gas emissions of facilities covered by the EU ETS system. The database ensures the enforcement of the rights of law-abiding enterprises, as well as the indispensable IT background for tasks related to the obligation to provide data to the Commission.

Annex I – National roadmap analysis

Hungary's National Digital Decade Strategic Roadmap

Hungary's National Strategic Roadmap was adopted by the government on 4 December 2023 following a public consultation and modifications based on the feedback of the stakeholders, then it was submitted to European Commission the next day. It is publicly available on the [Digital Hungary Agency website](#).

Hungary's roadmap provides a detailed overview of the nation's digital development aligned to the four pillars of the Digital Decade and describes the country's challenges and strength. Hungary provided national projected trajectories, including estimated yearly data points (following the JRC recommended methodology), except for Semiconductor and Edge nodes. Regarding Quantum computing, a simple trajectory graph is showing an increase to 1 in 2027, while for Unicorns a 2030 target value of 2 was provided. Hungary's roadmap sets out a 2030 target of 100% in terms of access to electronic identification, however Hungary has not yet notified an e-ID scheme to the Commission under the eIDAS regulation.

The only national targets in line with the EU target are those for e-Health and e-ID.

The following targets are very close to those of the EU:

- VHCN coverage –95% instead of 100%,

- 5G coverage –99% instead of 100%,

- SMEs with basic digital intensity – 89% instead of 90%,

- Digital public services for citizens (96% instead of 100%) and for businesses (97% instead of 100%) – justified by regulatory obligations (e.g., personal presence is mandatory).

The following targets are significantly below those of the EU, as Hungary does not consider it realistic to achieve the EU targets by 2030:

- At least basic digital skills – 60% instead of 80%

- ICT specialists - 8.3% instead of 10%

- Cloud services, Big data and AI – 60%, 30% and 24% respectively versus 75%

The roadmap sets out 42 measures, of which 37 are new, indicating a substantial commitment to digital advancement. Then estimated budget for these measures is EUR 2.436 million.

The below table reflects a best-effort attempt at categorising the measures and budget set out in Hungary's national roadmap.

Digital Decade Target/objective	Budget (EUR Million)	Number of measures
Connectivity Gigabit	474.3	2
Connectivity 5G	474.3	3
Semiconductors	-	-
Edge nodes	-	-
Quantum computing	0.0	1
SME take up	88.8	1
Cloud/AI/Big Data uptake	-	-
Cloud only uptake	0.0	1
AI only uptake	89.5	2
Big data uptake	89.5	2
Unicorns	-	-
Basic Digital Skills	879.8	5

ICT Specialists	18.5	3
eID	160.3	7
Key Public Services	160.9	13
e-Health	0.0	2
Objectives	-	-
Total	**2 435.9**	**42**

The proposed measures are a mix of investments and reforms. Information is provided on which parts are financed by the RRF and which parts are financed by the cohesion policy programmes. There are no regional level measures, given the size of the country.

The Hungarian Roadmap forecasts EUR 1 483 million EU investments, EUR 243 million national investments and EUR 710 million private investments.

Annex II – Factsheet on multi-country projects (MCPs) and funding

MCP and EDICs
Hungary is a member of the Alliance for Language Technologies (ALT-EDIC) and the Local Digital Twins towards the CitiVERSE – EDIC (both already set up). Beside this Hungary is developing the Statute and other relevant documents of the possible future Connected Public Administration EDIC, within an informal Working Group. Altogether, Hungary is involved in 3 EDICs already set-up or in development.

EU funding for Digital in Hungary
Hungary's recovery and resilience plan (RRP) allocates EUR 1.7 billion (29.1% of the total) to the digital transformation, of which EUR 1.2 billion directly contributes to the Digital Decade targets, according to a JRC study[71]. The most significant digital measure set out in the RRP is the modernisation of the public health sector (EUR 0.48 billion). As Hungary has not yet completed all of the super-milestones of the Rule of Law Conditionality procedure, RRF funding remains blocked. Hungary has therefore not yet submitted any payment request for the RRP. Hungary also received EUR 1.57 billion of DD-relevant budget from cohesion policy funds with priority given to enterprises and gigabit roll-out.

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[71] Based on an estimation of the possible contribution to the Digital Decade (Joint Research Centre report 'Mapping EU level funding instruments to Digital Decade targets - 2024 update' (Signorelli et al., 2024)).

![European Commission logo]

State of the Digital Decade 2024

Ireland

1 Executive summary

Ireland brings a positive contribution to the European Union's (EU) Digital Decade objectives and targets, in view of a successful digitalisation that fosters competitiveness, resilience, sovereignty, European values and climate action.

In 2023, Ireland made notable progress in FTTP infrastructure and invested significantly in the digital literacy of its population. However, **significant challenges** persist in addressing the ICT specialists' gap and in advancing e-Health initiatives, where progress is still slow.

As stated in the national digital framework **Harnessing Digital**, Ireland's goal is to be a digital leader at the heart of European and global digital developments.

To reinforce the recognition of Ireland's digital prowess both internally and on the international stage, the country continues to prioritise strategic initiatives aimed at bolstering digital infrastructure, fostering innovation and ensuring digital sovereignty. In addition, Ireland's commitment to improving the digital literacy and skills of its population further solidifies its position as a global leader in the digital landscape. By collaborating with industry stakeholders, academia, and government agencies, Ireland is set to accelerate its digital transformation even further, to contribute significantly to the EU's Digital Decade objectives, and to strengthen its position as a digital frontrunner on the global stage.

While the deployment of 5G networks is progressing steadily and is in line with the EU average, Ireland has been slow in deploying 5G service in the 3.6 GHz band, which is the only spectrum band currently available to deliver high performance 5G services to a large proportion of the population and for business-to-business (B2B) communications. Irish operators should be encouraged to accelerate such 5G deployment in mid band.

According to the **Special Eurobarometer 'Digital Decade 2024'**[72], 76% of the Irish respondents consider that the digitalisation of daily public and private services makes their life easier, above the EU average of 73%. Ireland is the third largest exporter of digitally delivered services in the world[73].

The country is a member of the Alliance for Language Technologies **European Digital Infrastructure Consortium** (ALT-EDIC) which has already been established and addresses the scarcity of European language data needed for AI solutions[74].

Ireland allocates 34% of its total Recover and Resilience plan to digital (EUR 313 million)[75]. Under Cohesion Policy, an additional EUR 54 million (5% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[76].

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[72] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351

[73] World Trade Organization (2023) Global Trade Outlook and Statistics.

[74] Information last updated on 31 May 2024.

[75] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.

[76] This amount includes all investment specifically aimed at or substantially contributing to digital transformation in the 2021-2027 Cohesion Policy programming period. The source funds are the European Regional Development Fund, the Cohesion Fund, the European Social Fund Plus, and the Just Transition Fund.

Digital Decade KPI [1]	Ireland			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	IE	EU
Fixed Very High Capacity Network (VHCN) coverage	83.8%	87.0%	3.8%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	72.1%	78.5%	8.9%	64.0%	13.5%	x	-
Overall 5G coverage	83.9%	85.3%	1.7%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		24		1 186		x	10 000
SMEs with at least a basic level of digital intensity	64.2%	66.1%	1.5%	57.7%	2.6%	90%	90%
Cloud	47.4%	53.1%	5.8%	38.9%	7.0%	75%	75%
Artificial Intelligence	7.9%	8.0%	0.6%	8.0%	2.6%	75%	75%
Data analytics	NA	37.1%	NA	33.2%	NA	75%	75%
AI or Cloud or Data analytics	NA	64.1%	NA	54.6%	NA		75%
Unicorns		12		263		x	500
At least basic digital skills	70.5%	72.9%	1.7%	55.6%	1.5%	80%	80%
ICT specialists	6.3%	6.2%	-1.6%	4.8%	4.3%	9.6%	~10%
eID scheme notification		Yes					
Digital public services for citizens	81.1	81.2	0.2%	79.4	3.1%	100	100
Digital public services for businesses	100.0	100.0	0.0%	85.4	2.0%	100	100
Access to e-Health records	0.0	11.4		79.1	10.6%	80	100

[1] See the methodological note for the description of the indicators and other descriptive metrics

National Digital Decade strategic roadmap

With respect to **Ireland's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating **a high ambition** and, based on this document, intends to allocate **very significant effort** to achieve the Digital Decade objectives and targets.

Ireland's national strategic roadmap is aligned with the EU Digital Decade Policy Programme and sets out a comprehensive plan with all sections completed. While the challenges, strengths, and assets are clearly indicated, important information, notably on targets FTTP, edge nodes, and unicorns are missing. The roadmap outlines 59 measures with an estimated budget of EUR 14.9 billion (2.9% of GDP) that are aligned with the targets and objectives of the Policy Programme and the European Declaration on Digital Rights and Principles. Building on existing strategies such as the national digital strategy 'Harnessing Digital', Ireland focuses on digital public services, ICT specialists, and connectivity, with a major emphasis on measures to support unicorns. The roadmap strikes a balance between private and public needs, aligning with the Digital Decade goals of enhancing competitiveness, cybersecurity, and citizen empowerment. Overall, Ireland's roadmap is consistent and innovative, positioning the country on track to meet the EU's digital targets.

Recommendations for the roadmap

Ireland should, when submitting adjustments to its national roadmap in accordance with Article 8(3) of the DDPP Decision:

- **TARGETS:** (i) Prioritize setting clear and measurable targets for all key areas outlined in the national strategic roadmap, including FTTP, edge nodes and unicorns. (ii) Increase efforts to achieve the EU-level target on e-Health, in line with the requirements under the upcoming European Health Data Space regulation.
- **MEASURES:** (i) Enhance the analysis and evaluation of measures included in the national strategic roadmap by providing comprehensive information on expected impacts and budget allocations for each measure, including RRP contribution. (ii) Provide more information on the implementation of digital rights and principles (and Digital Decade general objectives), including what national measures contribute to it.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' provides insights into Irish perceptions of digital rights. Although there is a decline of 7 points since last year, 62% of Irish respondents still believe the EU protects their digital rights, slightly above the EU average of 45%. Concerns have increased, with 41% worried about children's online safety, up 13 points, and 32% about control over their digital legacy, up 11 points. On the positive side, 70% appreciate the existence of digital skills, and 63% trust in the freedom of assembly online, both well above the EU averages. The monitoring of the Declaration on Digital Rights and Principles shows that increasing the profile of the Declaration at national level and fostering better stakeholder engagement could help improve outcomes in the years to come[77].

A competitive, sovereign and resilient EU based on technological leadership

Ireland's strategic initiatives are closely aligned with the EU's goals of advancing digital infrastructure, fostering research and innovation, and safeguarding digital sovereignty. Initiatives like the National Broadband Plan and the deployment of high-speed fibre networks demonstrate Ireland's commitment to meeting the EU's Digital Decade targets for connectivity infrastructure and ensuring resilient and accessible digital systems for citizens and businesses alike.

By supporting EU-wide digital ecosystems and innovative enterprises with initiatives such as the Digital Transition Fund and the SME Growth Plan, Ireland demonstrates its dedication to competitiveness and digital sovereignty. By prioritising cloud, AI and data analytics technologies uptake, Ireland aims to accelerate the digital transformation and nurture potential digital leaders, in line with the EU's vision. Furthermore, Ireland's focus on research and innovation underscores its commitment to driving digital progress and addressing key RDI challenges. With plans to set up a new research funding agency by 2024, Ireland is poised to further boost its position as a leader in digital innovation within the EU.

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[77] See SWD 'Digital Decade in 2024: Implementation and perspective' with annexes, SWD(2024)260: https://digital-strategy.ec.europa.eu/en/news-redirect/833325, Annex 4.

Recommendations – Ireland should:

- **CONNECTIVITY INFRASTRUCTURE:** (i) Continue efforts to ensure full gigabit and 5G coverage, including by addressing operational bottlenecks such as permissions for telecoms mast deployment to extend mobile coverage. (ii) Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.

- **EDGE NODES:** Explore opportunities for public-private partnerships and leverage funding mechanisms to support the rollout of edge nodes infrastructure.

- **CLOUD/AI/DATA ANALYTICS:** (i) Develop targeted programs and incentives to encourage enterprises and SMEs to adopt Big Data and AI and leverage their potential for innovation and growth; (ii) Stimulate the adoption of next generation cloud infrastructure and services by companies of all sizes, including by liaising with the Cloud IPCEI Exploitation office and/or the coordinators and the Member States participating in the IPCEI-CIS.

- **UNICORNS:** Increase funding mechanisms such as the Digital Transition Fund and Seed and Venture Capital Scheme to support digital entrepreneurship and nurture potential unicorns.

- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

Protecting and empowering EU people and society

Ireland has made significant strides towards achieving the EU's Digital Decade target for basic digital skills, with 72.9% of the population having at least basic digital skills, surpassing the EU average. Key initiatives such as Adult Literacy for Life and the Digital Strategy for Schools have played a vital role in promoting digital literacy across society. Efforts such as the STEM (*science, technology, engineering, and mathematics)* Education Implementation Plan demonstrate Ireland's commitment to empowering people through education and skill development, while addressing the demand for ICT specialists reflects a concerted approach to bridging divides and fostering digital readiness in the workforce.

Ireland is also advancing its digital public services to enhance inclusion and accessibility. Initiatives such as a national procurement framework and setting up Shared Government Data Centre facility reflect the country's efforts to modernise public services and promote efficiency. The investments in digital health initiatives further highlight Ireland's dedication to leveraging technology for healthcare accessibility and patient empowerment, driving its digital transformation agenda forward.

Recommendations – Ireland should:

- **ICT Specialists:** Expand apprenticeship programs, reskilling, and upskilling initiatives to meet the growing demand for ICT specialists, through a structural reform of the National Training Fund. Efforts should be continued in bridging the gender gap.

- **e-ID:** Notify to the Commission an e-ID scheme under eIDAS Regulation, while leveraging digital schemes such as MyGovID and the EU Digital Identity Wallet to improve access to essential services under eIDAS.

- **e-Health:** (i) Expand the coverage of the online access service to ensure that all citizens can access their electronic health data online. (ii) Make further data types available to citizens through the online access service. (iii) Increase the supply of health data by onboarding more

categories of healthcare providers.

Leveraging digital transformation for a smart greening

The latest Eurobarometer results reveal strong public support in Ireland, with 89% of respondents emphasising the role of digital technologies in the green transition. To deliver on its commitment to reduce emissions, Ireland is focusing on integrating green and digital transitions into future enterprise policy. Initiatives such as the Circular Economy Act and the Build Digital project reflect the country's efforts to promote sustainability in the digital sector. Challenges remain, with only 20% of businesses implementing energy-efficient measures for ICT equipment. However, government initiatives, such as the National Remote Work Strategy and the new data processing centre, aim to mitigate environmental impact while maximizing digital benefits. Regulatory bodies contribute to sustainability efforts, highlighting a comprehensive approach to advancing environmental goals within the digital landscape.

Recommendations – Ireland should:

- Develop a coherent approach to twinning the digital and green transitions. First, promote improvements in energy and material efficiency of digital infrastructures, in particular data centres. Second, support the development and deployment of digital solutions that reduce the carbon footprint in other sectors, such as energy, transport, buildings, and agriculture, including the uptake of such solutions by SMEs.

- Monitor and quantify the emission reductions of the deployed digital solutions in line with the relevant EU guidance and with the support of the methodology developed by the European Green Digital Coalition, in view of future policy development, as well as of attracting relevant financing.

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2 A competitive, sovereign and resilient EU based on technological leadership

2.1 Building technological leadership: digital infrastructure and technologies

Ireland's strategic initiatives align closely with the EU's objectives of fostering digital infrastructure development, promoting research and innovation, and ensuring digital sovereignty. Ireland has embarked on initiatives such as the National Broadband Plan and the deployment of high-speed fibre broadband networks, contributing significantly to the EU's Digital Decade target on connectivity infrastructure. Ireland's commitment to enhancing digital infrastructure underscores its dedication to fostering sustainable, resilient, and accessible digital infrastructures, for citizens and enterprises, including SMEs and startups.

Ireland's approach to supporting EU-wide digital ecosystems and scaling up innovative enterprises reflects its commitment to enhancing competitiveness while promoting digital sovereignty. Through initiatives such as the Digital Transition Fund and the National SME and Entrepreneurship Growth Plan, Ireland is promoting the digitalisation of businesses, thereby driving productivity gains, and fostering innovation. Additionally, Ireland's strategic focus on enhancing the take-up of cloud, AI, and data analytics technologies among enterprises demonstrates its dedication to accelerating digital transformation, while nurturing potential digital unicorns. By directing state funding towards innovative digital businesses and supporting over 800 businesses through the Digital Transition Fund, Ireland is positioning itself as a leader for digital innovation and entrepreneurship, in line with the EU's vision for a digitally sovereign Europe.

Research is also a priority area for Ireland. The share of the ICT sector in business enterprise expenditure on research and development is 30.8%. Ireland published an updated National Smart Specialisation Strategy for Innovation 2022-2027, embracing a regional approach to addressing Ireland's RDI challenges, with priority areas including digitalisation and digital transformation. As part of its Research and Innovation Strategy 'Impact 2030', Ireland announced that Taighde Éireann – Research Ireland, the new research and Innovation funding agency, is intended to be operational by 2024.

2.1.a Connectivity infrastructure (gigabit)
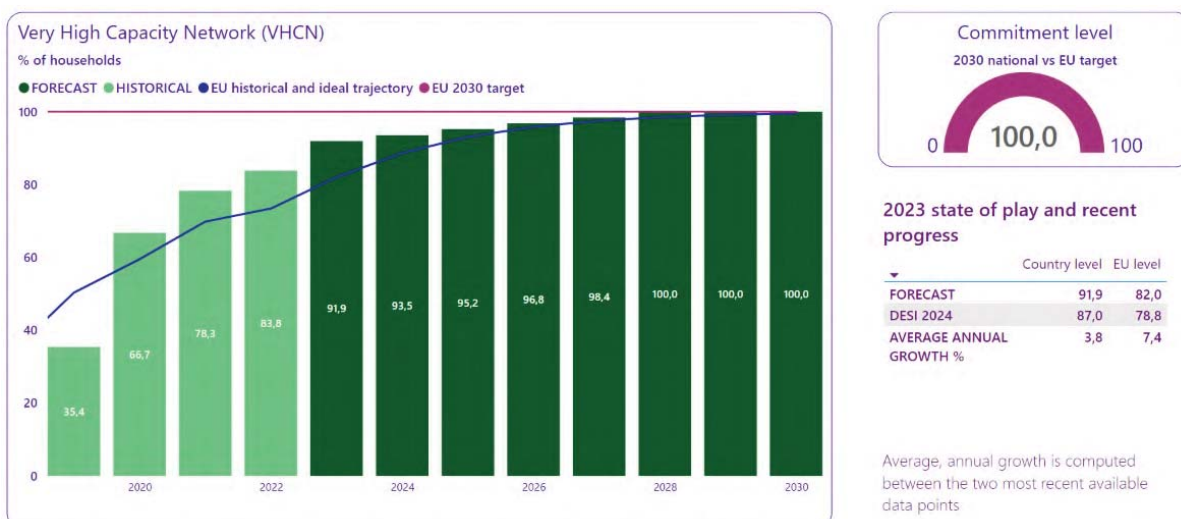
Note: The source of national forecast values is the 2023 country roadmap
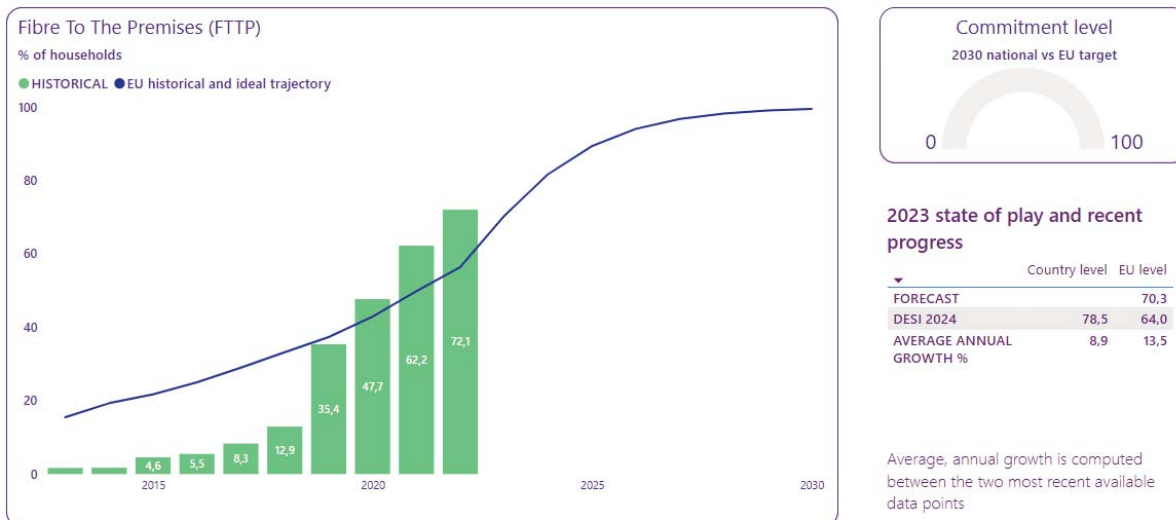
Note: The source of national forecast values is the 2023 country roadmap

Ireland makes a positive contribution to the EU's Digital Decade target for Very High Capacity Networks (VHCN), while demonstrating limited dynamic. With 87% of households currently covered with VHCN, Ireland performs above the EU average of 78.8% and shows an increase since the last figure, 84%, presented in the previous report.

Steady progress has been made on the delivery of the new high speed fibre broadband network under the National Broadband Plan. Original targets, delayed by the COVID-19 crisis, are expected to be met by 2027. Over 205 000 premises were passed across all counties, meaning they can avail of a connection to highspeed broadband. Over 65 000 premises were connected meaning that, on average, almost 30% of premises passed have been connected. Fibre deployment was also completed on 10 islands of Donegal, Mayo, Galway, and Cork counties, and is progressing to further 5 islands through the design phase. In total, Ireland has approximately 2.3 million passed premises.

On Fibre-to-the-Premises, coverage is at 78.5%, up from previous observed rate of 72.1%, and above the EU average of 64.0%. 37.6% of fixed broadband subscriptions are now based on FTTP, up from 28.9% in the previous year. However, the share of fixes broadband subscriptions higher that 1Gbps is still low (9.5%) and below the EU average (18.5%). Ireland did not provide a trajectory for this KPI in its roadmap.

Ireland has set as target that all Irish households and businesses will be covered by a Gigabit network no later than 2028, which looks attainable at the current growth rate. By the third quarter of 2023, 61% of fixed broadband subscriptions had a speed of at least 100Mbps, up from 53.5% in the previous year. As the migration from legacy infrastructure speeds up (copper switch-off), the national telecom regulatory authority is ensuring that replacement into modern infrastructure is being done while protecting end-users' interests and wholesale and retail competition. Ireland's RRP has also contributed to connectivity, through the provision of high-speed broadband connectivity to 990 schools.

2.1.b Connectivity infrastructure (5G)
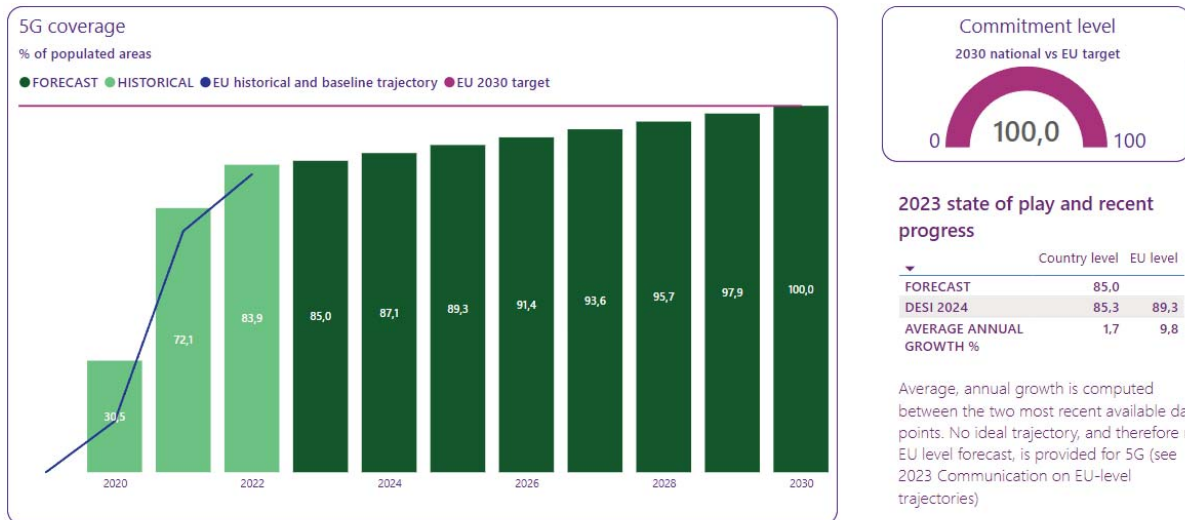
Note: The source of national forecast values is the 2023 country roadmap

Ireland has untapped potential to contribute to the EU's Digital Decade target on 5G, while demonstrating very limited dynamic. With 85.3% of households currently covered with 5G, showing a relatively small growth since the last reporting period, Ireland should speed up its efforts to positively contribute to the EU's Digital Decade target. Ireland is not far below the EU average of 89.3%, but progress has been slow on a year-to-year basis as the last observed rate stood at 83.9%.

While coverage is higher than forecasted in Ireland's national roadmap, challenges concerning network investment have become more visible, including high business costs and skills shortages, as the country entered a technical economic recession in 2023. In addition, operational bottlenecks like permissions for the deployment of telecoms masts may prove to be an impediment to the extension of the mobile coverage.

2.1.c Semiconductors

Ireland is committed to contributing to the EU target of having at least 20% of the world production of semiconductors by 2030. Following a stakeholder consultation in March 2024, Ireland is progressing the formulation of a National Semiconductor Strategy which will be published in the coming months. The Strategy aims to ensure Ireland can play its proportionate part in reaching the EU Chips Act and Digital Europe target to double its current global market share of semiconductors to 20% by 2030. The first use of extreme ultraviolet (EUV) in high-volume manufacturing in Europe was announced by Intel in 2023. Ireland is also part of the European Semiconductor Board and the OECD Informal Semiconductor Network. Ireland became one of 14 Member States with direct participants in the IPCEI on Microelectronics and Communication Technologies (IPCEI ME/CT). The Irish participant, Analog Devices Inc., announced a EUR 630 million investment in their national operation.

In April, the Department of Enterprise, Trade and Employment announced a call for expressions of interest for candidate Competence Centres under the Chips for Europe Initiative. The Irish Competence Centre will work closely with industry, research and technology organisations, universities, and the public sector to contribute to skills development and provide access to joint programmes, pilot lines and design services and tools.

A specific stream was added within the Ukraine Enterprise Crisis Scheme under the European Commission's Temporary Crisis and Transition Framework to assist businesses with trading challenges and rising energy

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costs, to specifically target and support the microelectronic manufacturing sector. The purpose of assistance to microelectronics manufacturers is to sustain capital investment plans in key sectors of systemic national or European importance in terms of supply chains, value added, production competitiveness and technological development in the EU.
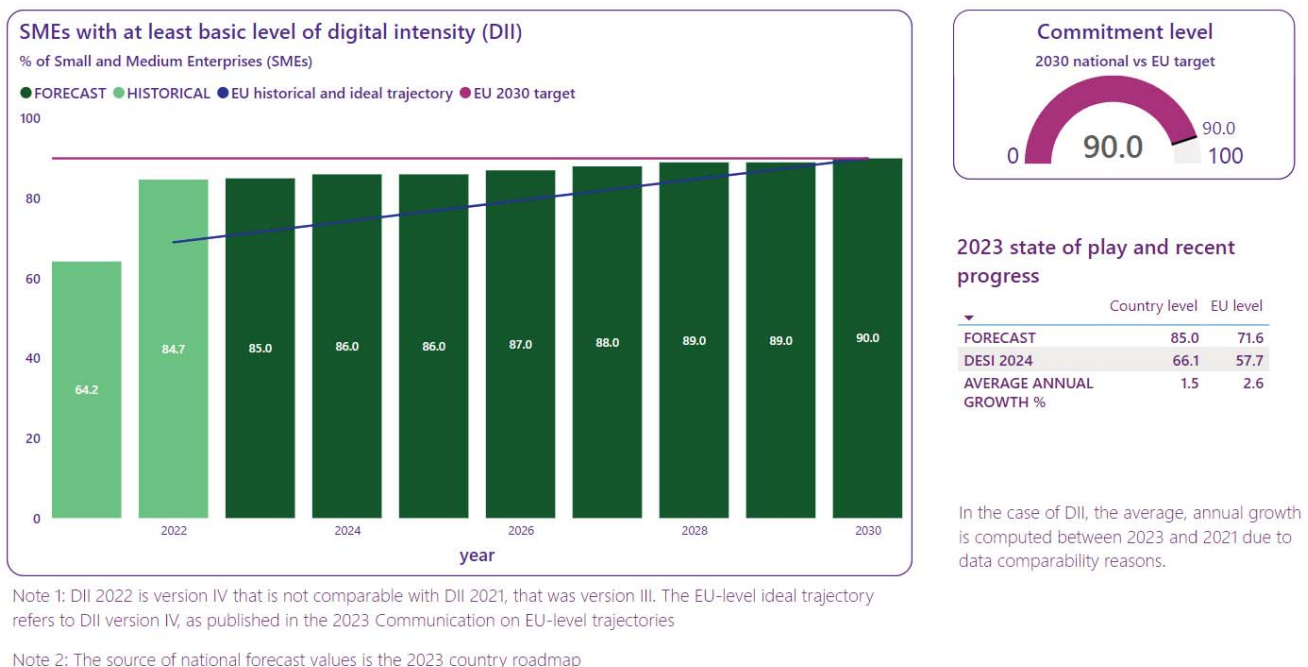
2.1.d Edge nodes

For Ireland to harness the full benefits of edge computing, it may need to evaluate and potentially continue to accelerate its deployment strategy. As of 2023, 24 edge nodes are estimated to have been deployed in Ireland.

The national roadmap has a target of 23 edge nodes for the public sector by 2025[78]. The measure on Public sector edge node project has already been allocated a public investment of EUR 41.5 million, with an additional EUR 63.4 million planned.

2.1.e Quantum technologies

Ireland published [Quantum 2030, Ireland's National Strategy for Quantum Technologies](#)**, with a core vision to make Ireland an internationally competitive hub in Quantum Technologies by 2030**. The strategy is based on five pillars: research, talent, collaboration, entrepreneurship, and awareness. While the national roadmap has no target for quantum, Ireland is part of the Governing Board of the EuroHPC Joint Undertaking, and is also hosting the HPC Spectra project, aimed at improving the EuroHPC JU's training strategy. It also participates in the National Competence Centres and the Development and Deployment of the European AI-on-demand Platform projects. Furthermore, under the EuroQCI initiative, Ireland is setting up a quantum communication infrastructure network with support from the Digital Europe programme.

2.2 Supporting EU-wide digital ecosystems and scaling up innovative enterprises

SMEs with at least basic level of digital intensity (DII)
% of Small and Medium Enterprises (SMEs)
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Values: 2022: 64.2, 84.7; 85.0; 86.0; 86.0; 87.0; 88.0; 89.0; 89.0; 2030: 90.0

Commitment level
2030 national vs EU target

90.0

0 — 90.0 — 100

2023 state of play and recent progress

	Country level	EU level
FORECAST	85.0	71.6
DESI 2024	66.1	57.7
AVERAGE ANNUAL GROWTH %	1.5	2.6

In the case of DII, the average, annual growth is computed between 2023 and 2021 due to data comparability reasons.

Note 1: DII 2022 is version IV that is not comparable with DII 2021, that was version III. The EU-level ideal trajectory refers to DII version IV, as published in the 2023 Communication on EU-level trajectories

Note 2: The source of national forecast values is the 2023 country roadmap

To enhance competitiveness, Ireland's strategy revolves around leveraging sustainable practices, scaling skills, and fostering innovation, as outlined in the 2022 White Paper on Enterprise. Central to this vision is

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[78] EC (2023) Edge deployment data report. Country Reports nodes.

the integration of digital transformation into enterprise policy, with a particular emphasis on adopting AI tools. Initiatives such as the Digital Transition Fund, operational until 2026, are instrumental in facilitating the digitalisation of businesses, thereby driving productivity gains and enhancing competitiveness.

Furthermore, there is a concerted effort to boost research and innovation, with a focus on nurturing the growth and competitiveness of ICT enterprises through advanced education and training programmes. Ireland also prioritises securing supply chains, both domestically and internationally. At the internal level, initiatives such as rural plans and European Digital Innovation Hubs (EDIHs) play a pivotal role in fostering interconnected digital ecosystems. In addition, Ireland is actively supporting the startup ecosystem through targeted actions and funding mechanisms.

2.2.a SMEs with at least basic digital intensity

With 66.1% of SMEs having at least a basic level of digital intensity, Ireland brings a very strong contribution to the EU's Digital Decade target on digitalisation of SMEs, while also showing a positive dynamic. This rate represents a 1.5% average yearly increase compared to the last comparable data. The basic level of digital intensity of Ireland is 8 percentage points higher than that of the EU.

Ireland's SMEs also perform very well in other indicators. 21% of business turnover at SME level comes from e-commerce, a rate much higher that the EU average of 12%, and the highest in the EU. 30% of SMEs sell online, among the top five countries, compared to an EU average of 19%.

Ireland's roadmap commits to achieving the EU-level target of 90% for 2030. It acknowledges the need to accelerate and enhance digital adoption across Irish businesses and has the ambition to achieve a significant productivity dividend from a further and sustained uptake in digital adoption across the Irish enterprise base. Digital transformation of SMEs is a priority area of the National SME and Entrepreneurship Growth Plan and Taskforce. In 2023, as part of Project Ireland 2040, the Build Digital Project was established to support the digital transformation of the construction sector, by supporting the sector's adoption of digital technologies. Two specific measures support this target. For businesses with low levels of digital maturity, a Digital Portal should raise awareness and provide basic guidance. The Digital Transition Fund, in addition to existing schemes like the Trading Online Voucher, the Online Retail Scheme, and Digital Start, aims to foster the digitalisation of businesses across products, processes, supply chains and business models. Funding in the form of grants under the Digital Transition Fund, also supported by Ireland's RRP, is split among nine digitalisation schemes, each supporting different activities linked to digitalisation.
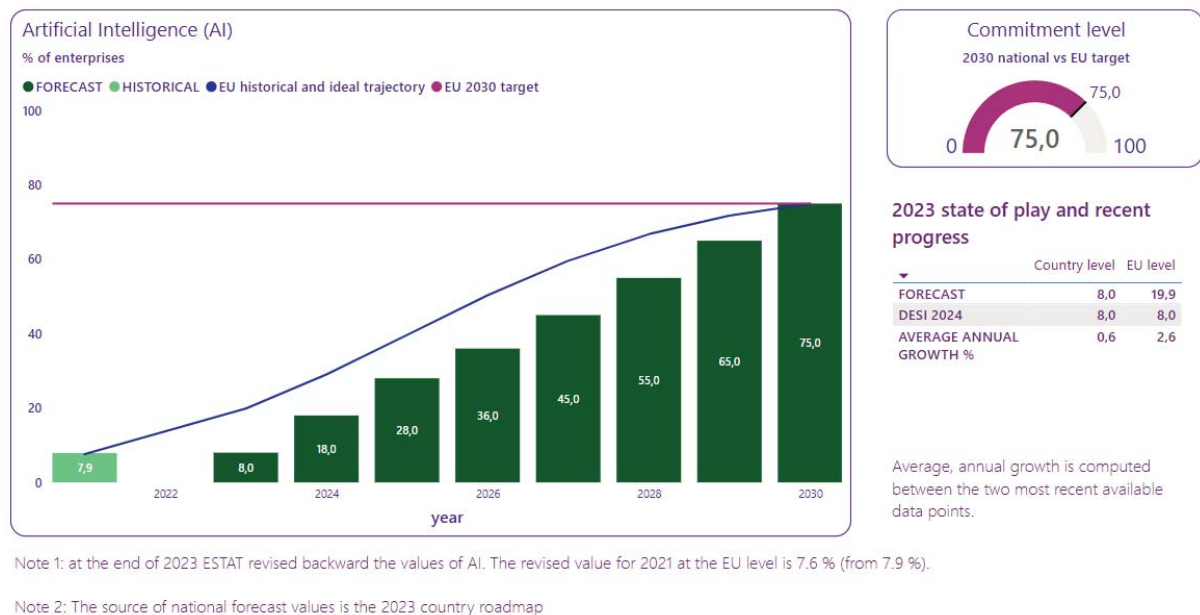
2.2.b Take up of cloud/ data analytics / AI
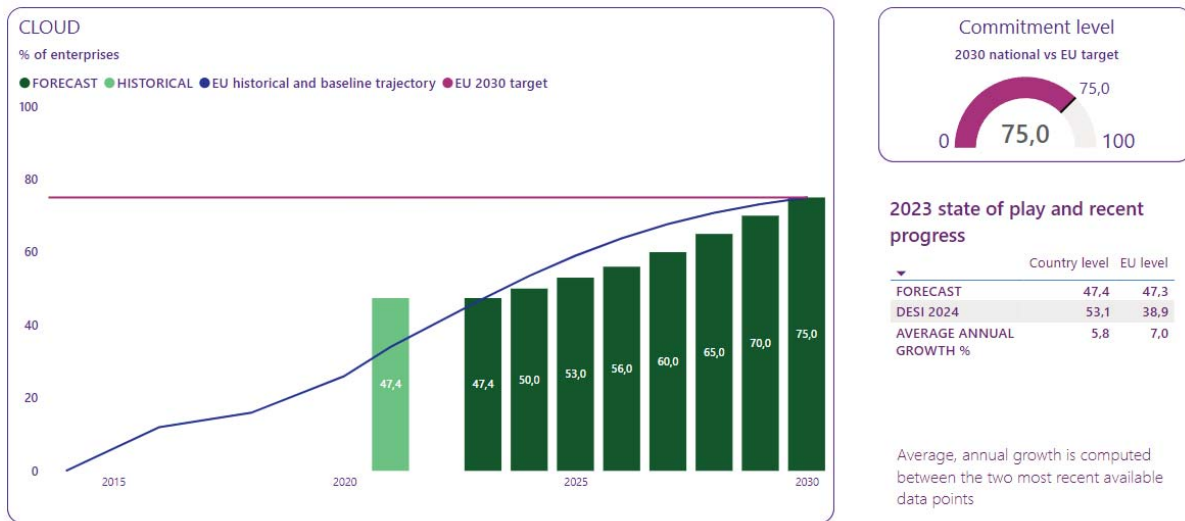
- **Cloud**

Note: The source of national forecast values is the 2023 country roadmap

Ireland brings a very strong contribution to the EU's Digital Decade target, while demonstrating a positive dynamic. The take-up of cloud solutions (intermediated or sophisticated cloud services) by Irish enterprises, at 53.1%, is well above the EU average (38.9%). The take-up rate shows a positive and relatively similar dynamic compared to the EU annual growth rate of +7% per year on average. Initiatives like the SME Data Migration Pilot from the Data2Sustain, one of four Irish European Digital Innovation Hubs (EDIH), guide enterprises through their transition from local to cloud-based storage.

Ireland's roadmap proposes a target of 75%, in line with the EU-level target and a prudent trajectory, with most of the take-up envisaged for after 2027.

- **Data analytics (Big data)[79]**

BIG DATA (DATA ANALYTICS as of 2023)

% of enterprises

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Commitment level
2030 national vs EU target

75,0
0   **75,0**   100

2023 state of play and recent progress

	Country level	EU level
FORECAST	22,7	34,6
DESI 2024	37,1	33,2
AVERAGE ANNUAL GROWTH %		

Annual growth cannot be computed in this case because Big Data was replaced by Data Analytics in 2023. The two indicators are not comparable.

Note: The source of national forecast values is the 2023 country roadmap

With a rate of 37.1%, Ireland brings a very strong contribution to the EU's Digital Decade target on data analytics, while also showing a positive dynamic. This rate is higher than the EU average of 33.2 %. The national roadmap sets up a target of 75% for 2030, in line with the EU-level target.

When considering all three technologies collectively, Ireland's rate for the KPI on 'Take-up by enterprises of AI, data analytics, or cloud' stands at 64.1%, surpassing the EU average of 54.6%. Ireland's roadmap includes several measures to boost the take-up of these and other technologies (e.g., cyber-security related) take-up. Apart from the establishment of four EDIHs and the SME and Entrepreneurship taskforce, the government receives leading expert advice from the industry through the Enterprise Digital Advisory Forum and various financial programmes (see below).

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[79] As of 2023, Big data was changed by Eurostat, in agreement with all the EU National Statistical Institutes, into Data analytics, which covers a broader range of technologies than just Big Data. For this reason, no comparison is possible with previous years.

- **Artificial Intelligence**

Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

Note 2: The source of national forecast values is the 2023 country roadmap

Ireland brings a positive contribution to the EU's Digital Decade target on AI, while demonstrating very little dynamic. Ireland's take-up of Artificial Intelligence rate is on par with the EU average, at 8% and substantially unchanged compared to the last available data (7.9% in 2021). As stated in the progress report on the National AI Strategy, progress has been made in some strands, like driving adoption of AI in Irish enterprises, with concrete examples in the pharmaceutical, biotech and health sectors.

To achieve the target of 75% proposed in the national roadmap, which is in line with the EU-level target, increased investment in AI take-up at all levels could help Ireland achieve its objectives.

2.2.c Unicorns, scale-ups and start-ups

Venture capital investments (seed and start-up and other early stage) in Ireland amounted to 0.05% of GDP. This figure is similar to that of bigger economies (Spain, Germany) but lower than that of the EU frontrunners (Finland, Netherlands, Sweden).

The national roadmap proposes a measure to ensure that at least 35% of state funding for start-ups and early-stage companies is directed to innovative digital businesses, with the ambition of nurturing potential digital unicorns. It also sets the target of at least 800 businesses receiving support by 2026 under the Digital Transition Fund which allocates EUR 85 million to support businesses to digitalise. Other financial programmes include the Seed and Venture Capital Scheme, to expire in 2024, and the Irish Innovation Seed Fund Programme. Ireland currently has 12 unicorns, but at this stage, its roadmap has not proposed yet a target for unicorns.

2.3 Strengthening cybersecurity & resilience

On the resilience objective, Ireland is prioritising investments in its ICT infrastructure. Due to its Atlantic Ocean front geographical position, Ireland has a key role concerning the subsea cable routes. Additional international routes, both transatlantic (EU to North/South America) and between Ireland and the EU neighbours, are required to meet growing demand for secure and resilient connectivity capable of meeting significant projected data flows and will require significant investment.

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On cybersecurity, statistics on Ireland's ICT infrastructure reveals that 17% of enterprises are vulnerable to disruptions from cyberattacks and 15% are vulnerable to system failures. Irish enterprises are however well aware of security incidents and consequences, as 42.3% of them have insurance against ICT incidents, a rate only below Denmark and Sweden at EU level. Eurobarometer results show that 89% of the respondents think that Improved cybersecurity, better protection of online data and safety of digital technologies would facilitate their daily use of digital technologies.

Under the National Challenge Fund, supported by the RRP and managed by Science Foundation Ireland, the Digital for Resilience Challenge provides support to research teams to focus on enhancing Ireland's capabilities in crisis prediction and response. Researchers have the opportunity to explore the development of new digitally enabled methods, models and tools to better understand the potential impacts on future environmental, social or economic scenarios and shock events. The Future Digital Challenge focuses on supporting research teams to create and apply disruptive digital technologies that contribute to the country's recovery and resilience. One particular example is the 'Digital Resilience for SMEs' project which aims to empower SMEs to reduce their cyber security risk through a suite of support measures.

In 2023, Ireland carried out a midterm review of the National Cyber Security Strategy, guided by a stakeholder consultation process and setting out new strategic actions to be implemented within the lifetime of the strategy. The key initiatives include:

- Continued investment in capacity building for the National Cyber Security Centre particularly in its ability to monitor and respond to cybersecurity incidents and developing threats.

- Develop further sectoral information sharing networks with relevant operators of critical national infrastructure and important industry sectors including Digital Infrastructure and Energy Sectors.

- The establishment of a National Counter-Ransomware Task Force to coordinate efforts to respond to this severe cyber threat by the NCSC.

- Using a multistakeholder approach to address the cyber skills deficit challenge and support the further development of the cybersecurity industry in Ireland.

An annual update on the implementation of the National Cyber Security Strategy 2019-2024 is due to be published at the end of June 2024.

Within the National Cyber Security Centre (NCSC), a new National Cyber Security Coordination and Development Centre was announced. The NCC-IE project will run for 2 years and is being jointly funded by an EU contribution of EUR 2 million via the Digital Europe Programme and EUR 2.2 million from national funds. It will coordinate with industry, academia, research, and other stakeholders to develop awareness and strengthen the uptake of cybersecurity solutions. The NCSC is also availing of support services via ENISA's Cybersecurity Support Action and developing a cybersecurity industrial strategy.

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Best practice: *The National Broadband Plan*

The National Broadband Plan plays a pivotal role in facilitating Ireland's digital transformation, ensuring that citizens and businesses across remote areas have equitable access to the opportunities offered by a connected and digital economy. By promoting universal connectivity, the plan aims to provide equal access to high-speed broadband, irrespective of geographic location, thereby upholding relevant digital rights and principles.

Moreover, the plan is an integral component of the Rural Development Policy 2021-2025, which seeks to sustain and enhance the population of rural areas. It aims to revitalize town centres, reduce commuting times, lower transport emissions, and enhance overall quality of life by supporting the development of a highly efficient Gigabit infrastructure.

Despite initial delays, including those attributed to COVID-related challenges, the plan achieved its 2023 target of passing 185 000 premises by October 2023. By the end of 2023, over 205 000 premises across all counties were passed and made available for immediate connection, surpassing the target by over 10%. In addition, in 2023, National Broadband Ireland (NBI) completed fibre deployment activities on 10 islands of Donegal, Mayo, Galway, and Cork counties, with progress underway for an additional 5 islands.

Spanning 96% of Ireland's landmass, the National Broadband Plan is the largest infrastructural endeavour in rural Ireland since rural electrification. It aims to provide high-speed broadband access to 1.1 million people (around 23% of Ireland's population) residing and working in almost 564 000 premises.

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3 Protecting and empowering EU people and society

3.1 Empowering people and bringing the digital transformation closer to their needs

Ireland's progress towards achieving the EU's digital decade target on basic digital skills has been commendable. With 72.9% of the population equipped with basic digital skills in 2023, surpassing the EU average, Ireland's strategic initiatives, such as the Adult Literacy for Life and Digital Strategy for Schools, have played a pivotal role in fostering digital competencies across various segments of society. Moreover, the implementation of the STEM Education Implementation Plan and the integration of digital literacy in the new Primary Curriculum Framework underscore Ireland's commitment to empowering people through education and skill development. Furthermore, Ireland's efforts to address the demand for ICT specialists, with proposed measures and investments, reflect a concerted approach towards bridging divides and ensuring that individuals are equipped with the necessary skills to thrive in a digital-driven economy.

In tandem with efforts to empower individuals, Ireland is also taking significant steps to enhance digital public services while fostering inclusion and accessibility. With a focus on advancing digital solutions for citizens and businesses, Ireland aims to ensure that public services are not only user-friendly and efficient but also accessible to all segments of society. Initiatives such as the development of a national framework for public procurement and the setting up of a Shared Government Data Centre facility underscore Ireland's commitment to modernising public services while promoting efficiency. Under the National Challenge Fund, supported by the RRP and managed by Science Foundation Ireland, The OurTech Challenge focuses on creating people-centric digital-first public services, and new ways to strengthen the connections between people, communities and government.

Investments in digital health initiatives, including the Digital Health & Social Care Strategic Framework 2024-2030, demonstrate Ireland's dedication to leveraging digital technologies to increase healthcare accessibility and patient empowerment though more efforts should be made to improve its poor score in the e-Health indicator.

3.1.1 Equipping people with digital skills
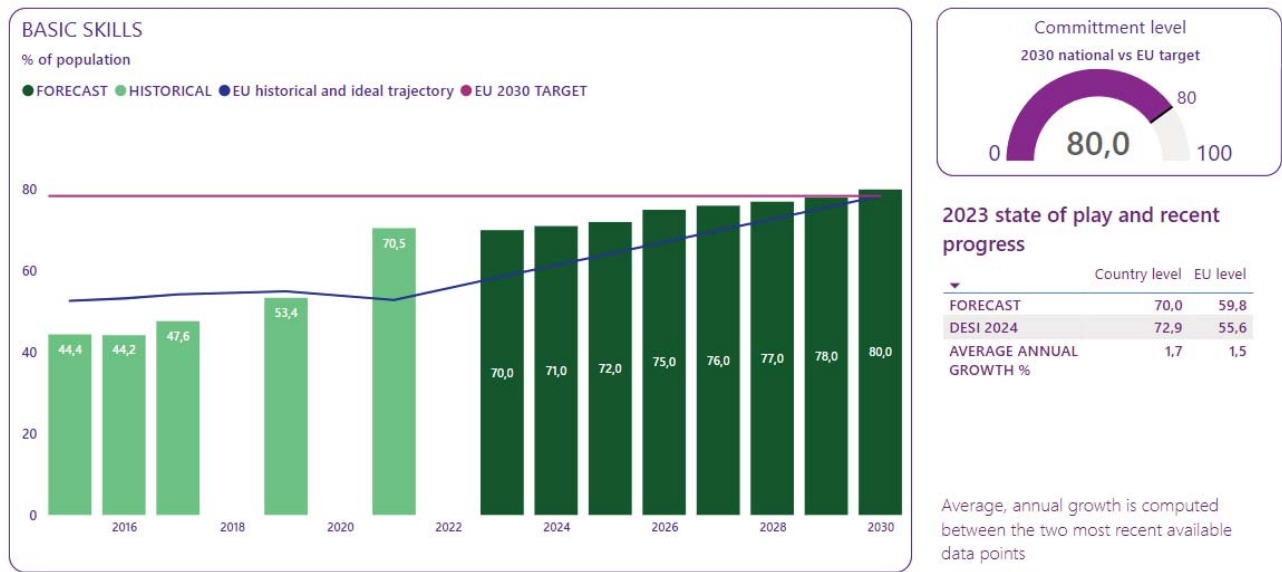
3.1.1.a Basic digital skills

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Ireland brings a very strong contribution to the EU's Digital Decade target on basic digital skills while also showing a comparatively dynamic growth. In 2023, 72.9% of the Irish population had at least basic digital skills, above the EU average of 55.6%, with only the Netherlands and Finland having higher rates. Ireland is in the same position in the above basic digital skills indicator, with a rate of 43.8% it is the third highest and well above the EU average (27.3%).

At the current growth rate, Ireland is well placed to achieve its national roadmap target of 80% before 2030. Ireland has already taken appropriate measures to increase digital skills, including their strategies Adult Literacy for Life and Digital Strategy for Schools, both of which are included in Ireland's RRP, and the National Further Education and Training Strategy. Its new Literacy, Numeracy and Digital Literacy Strategy, though expected for 2023, should complete the holistic approach to digital skills for every citizen. The country has also launched the STEM Education Implementation Plan to 2026. This is the second implementation plan under the STEM Education Policy Statement 2017–2026. In its new Primary Curriculum Framework presented in 2023, Ireland recognized 'Being a digital learner' as a key competency.

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3.1.1.b ICT Specialists

ICT SPECIALISTS
% of total employment
● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Values: 4,7 | 4,8 | 4,6 | 4,9 | 5,0 | 4,8 | 4,9 | 5,7 | 6,3 | 6,3 | 7,1 | 7,5 | 7,9 | 8,2 | 8,6 | 8,9 | 9,3 | 9,6

Commitment level
2030 national vs EU target
10,0
0   9,6   15

2023 state of play and recent progress

	Country level	EU level
FORECAST	7,1	5,4
DESI 2024	6,2	4,8
AVERAGE ANNUAL GROWTH %	-1,6	4,3

Average, annual growth is computed between the two most recent available data points

Note: The source of national forecast values is the 2023 country roadmap

Ireland brings a very strong contribution to the EU's Digital Decade target while demonstrating a limited dynamic. 6.2% of people employed are classified as ICT specialists, a rate higher than the EU average of 4.8%, but substantially unchanged in comparison to Ireland's previous rate.

The proportionate target proposed in Ireland's roadmap to achieve the EU-level target of 20 million ICT specialists in employment by 2030 is 226 000 people, equating to around 8 700 additional graduates or ICT specialists entering the country per year. With an estimated budget of EUR 957 million for this target, the national roadmap proposes nine measures to reinforce and meet the demand for ICT specialists.

In their 2023 recruitment agency survey[80], SOLAS, the State agency that oversees the further education and training sector, reported that 41% of vacancies in ICT were considered difficult to fill. Respondents stated that standard digital skills are now the minimum expectation across most roles. eCollege, SOLAS's digital gateway, and other private initiatives, aim to meet the needs of employers in the ICT sector offering free up-to-date training. Skillnet Ireland, the national talent development agency, delivered digital skills programmes through their six digital-focused networks. In their latest 2024 business survey[81], 65% of all businesses highlighted that their staff would require some form of digital upskilling in the coming years.

Ireland is setting up appropriate structures, including a High-Level Skills Implementation Group, to deliver an action plan to respond to the recommendations of the OECD Review of the National Skills Strategy published in 2023. It is working on a research programme on skills requirements, including the identification of specific high-level ICT skills deficits and requirements within the labour market. To develop Ireland's higher and further (vocational) education and research and innovation systems, a more unified tertiary education and research system is being implemented.

The National Training Fund, financed by a levy on employers, is a fundamental source of funding to provide training for those seeking to take up employment and to upskill those already in employment. However, its

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[80] https://www.solas.ie/f/70398/x/837c65f80c/solas-difficult-to-fill-vacancies-survey.pdf
[81] https://www.skillnetireland.ie/insights/irelands-talent-landscape-2024

accumulated surplus is expected to reach EUR 2 billion by 2025. A comprehensive reform of the Fund would help respond to industry skills needs. The RRP also provides support to technological universities (the National Technological University Transformation for Recovery and Resilience consortium, NTUTORR) to reform their study programmes and staff training with a focus also on digital transformation and learning for sustainability.

3.1.2 Key digital public services and solutions – trusted, user-friendly, and accessible to all

3.1.2.a e-ID

Ireland plans to successfully notify and meet the EU 2030 target for both e-ID and the digital wallet. Ireland has not yet notified an e-ID scheme to the Commission under the eIDAS Regulation, though it has set a target of 80% of eligible citizens using MyGovID by 2030 and it is actively testing a new online verification process. MyGovID had close to 2.3 million verified accounts in October 2023[82], accounting for over 50% of the adult population, with a significant increase in uptake in recent years.

The use of e-ID to access online services for private purpose, provided by public services or the business sector, is above the EU average. 64.9% of Irish citizens have used their e-ID to access services provided by public services in the last 12 months, compared to the EU average of 35.7%.

Further steps are being taken, such as conducting a pre-notification health check of Ireland's existing e-ID infrastructure and processes, along with iterating the national e-ID for the EU Digital Identity Wallet, currently being piloted by a test group of policymakers. Ireland is actively involved in the Digital Credentials for Europe project (DC4EU), which seeks to implement the eIDAS trust framework, particularly in the education and social security sectors. Engagements are also being taken on the potential future use of the national e-ID service in other sectors, such as banking and insurance.

3.1.2.b Digitalisation of public services for citizens and businesses

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

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[82] https://www.gov.ie/en/press-release/e967d-publication-of-harnessing-digital-2023-progress-report/
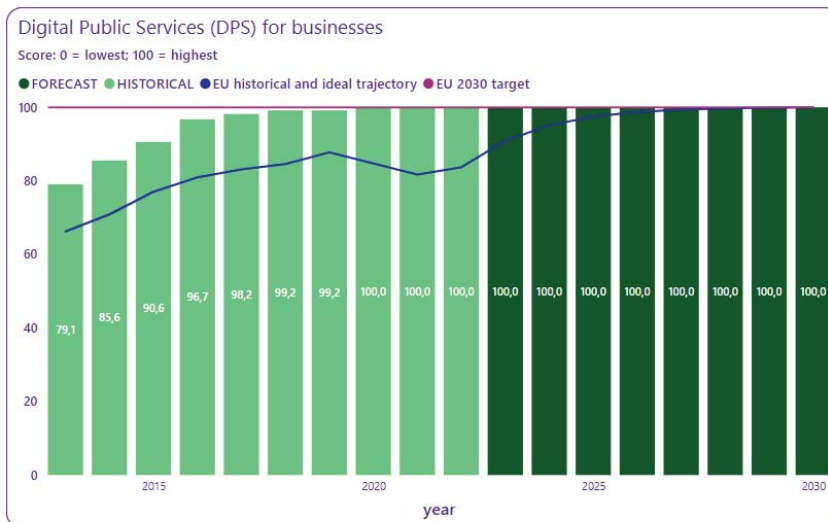
Digital Public Services (DPS) for businesses
Score: 0 = lowest; 100 = highest

● FORECAST ● HISTORICAL ● EU historical and ideal trajectory ● EU 2030 target

Chart values (historical bars): 79,1 · 85,6 · 90,6 · 96,7 · 98,2 · 99,2 · 99,2 · 100,0 · 100,0 · 100,0
Forecast bars: 100,0 · 100,0 · 100,0 · 100,0 · 100,0 · 100,0 · 100,0 · 100,0

year

Commitment level
2030 national vs EU target

0   100,0   100

2023 state of play and recent progress

	Country level	EU level
FORECAST	100,0	90,9
DESI 2024	100,0	85,4
AVERAGE ANNUAL GROWTH %	0,0	2,0

Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Ireland brings a positive contribution to the EU's Digital Decade target, while demonstrating little dynamic. It ranks above the EU average for public services for citizens (81.2 vs 79.4), with no relative growth compared to last year. Over half of the 16+ population uses government services at least 5+ times per year, 90% of which are accessible online. However, a Digital Public Services research aimed at individual users finds that there is room for improvement to help ease online government services experience[83].

The development of the related Life Events portal is advancing, with driving licences and birth certificates to be the first services available. Birth certificates, driving licences and a MyHealthID will also be amongst the first services available through the digital wallet.

Ireland brings a very strong contribution to the EU's Digital Decade target, having reached the EU target of 100 on Digital Public Services for businesses. This milestone, only shared with Finland and Malta, was achieved by the country in 2020, the first one in the EU reaching this target. Specific actions are under way in this area, e.g., the development of a national framework for public procurement of design services that encourages greater participation by small businesses[84].

Ireland is implementing actions in several priority areas, in linewith the Digital and ICT Strategy for Ireland's Public Service, 'Connecting Government 2030'. To harness data effectively, the Public Service API[85] Catalogue has been released, a key deliverable in the Public Service Data Strategy 2019-2023, while the Public Service API Standards and Guidelines document will be published shortly. Construction is progressing on a Shared Government Data Centre facility, to provide a fit for purpose modern, secure, and green facility, with the help of the RRF. Ireland has also presented its second Open Data Strategy for 2023-2027.

On digital skills in public services, the Civil Service initiated in 2023 a pilot reskilling programme for existing staff to upskill staff members to work in ICT. The Public Service Apprenticeship Plan was also published in 2023, with the ambition of having the civil and public service reach 750 apprentice registrations per year by

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[83] https://www.gov.ie/en/consultation/05e8f-public-consultation-of-public-services/
[84] https://www.gov.ie/en/publication/1e3e2-action/
[85] Application Programming Interface.

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2025. In 2023, 101 ICT apprentices were recruited to the Civil Service to meet the demand for in-house ICT skills. The Public Service Agreement 2024-2026 also highlights the importance of acquiring the digital skills necessary to perform effectively in an increasingly digital environment.

Ireland's public procurement, accounting for approximately 8.8% of GDP in 2020, is soon to embark on a digital transformation strategy, backed by technical assistance from the OECD and funding from the EU.

3.1.2.c e-Health
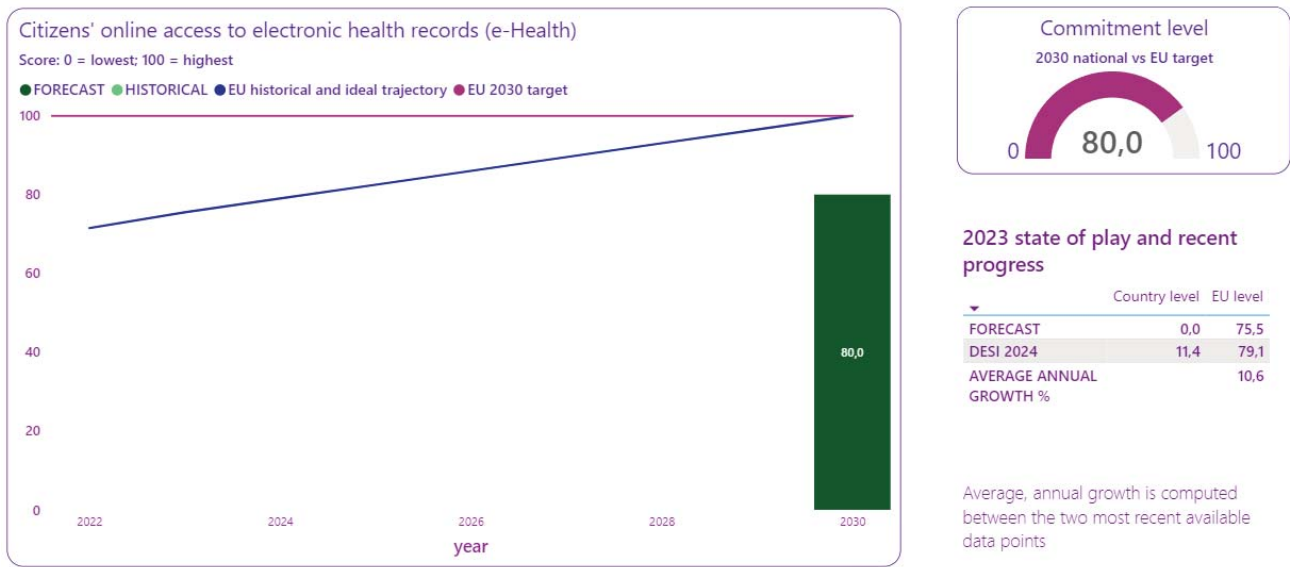
Note: The source of national forecast values is the 2023 country roadmap

Ireland has untapped potential to contribute to the EU Digital Decade target on e-health, while showing limited dynamic. In the latest Eurobarometer, 85% of respondents in Ireland said that digital technologies will be fairly important or very important for accessing or receiving healthcare services. In 2023, Ireland scored 11 out of 100 on the e-Health indicator, the lowest in the EU. For 2030, Ireland aims at a score of 80 on e-Health, far below the 100 EU-level score, and not in line with the requirements under the upcoming European Health Data Space regulation.

Digital Health is a priority for Ireland, including developing the Digital Health & Social Care Strategic Framework 2024-2030, that will focus on empowering and enabling patients, and on identifying the need for a patient app that will enable the delivery of digital patient records for the first time in Ireland. The framework is being developed in parallel with the Health Information Bill, which supports digital and data initiatives in healthcare. The bill should allow healthcare providers to view patient records held by others (shared care record) which will eventually evolve into a centralised electronic health record. Current deployments are being adjusted to take into account the 2021 cyber-attack and put in place measures to increase cyber resilience.

Other initiatives include the e-Pharmacy programme and the roll-out of the national individual health identifier. Ireland participates in the EU's eHealth Network to deliver patient summaries and electronic prescription for cross-border use cases and has participated in all of the test cycles but has not yet gone live with these services.

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3.2 Building a safe and human centric digital environment and preserving our democracy

Ireland has taken concrete actions to contribute to the European objective of ensuring privacy and safety online. The Online Safety and Media Regulation (OSMR) Act entered into force in 2023, formally establishing a new independent multi-person regulator known as Coimisiún na Meán. The OSMR Act, together with the EU Digital Services Act and the EU Terrorist Content Online Regulation, form the Online Safety Framework. The framework is developed and applied by Coimisiún na Meán with a view to minimising the availability of harmful online content, including offence-specific content such as hate speech and certain offensive and abusive communications, as well as serious cyber-bullying material and material that promotes or encourages eating disorders, self-harm, or suicide. The OSMR Act imposes obligations that aim to ensure that relevant designated online services are taking the appropriate systemic measures to ensure that children are not accessing inappropriate online content.

Coimisiún na Meán opened a public consultation on its draft Online Safety Code for video-sharing platform services in December 2023. An Coimisiún also has a role in carrying out educational initiatives around issues related to online safety and media literacy.

An Coimisiún Toghcháin (the Electoral Commission), established in 2023 under the Electoral Reform Act 2022 is now operational. The establishment of An Coimisiún Toghcháin will strengthen Ireland's electoral system as a whole. The Electoral Reform Act provides An Coimisiún with powers to regulate online paid political advertising during electoral periods and to investigate and monitor online disinformation, online misinformation and manipulative or inauthentic behaviour online during election campaign periods, as well as functions to prevent manipulative or inauthentic behaviours online.

On the use of AI, 87% of Eurobarometer respondents in Ireland consider it very important that public authorities shape the development of AI and other digital technologies to ensure they respect our rights and values. Interim guidelines for the use of AI, developed by a cross-Department Working Group on Trustworthy AI in the Public Service, are available to public service organisations considering the use of AI tools. The guidelines outline the government's commitment to the ethical use of AI, encourages risk assessments to be carried out, and outlines the relevant safeguards and considerations when exploring the use of AI tools.

The Digital Regulators Group (DRG) was set up in line with the Irish Digital Strategy, 'Harnessing Digital – The Digital Ireland Framework', and in anticipation of the diverse cross-jurisdictional EU legislative instruments focusing on the digital economy. The DRG comprises the Commission for Communications Regulation (ComReg), the Data Protection Commission (DPC), the Competition and Consumer Protection Commission (CCPC), and Coimisiún na Meán (Media Commission). The group will identify areas of regulatory commonality and challenge, with a view to maximising the coherence of digital and regulatory structures, to support a wider regulatory co-operation framework. A clear, consistent, and stable regulatory framework that protects consumers and citizens while supporting an innovative sector is central to Ireland's future as a top destination for digital investment.

4 Leveraging digital transformation for a smart greening

In the latest Eurobarometer survey, 89% of Irish respondents said that it is fairly or very important that public authorities ensure that digital technologies serve the green transition. **Under the Programme for Government, Ireland has committed to reducing emissions by 51% across all sectors of the economy by 2030 and to become net zero by 2050**. Central to achieving both the green and digital transitions is the decarbonisation of the electricity supply.

The White Paper on Enterprise places the green and digital transition at the centre of future enterprise policy. Progressing the circular economy is also key to shifting from linear 'take-make-waste' supply chains and business models to more sustainable patterns of production and consumption. In Ireland, the Circular Economy and Miscellaneous Provisions Act was signed into law in 2022, underpinning Ireland's shift to circularity and reducing greenhouse gas emissions.

Regarding climate and environmental considerations, Irish enterprises demonstrate commendable awareness and proactivity. However, there's not yet a clear commitment to energy efficiency, with only 20% of businesses implementing measures affecting the energy consumption of ICT equipment. While 56% of enterprises consider the environmental impact of ICT services or equipment prior to selection, among those with a high digital intensity index, only 30% have considered the environmental impact of their ICT choices[86]. This suggests an opportunity for businesses to further integrate eco-friendly strategies with their digital growth objectives. The Build Digital Project, as mentioned earlier, takes the lead in promoting the integration of digital technologies within the construction sector. Alongside this initiative, the Office of Government Procurement has introduced new cost and carbon reporting templates for implementation within the Capital Works Management Framework. These developments offer opportunities to track and mitigate both embodied and operational carbon in construction projects.

Ireland's government is also implementing specific actions to enhance the green transition. Its new data processing centre will result in substantial savings in life-cycle greenhouse gas emissions. The target PUE[87] for the new government data centre will be 1.2, in line with the Climate Neutral Data Centre Pact target of 1.3 for new data centres in cool climates. The National Remote Work Strategy, coupled with the National Broadband plan, aim to make remote working a lasting feature of Ireland's workforce in a way that can maximise digital and environmental benefits. ComReg is an active member of the Body of European Regulators for Electronic Communications (BEREC) Working Group (WG) on Sustainability and contributed to the report 'Sustainability Indicators for Electronic Communications Networks and Services'[88], published in 2023. ComReg is also involved in BEREC's 'Report on empowering end-users through environmental transparency on digital products' expected in 2024.

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[86] EC (2023) Edge nodes.

[87] The demonstrated life-cycle greenhouse gas emission savings are measured through reductions in Power Usage Effectiveness (PUE), a metric used to assess the energy efficiency of a data centre. The closer the PUE value is to 1, the more efficient is the data centre, as a greater share of the power consumed is being used by the IT equipment and not by other functions, such as cooling needs, lighting, and surveillance equipment.

[88] https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-sustainability-indicators-for-electronic-communications-networks-and-services

Annex I – National roadmap analysis

Ireland's National Digital Decade Strategic Roadmap

Ireland submitted its national strategic roadmap in November 2023, in accordance with Article 7 of the Digital Decade Policy Programme Decision, and it has been published in May 2024. Ireland has adopted a comprehensive roadmap, with all sections completed. Challenges, strengths, and assets are well explained. Most information on targets is provided, except for edge nodes, semiconductors, quantum, unicorns and eID. Ireland has presented 59 measures with an estimated global budget of EUR 14.9 billion. Sufficient elements are presented to show the relation between Ireland's national digital strategy and the objectives of the Digital Decade policy programme and the European Declaration on Digital Rights and Principles. Multi-country projects, EDICs, Joint Undertakings and initiatives show the country cooperation at EU level.

The roadmap refers to existing strategies and initiatives, notably the national digital strategy 'Harnessing Digital', published in 2022. However, some important elements needed for the roadmap analysis are lacking (e.g., expected impact of measures, some targets and trajectories (unicorns, semiconductor, quantum). All targets provided are aligned with the EU targets with one exception (e-Health).

Digital Decade target/objective	Budget (EUR million)	Number of measures
Connectivity Gigabit	2 953.7	6
Connectivity 5G	672.0	2
Semiconductors	0.0	2
Edge nodes	41.5	1
Quantum computing	0.0	5
SME take up	85.1	2
Cloud/AI/Big Data uptake	27.0	3
Cloud only uptake	-	-
AI only uptake	-	-
Big data uptake	-	-
Unicorns	4 090.0	5
Basic Digital Skills	201.0	7
ICT Specialists	957.1	9
e-ID	0.0	1
Key Public Services	193.0	10
e-Health	174.3	6
Objectives	-	-
Total	**9 394.7**	**59**

The highest number of measures are allocated to Digital public services (10 measures), ICT specialists (9 measures with a public budget of EUR 957 million) and Connectivity (8 measures with a total budget of EUR 3626 million). Unicorns account for 5 measures and a budget of around EUR 4090 million. Many measures are new (22, around two-fifths of all measures).

Ireland presents a balanced mix of measures addressing both private and public needs, along with initiatives on connectivity and skills enhancement. These measures retake the core actions outlined in existing national digital strategies and align them with several objectives outlined in the Digital Decade agenda, including enhancing competitiveness, bolstering cybersecurity, and empowering citizens. Overall, the roadmap demonstrates coherence across various aspects of digitalisation and introduces innovative proposals aimed at maintaining leadership and attaining the EU's targets.

Annex II – Factsheet on multi-country projects (MCPs) and funding

MCP and EDICs

Ireland is a member of the Alliance for Language Technologies European Digital Infrastructure Consortium (ALT-EDIC, already set up) which addresses the scarcity of European language data needed for AI solutions.

It participates in the Chips Joint Undertaking and the European High Performance Computing Joint Undertaking (EuroHPC JU) as well as in the Important Project of Common European Interest in microelectronics and communication technologies (IPCEI ME/CT).

Ireland is also part of the working group on future Europe's 1+Million Genome Initiative (1+MG) EDIC.

EU funding for Digital in Ireland

Ireland's Recovery and Resilience Plan (RRP) assigns EUR 312 million (34.2% of a total allocation of EUR 914 million) to the digital transition. According to a Joint Research Centre's study[89] this amount fully contributes to the Digital Decade targets. The largest digital measure of the RRP is dedicated to the digitalisation of the public health sector (EUR 75 million). Milestones and targets for businesses, including SMEs and unicorns, are related to measures having a budget of 97 EUR million.

In May 2024, a first payment request led to the disbursement of EUR 324 million with all milestones and targets satisfactorily fulfilled.

According to the same mapping study from JRC, Ireland also received EUR 34.8 million of DD-relevant budget from cohesion policy funds with an accent given to digitalisation of enterprises, including fostering the growth of unicorns.

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[89] Based on an estimation of the possible contribution to the Digital Decade (Joint Research Centre report 'Mapping EU level funding instruments to Digital Decade targets - 2024 update' (Signorelli et al., 2024)).

State of the Digital Decade 2024

Italy

1 Executive summary

Italy has untapped potential to the European Union's (EU) Digital Decade objectives and targets, in view of a successful digitalisation that fosters competitiveness, resilience, sovereignty, European values and climate action.

In 2023, Italy made progress in the area of e-government, in particular in e-health and key digital public services for businesses and continued to advance on gigabit networks roll-out. However, despite some progress, particularly important **challenges persist** in digital skills, while Italian enterprises lag behind in the adoption of advanced technologies such as AI.

In recent years, also building on the Recovery and Resilience Plan, Italy **put in place significant efforts for the digital transformation of the country**, intensifying initiatives to digitalise the public administration, support the digitalisation of enterprises and improve digital skills across the country. Additionally, Italy can count on a robust foundation in areas as such as semiconductors, edge computing and quantum, which are key for the **country's position and technological leadership**.

According to the **Special Eurobarometer 'Digital Decade 2024'**[90], 71% of the Italians consider that the digitalisation of daily public and private services is making their life easier (73% in the EU), a figure that needs to be improved by bringing all citizens on board.

Participating in **joint efforts with other EU Member States** also remains crucial. Currently, Italy is involved in nine **European Digital Infrastructure Consortia** (EDICs) already set up or in the making[91], and in the Important Projects of Common European Interest (IPCEI) in the area of cloud infrastructure and services and microelectronics.

Italy allocates 25.6% of its total Recovery and Resilience Plan to digital (EUR 47 billion)[92], which **represents a significant opportunity but remains insufficient to fully reach the Digital Decade targets and requires strong focus on implementation and** alignment with the various existing strategic plans. Under Cohesion Policy, an additional EUR 5.5 billion (13% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[93].

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[90] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351
[91] Information updated on 31 May 2024.
[92] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.
[93] This amount includes all investment specifically aimed at or substantially contributing to digital transformation in the 2021-2027 Cohesion Policy programming period. The source funds are the European Regional Development Fund, the Cohesion Fund, the European Social Fund Plus, and the Just Transition Fund.

Digital Decade KPI [1]	Italy			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	IT	EU
Fixed Very High Capacity Network (VHCN) coverage	53.7%	59.6%	11.0%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage [2]	53.7%	59.6%	11.0%	64.0%	13.5%	100%	-
Overall 5G coverage	99.7%	99.5%	-0.2%[3]	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		77		1 186		946	10 000
SMEs with at least a basic level of digital intensity	60.3%	60.7%	0.3%	57.7%	2.6%	90%	90%
Cloud	51.9%	55.1%	3.0%	38.9%	7.0%	74%	75%
Artificial Intelligence	6.2%	5.0%	-10.2%[4]	8.0%	2.6%	60%	75%
Data analytics	NA	26.6%	NA	33.2%	NA	60%	75%
AI or Cloud or Data analytics	NA	63.1%	NA	54.6%	NA		75%
Unicorns		7		263		16	500
At least basic digital skills	45.6%	45.8%	0.2%	55.6%	1.5%	74.6%	80%
ICT specialists	3.9%	4.1%	5.1%	4.8%	4.3%	7.3%	~10%
eID scheme notification		Yes					
Digital public services for citizens	67.9	68.3	0.5%	79.4	3.1%	100	100
Digital public services for businesses	74.7	76.3	2.1%	85.4	2.0%	100	100
Access to e-Health records	71.3	82.7	15.9%	79.1	10.6%	100	100

[1] See the methodological note for the description of the indicators and other descriptive metrics.
[2] The indicator on VHCN coverage and the indicator on FTTP coverage coincide.
[3] The variation does not reflect a change in coverage, but it is the consequence of small refinements in criteria adopted to estimate the coverage.
[4] The variation between the two years is not considered statistically significant but in line with the stagnation of this indicator.

National Digital Decade strategic roadmap

With respect to **Italy's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating **a very high ambition** and, based on this document, intends to devote **significant effort** to achieve the Digital Decade objectives and targets. However, **the formal adoption and publication of the roadmap at the national level,** which is crucial for the country to fully commit towards these ambitions, **is still pending**.

The roadmap provides a **complete overview**, covering **all targets to 2030**. While targets are generally ambitious and in line with the EU targets, those on basic digital skills and ICT specialists and on the uptake of Artificial Intelligence (AI) and data analytics remain below the EU levels, reflecting only the measures currently in place. The roadmap outlines a total of over **60 policy measures with a budget of over EUR 32 billion (about 1.6% of GDP)**. Accent is on improving digital skills, ICT specialists and digital public services. However, some areas, including unicorns and uptake of AI, lack targeted measures. A more comprehensive approach could be taken regarding the country's position in key technology areas, such as semiconductors and quantum.

Recommendations for the roadmap

Italy should, when submitting adjustments to its national roadmap in accordance with Article 8(3) of the DDPP Decision:

- **TARGETS:** (i) Provide a trajectory for the target on unicorns; (ii) Consider aligning the level of ambition of targets for basic digital skills, ICT specialists and technologies take up (AI, cloud, data analytics) to the EU's target.

- **MEASURES:** (i) Strengthen and/or better tailor the measures contributing to targets that are the most difficult to achieve, especially for **skills, ICT specialists, take up of AI and big data analytics**; (ii) Specify the measures that support the **target on unicorns**; (iii) Consider providing a more comprehensive analysis and overview of the measures and strategies for **semiconductors and quantum**; (iv) Review the **budget** description of all measures, ensuring completeness and accuracy; (v) Provide more information on the i**mplementation of digital rights and principles** (and Digital Decade general objectives), including what national measures contribute to it.

- **CONSULTATION:** Organize a consultation process on the roadmap, according to the national rules, and report on it.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' reveals that, in Italy, 49% of the population believes the EU protects their digital rights well, and while it marks a 6-point decline from the previous year, still remains above the EU average of 45%. Confidence in digital privacy stands at 57%, also above the EU average. Concerns include the safety of digital environments for children, with 45% expressing worry, and 40% are concerned about control over personal data. Despite these concerns, 83% of Italians recognize the importance of digital technologies for accessing public services, and 81% for connecting with friends and family, highlighting a strong appreciation for digital advancements. The monitoring of the Declaration on Digital Rights and Principles shows that increasing the profile of the Declaration at national level and fostering better stakeholder engagement could help improve outcomes in the years to come[94].

A competitive, sovereign and resilient EU based on technological leadership

The country is making progress in deploying connectivity networks, while advanced technologies such as edge, quantum and semiconductors are increasingly gaining attention. Sustaining this momentum should remain a priority in order to strengthen the country's capabilities and positioning. While Italy is advanced in general 5G coverage, continued and rapid progress to deploy fixed Very High-Capacity Networks (VHCN), and specifically fibre-to-the-premises networks (FTTP), is needed, next to increased efforts to link the connectivity infrastructure with cloud and edge computing capabilities. In addition, more efforts should be devoted to improving the Quality of Service of 5G networks and provide on a large scale the superior performance that is needed for advanced use cases, especially for business-to-business (B2B) communications.

The presence of key projects and centres of excellence in quantum capabilities could boost Italy's ambitions in the field, but the level of investment needs careful assessment. The semiconductor sector is gaining attention with growing investments, requiring a coherent vision and sustained efforts.

The uptake of technologies is relatively high among Italian enterprises, including SMEs. However, major gaps remain in the use of AI and in the area of innovative and high-growth enterprises (unicorns). Scaling up enterprises in Italy remains difficult, hindered by a generally weak ecosystem and limited venture capital investments.

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94 See SWD 'Digital Decade in 2024: Implementation and perspective' with annexes, SWD(2024)260: https://digital-strategy.ec.europa.eu/en/news-redirect/833325, Annex 4.

Recommendations – Italy should:

- **CONNECTIVITY INFRASTRUCTURE:** (i) Continue to deploy FTTP ensuring a high growth rate and strengthen efforts to develop connectivity infrastructures coherently and jointly with cloud and edge computing capabilities exploiting the potential of the country's 5G network; (ii) Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.

- **SEMICONDUCTORS AND QUANTUM**: Continue the efforts in the semiconductors sector and increase investments in quantum technologies also within the frame of EU initiatives and in view of contributing to the European Chips Act.

- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

- **AI/CLOUD/DATA ANALYTICS:**
  - (i) Strengthen measures targeted to the adoption of technologies by enterprises, with particular attention to AI and looking at the barriers and drivers specific to the national context.
  - (ii) Ensuring the broad uptake of the next generation of cloud infrastructure and services under development in the IPCEI-CIS by companies of all sizes, including by developing a country-specific dissemination strategy (complementing what has already been committed under IPCEI-CIS); contributing to the additional dissemination activities led by the Cloud IPCEI Exploitation Office.

- **UNICORNS:** Strengthen actions to sustain the ecosystem of start-ups and innovative enterprises, including boosting the availability of effective financial tools, initiatives to support the scale up of enterprises, in particular in strategic sectors, building synergies between research and industrial systems.

Protecting and empowering EU people and society

The country's major gaps remain in digital skills, impacting efforts to close the digital divides and hindering competitiveness. Despite the roadmap's focus and Italy's numerous recent initiatives, only 45.8% of people in Italy have at least basic digital skills and **the share of ICT specialists in employment remains limited, while demand by enterprises for these skills is surging.**

Italy performs well on the deployment of the Electronic Health Records and its action to strengthen access to key digital public services continued in 2023, but further efforts are needed. Italy has two certified eIDAS digital identity schemes and is contributing to the work for the deployment of the EU Digital Identity Wallet. The Electronic Health Record (EHR) has been introduced in all regions. However, the availability of digital public services for citizens was still below the EU average in 2023. The ongoing major e-government projects and investments are not yet showing their full impact.

Recommendations – Italy should:

- **BASIC DIGITAL SKILLS:** Increase efforts to boost digital skills across all target groups with tailored interventions, including by: (i) strengthening services to accompany citizens in the use of digital tools; (ii) expanding digital educational programmes in schools and increasing interest in STEM (Science Technology Engineering and Mathematics) and ICT disciplines; (iii)

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and incentivising reskilling and upskilling paths for workers.

- **ICT SPECIALISTS:** (i) Increase ICT programmes in higher education, including the strengthening of ITS Academies, in connection with the job market needs and in collaboration with industry; (ii) take specific measures to increase participation of women in ICT education and in the ICT careers; (iii) consider measures to attract and retain ICT specialists.

- **KEY DIGITAL PUBLIC SERVICES:** Continue efforts to digitalise public services, focusing on user-friendliness and interoperability to further increase simplification and re-use of information available to public administrations.

- **E-HEALTH:** (i) Increase the supply of health data by onboarding more categories of healthcare providers; (ii) build on existing legal provisions and implement access opportunities for legal guardians, authorised persons and disadvantaged groups; (iii) make all types of medical images available to citizens in a timely manner and in all regions through the online access service, including through mobile applications.

Leveraging digital transformation for a smart greening

The Recovery and Resilience Plan is boosting initiatives twinning the green and digital transition. The adoption of the 'Transition 5.0' plan, part of the REPowerEU chapter, promotes the transition of enterprises through investment to reduce their energy consumption. The plan also includes measures on advanced climate change monitoring and support for smart transport systems in three pilot cities. These efforts complement existing initiatives in urban energy management, strategic asset utilisation, and innovative public procurement.

Recommendations – Italy should:

- Continue and intensify the efforts to join up the twin green and digital transition, also leveraging advanced technologies and scaling up successful initiatives.

- Develop a coherent approach to twinning the digital and green transitions. First, promote improvements in energy and material efficiency of digital infrastructures, in particular data centres. Second, support the development and deployment of digital solutions that reduce the carbon footprint in other sectors, such as energy, transport, buildings, and agriculture, including the uptake of such solutions by SMEs.

- Monitor and quantify the emission reductions of the deployed digital solutions in line with the relevant EU guidance and with the support of the methodology developed by the European Green Digital Coalition, in view of future policy development, as well as of attracting relevant financing.

2 A competitive, sovereign and resilient EU based on technological leadership

The current global situation is characterised by economic and geopolitical instability. In this time of systemic uncertainty, investment in the digital transformation is set to play a leading role in the growth of the economy.

Italy can count on the expansion of its digital infrastructure, boosted by the resources available under the Recovery and Resilience Plan (RRP), alongside a good level of basic digitalisation among its SMEs. The country is also emerging as a key player in the development of quantum technologies, while investments in the strategic sector of semiconductors are becoming more and more prominent. However, there are shortcomings, particularly in the adoption of artificial intelligence (AI) by Italian enterprises and efforts are still needed to achieve nationwide connectivity and strengthen investments in strategic sectors.

2.1 Building technological leadership: digital infrastructure and technologies

2.1.a Connectivity infrastructure (gigabit)
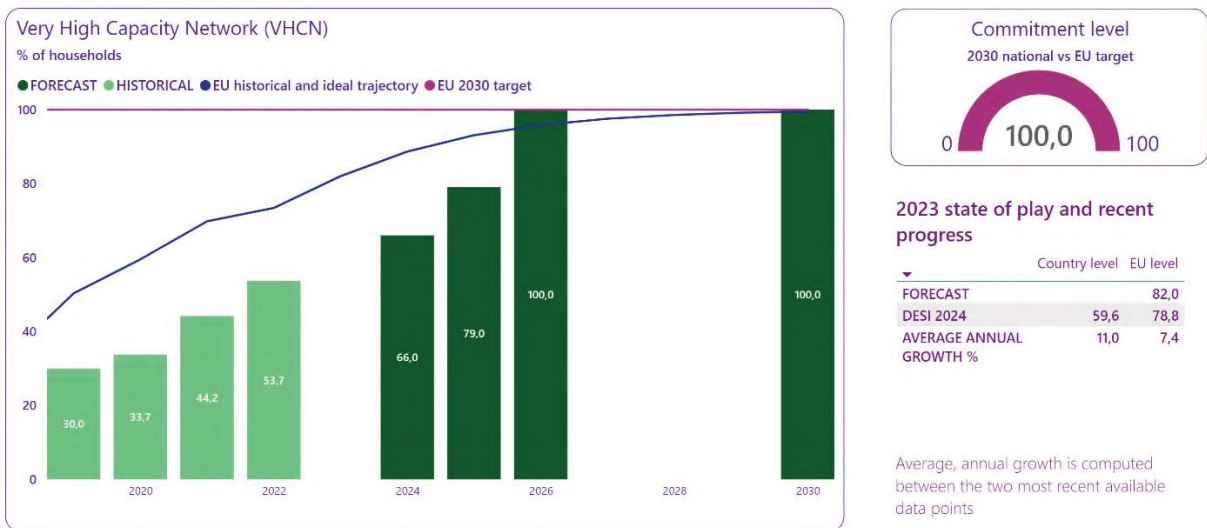
Note: The source of national forecast values is the 2023 country roadmap

Italy has scope to improve its performance to contribute to EU's digital decade VHCN target, despite the positive dynamic. Coverage remains below the EU average and the urban-rural divide persists. In 2023, VHCN/FTTP[95] coverage stood at 59.6%, a 11% increase compared to 2022 but still below the EU averages (78.8% for VHCN and 64% for FTTP). In rural areas, VHCN/FTTP coverage drops to 37.7% (EU average is 55.6% for VHCN and 52.7% for FTTP).

Despite the growth rate having slowed down, there is a positive dynamic for VHCN/FTTP deployment, which continued to increase in 2023. Deployment reached an inflection point earlier than expected[96], possibly due to the increased focus on less densely populated areas where implementation is more

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[95] VHCN is defined as the combination of FTTP and DOCSIS 3.1. In the absence of DOCSIS 3.1 in Italy, the indicator on VHCN coverage and the indicator on FTTP coverage coincide.

[96] According to data provided by AGCOM on the evolution of the FTTH network coverage curve, the point of inflection, or the moment when growth begins to slow down significantly, occurs earlier compared to what was observed previously with FTTC technology. While for FTTC, the inflection point had been identified around 65% of households covered, for FTTH it has been found that this occurs near 50% of households, if not lower.

expensive and complex. In parallel, deployment in black areas has been stagnating, due to constraints such as the lack of specialised workforce. According to AGCOM, most of the coverage gaps currently remain in black areas (19.8%), followed by grey (14.8%) and white areas (5.8%).

The share of fast fixed broadband take-up is also increasing, although it remains limited. In 2023, the share of fixed broadband subscriptions ensuring connectivity speeds equal or above 1 Gbps stood at 19.3% (up from 14.7% in 2022 and slightly above the EU average of 18.5%).

Italy aims to reach 100% VHCN coverage by 2026, which is earlier than the EU target of 2030. It remains an ambitious objective in view of the current downturn in the growth and the fact that the last deployments might prove more difficult to achieve.

Achieving the target will require swift and robust implementation of the planned investment, so far affected by delays, and sustained action by market operators. As stated in the roadmap, the target is supported by two main lines of intervention, which complement the expected investment by market operators. First is the **Ultra-Broadband Plan in white areas**, adopted in 2015, which has so far connected about 6.6 million residential units (out of a target of 8.4 million)[97]. The plan, originally due to be completed in 2022, was affected by persisting delays, attributed in part to works starting late. Second is '**Italia 1 Giga**', supported by the Recovery and Resilience Plan (RRP), whose objective is deploying at least 1 Gbps connectivity via fibre-to-the-home/building (FTTH/B) or Fixed Wireless Access (FWA) in grey areas. Following the revision of the RRP adopted in December 2023, the target was reduced from 8 500 000 to 3 400 000 house numbers[98] following a more precise mapping of the residential units to be connected.

The new Broadband Strategy 2023-2026 **is expected to contribute to better monitoring and planning high-capacity networks deployment**[99]. In identifying the weaknesses in the implementation of previous and ongoing plans (delays in the issuance of the permits, lack of qualified workers and of sufficient planning instruments, low demand), the strategy confirms existing initiatives[100] and launches an additional set of interventions for monitoring and developing fixed network infrastructure, next-generation 5G networks, and the deployment of innovative services. A central element of the strategy is the strengthening of the 'instruments' (**mapping and databases**) to monitor the existing infrastructure and, thus, optimize public investments in the deployment of high-capacity networks. Building on the experience developed under the 'Italia 1 Giga' Plan, the implementation of which was facilitated by on-site checks (walk-ins) to check the factual existence and connectivity of the designated house numbers outlined in the plan, Italy is planning a series of actions to create a common database containing all the information related to ultra-wideband infrastructure, including real-time monitoring. Moreover, according to the changes to the Italian Electronic Communication Code, mapping exercises should be carried out on yearly basis and include not only the network but also their capacity and level of usage. Moreover, investment commitments made by the operator in the context of the mapping exercise should become binding, with possible positive impacts on

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[97] In particular, to date, the ultra broadband services were saleable for 4.7 million FTTH real estate units, compared to a total of 6.3 million units expected at the end of the plan, and for 1.9 million FWA real estate units, compared to a total 2.1 million units expected at the end of the plan. The activation overall reached 307 556 real estate units. The reasons for the low number of activations must be attributed essentially to limited interest by retail operators in the withe areas and, in part, to customer refusals expressed after the order to start the service, and to a high percentage of addresses without house numbers.

[98] In the revision, the objective of reaching at least 450 000 scattered households was maintained.

[99] In terms of fixed coverage, the overall objective of the new strategy is to provide fixed network coverage with speeds (transmission capacity in the peak hour and for each active customer) equal to or greater than 1 Gigabit/s for all civic numbers/building units and FWA (Fixed Wireless Access) coverage in the most remote areas with a minimum speed of 100 Megabit/s for each active customer in the peak hour.

[100] Ultra-Broadband Plan in white areas, Connectivity measures funded under the Recovery and Resilience Plan, connectivity vouchers for enterprises (that will also use the resources not allocated under the vouchers for households due to the lack of demand).

black areas where modest increases in coverage have been observed. These changes also include **interventions to simplify** procedures for network deployment, particularly for fixed fibre optic networks across the national territory. The existing framework is complex, creating hurdles with national and local administrative rules. To streamline processes, administrative simplification measures were adopted to clarify timelines and conditions for procedure interruption and define a national-level policy framework that standardises authorisation methods and procedures.

The electronic communication markets are characterised by strong retail competition, based mainly on prices with low margins for operators which impairs their investment capacity. The market is responding with consolidation, sharing agreements, and new structural changes of the incumbent network ownership. The regulator adopted a new market review of access markets setting more pro-competitive rules aimed at encouraging, in a neutral manner, investments in very high capacity networks by all operators, ensuring greater flexibility of remedies where certain conditions are met.

Overall, although Italy is advancing and measures are in place, there is still a need to further incentivise rapid deployment of gigabit connectivity, as also highlighted in last year recommendation.

2.1.b Connectivity infrastructure (5G)
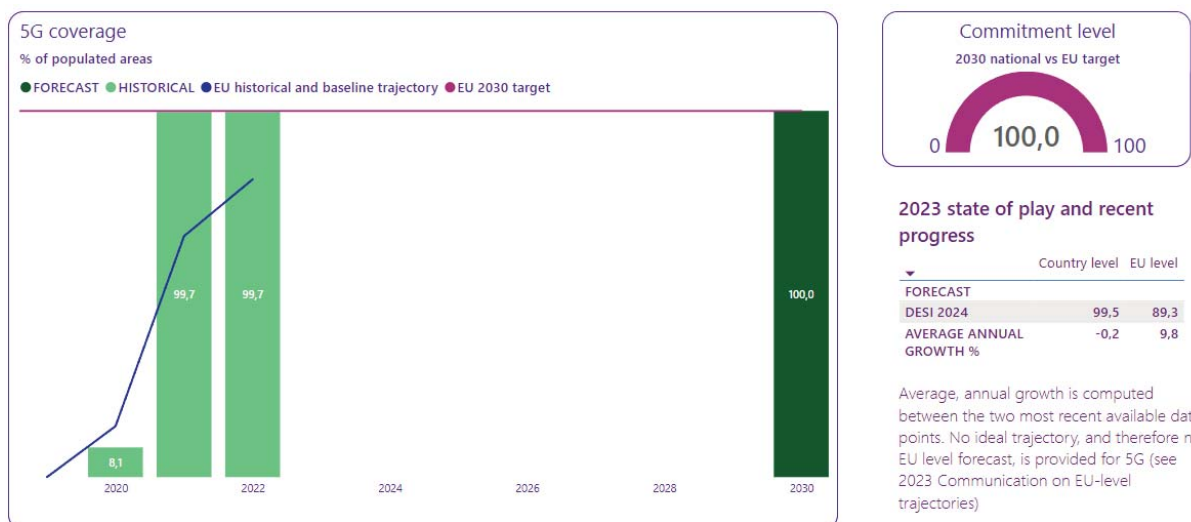
Note: The source of national forecast values is the 2023 country roadmap

Italy brings a very strong contribution to the EU's digital decade target of 5G coverage in populated areas. Italy had achieved nationwide 5G coverage in 2022 and recorded a value of 99.5% in 2023[101] [102]. In addition, 88.3% of Italian households are covered by the 3.4-3.8 GHz band (EU average is 50.6%), which enables advanced applications requiring large spectrum bandwidth. 5G uptake is slightly below the EU average, and overall limited: 5G SIM cards are about 20.4% of the population (EU average is 24.6%). No new assignment procedures of EU-harmonised spectrum were carried out in 2023, but AGCOM took several measures aimed at rationalising the spectrum usage[103]. The electromagnetic field (EMF) limits were increased from 6 V/m to

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[101] The variation compared to 2022 does not reflect a change in coverage but it is the consequence of small refinements in criteria adopted to estimate the coverage.

[102] In Italy, the rights of use of frequencies in the so-called 5G 'pioneer bands' were awarded in 2018 with a multi-band auction (i.e., 694-790 MHz, 3600-3800 MHz and 26.5-27.5 GHz bands), according to the regulation set by AGCOM (Decision no. 231/18/CONS). First commercial 5G services were launched in the summer 2019 in some major Italian cities (including Rome and Milan).

[103] AGCOM adopted measures regarding the supplementary coverage obligations for Iliad Italia, S.p.a. and other measures to foster the defragmentation process in the 3.4-3.6 GHz band to promote the efficiency of 5G networks.

15 V/m. Although this new measure[104] still sets the values below the respective limit recommended at EU level (Council Recommendation 1999/519/EC), it is expected to have a significant positive impact on 5G network deployment and operation.

The main measure currently supporting further progress in 5G coverage is 'Italia 5G'. Part of the RRP, it aims at the deployment of 5G networks along extra-urban roads, corridors and market failure populated areas and it is expected to be completed by 2026. Part of its targets were significantly revised during implementation because of lack of interest by the market in covering scarcely populated market failure areas[105].

The Broadband Strategy 2023-2026 includes relevant measures for the development and adoption of next-generation 5G networks, and the deployment of innovative services based on 5G (5G verticals). Measures proposed include the deployment of (publicly-owned) 5G infrastructure along the railway network and in the tunnels Milano-Cortina, providing uninterrupted 5G connectivity, improved logistics, safety and quality of service offered to passengers; and the deployment of next generation mobile networks, of 5G verticals and services based on Edge Cloud Computing, through pilots in areas such as healthcare, agriculture, logistics. Those measures are very important for future market developments, but their implementation has not started yet, in the absence of defined sources of funding.

An impulse for the development of 5G innovative use cases comes from the 'Houses of Emerging Technologies' (CTEs). Since 2018, the initiative has established 13 CTEs to drive the adoption of 5G and enabling technologies, completing 29 experiments and 65 use cases. With EUR 144 million allocated, these projects will conclude by 2025, focusing on areas like augmented reality and industrial automation. The CTEs, evenly distributed geographically, also serve as hubs for innovation, offering support to startups and facilitating access to funding. First tangible results are expected for next year.

In conclusion, steps have been taken towards measures promoting 5G applications, but their full implementation remains important to respond to the recommendation issued in last year's report calling for consolidating 'the significant achievements made in mobile connectivity, particularly for advanced applications'.

2.1.c Semiconductors

Italy's semiconductors sector stands out as one of the most important in Europe. This is mainly due to the role played by a leading company in the market, but also to the presence of smaller and highly specialised enterprises in semiconductors which enrich the industrial landscape, such as in manufacturing equipment. However, these Italian enterprises, often family-owned SMEs, face the pressure of increasingly intense global competition. Moreover, Italy lacks production facilities to manufacture cutting-edge chips, which will play an increasingly key role in global value chains. As the rest of the EU, Italy also lags behind in the design of integrated circuits, which represents one of the areas with the highest added value in the semiconductor sector[106].

Italy can count on various research and technology transfer centres, encompassing universities, specialised research institutes, and national and international networks. There are several institutes (with a key role played by the National Research Council - CNR) and universities engaged in R&D in the area of

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[104] Law No 214 of 30 December 2023.

[105] In the framework of the revision of the RRP adopted in December 2023, one of the targets was reduced from 'At least additional 15 000 sq. km of market failure areas provided with 5G coverage of at least 1 Gbps' to 'At least additional 1 400 sq. km of market failure populated areas enabled with 5G coverage, out of which, at least 500 sq. km provided with 5G coverage'.

[106] Maria Rita Pierleoni, L'industria globale dei semiconduttori e il ruolo dell'Italia, published by Ministero dell'Economia e delle Finanze and Ministero del Tesoro (Nota tematica N° 3 - Dicembre 2023).

semiconductors, and equipped with laboratories and research infrastructure. In parallel, a number of initiatives bring together research institutions/universities and industrial partners, facilitating technology transfer[107]. Among others, the Foundation Chips.IT is one of the initiatives launched in 2023 as the Italian hub for the design of integrated circuits. It will coordinate research and design activities involving both public and private actors, and provide state-of-the-art equipment and software. The foundation will also serve as a Competence Centre, helping to train professionals in this sector.

In 2023, the Italian government heightened the focus on this sector, promoting investment in semiconductors including the allocation of resources for the Microprocessor Fund and tax credits to enterprises. In October 2023, Italy started implement the Microprocessor Fund[108] that, with an allocation of EUR 3.3 billion, promotes research and development in microprocessor technology and investment in new industrial applications. This includes the conversion of existing industrial sites and the establishment of new facilities, also through the attraction of foreign investment. Using the Microprocessor Fund, the government allocated about EUR 600 million in tax credits addressed to enterprises engaged in R&D in the area of semiconductors, and to support participation in EU projects under the Chips Joint Undertaking[109].

Government support is coupled with growing private investment. In 2023, it was announced that the Singapore-based semiconductor firm Silicon Box will invest EUR 3.2 billion in a new plant in northern Italy, with the support of the Italian government. The company is specialised in the integration, advanced packaging and testing of so-called chiplets, with applications in field of artificial intelligence (AI), high performance computing (HPC) and electric vehicles[110]. Moreover, additional investment in Sicily is expected to build the biggest EU hub for silicon carbide, including the pilot line promoted under the Chips Act and approved under the Chips Joint Undertaking in April 2024[111].

Investment planned under the National Recovery and Resilience Plan (RRP) complement the initiatives in this area, supporting the participation in the IPCEI 'Microelectronics II'[112], the construction of a plant in the semiconductor value chain in Sicily[113], large R&D projects in enterprises[114].

Overall, a number of relevant measures is raising, although not all reflected in the roadmap. The State of the Digital Decade report 2023 encouraged Italy to continue its activities on semiconductors in order to help the EU become a strong market player in this area. The establishment of a new Committee within the Ministry of Enterprises and Made in Italy could also ease the monitoring and coordination of the actions taken, give coherence and improve synergies between different initiatives.

2.1.d Edge nodes

The analysis by the Edge Observatory first data report[115] estimates that the number of edge nodes deployed in Italy is 77. This value represents 6.5% of all edge nodes estimated in the EU in 2023, and

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[107] Ibidem.

[108] Established in 2022, Italy issued the decree specifying the resources allocated, the scope and implementation procedures of the Fund at the end of 2023 (Decree of the President of the Council of the Ministers of 27 October 2023 published on the Official Journal of 12-04-2023, no. 283).

[109] Legislative decree of 10 August 2023, n. 104, Urgent provisions aimed at safeguarding users, in the fields of economic and financial activities, as well as strategic investments.

[110] Website of the Ministry of Enterprises and Made in Italy (https://www.mimit.gov.it/it/notizie-stampa/urso-annuncia-un-maxi-investimento-da-3-2-miliardi-di-silicon-box-in-italia).

[111] Website of the Ministry of Enterprises and Made in Italy (https://www.mimit.gov.it/it/notizie-stampa/chips-urso-ok-ue-a-linea-pilota-a-catania-italia-conferma-leadership-sui-semiconduttori).

[112] For an investment estimated to about EUR 450 million.

[113] The investment is a EUR 292.5 million direct grant to support STMicroelectronics' EUR 730 million investment for the construction of a Silicon Carbide ('SiC') wafer plant.

[114] With the measure Innovation Agreements, which supports investments in key enabling technologies, including semiconductors.

stands well below other EU countries like France or Germany. Italy provides a preliminary national trajectory for edge nodes in its roadmap, with the objective of deploying of 946 edge nodes in 2030. The ambitious trajectory aligns with the country's scale and large market size and could be influenced by targeted investments in specific sectors that leverage edge computing technologies[116]. A mapping of the existing data centres is ongoing, and its results will help to better estimate the state of play and trajectory. New legislative initiatives on the use of edge infrastructures and services for public administrations are also ongoing.

The Broadband Strategy 2023-2026 includes measures to support the creation of an Edge-Cloud Computing network, but plans for operational deployments are unclear. A measure that also forms part of the national roadmap supports the adaptation of access and distribution points of Telco networks to edge technology. The public support interventions aim to increase network resilience through asset modernisation. A more operational description of the measure and the allocation of the planned budget (EUR 50 million) remain pending. The measures to stimulate 5G verticals will also contribute to the target in this area. Finally, Telecoms operators are investing in the sector (see section 2.1.b above).

At the EU level, Italy participates in the IPCEI Next Generation Cloud Infrastructure and Services. It supports the development of software technologies useful in the exploitation of edge nodes, notably industrial 5G. It should also enable the EU to develop cutting-edge technologies for innovative edge nodes, with low latency and energy footprint.

2.1.e Quantum technologies

Italy set an ambitious target on quantum computing: building 5 quantum computers by 2030. The target is supported by centres of excellence in this area and several projects contributing to the development of HPC and quantum capabilities. Italy is home to prestigious research centres, like the CINECA (Consorzio Interuniversitario per il Calcolo Automatico dell'Italia del Nord Orientale), and the National Quantum Science and Technology Institute (NQSTI).

Many initiatives to boost research and deployment of solutions are ongoing. In particular, CINECA and other universities, research centres, private and public operators are involved in a number of projects, including the 'ICSC National Research Centre for High Performance Computing, Big Data and Quantum Computing'. This initiative was launched with the support of the RRP and is facilitating the creation of networks of universities, research centres and enterprises for R&D&I in several thematic areas. These include: 'supercomputing cloud infrastructure', to consolidate a federation of supercomputing centres and data-intensive facilities (Spoke 0)[117]; 'quantum computing', aimed at the creation of applications using quantum calculators as accelerators, the development of hardware and software tools and the planning of large and scalable quantum computers (Spoke 10). The objective of Spoke 10 is to build 3 quantum computers by 2025[118]. Overall, notable results have already been achieved (for an example, see the box below on the ongoing activities at the University of Naples 'Federico II').

Another project is 'WCRI-QCSC', which aims to acquire a general purpose quantum trapped ion computer by 2028, with potential applications, for instance, in cybersecurity, privacy, health[119].

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[115] The Edge Observatory 1st data report (https://ec.europa.eu/newsroom/dae/redirection/document/104539).

[116] Edge Observatory for the Digital Decade, 2023.

[117] https://www.hpc.cineca.it/projects/pnrr-cn/. The budget is about EUR 19 million.

[118] SPOKE 10 – QUANTUM COMPUTING - Supercomputing ICSC (supercomputing-icsc.it). The budget is about EUR 30 million.

[119] Website of the University of Padua (https://qtech.unipd.it/trapped-ion-quantum-computer-padua).

Overall investments in quantum are increasing. A new draft law is expected to support regulatory instruments on new technologies, including on quantum technologies, with a total budget around EUR 150 million. Furthermore, the projects mentioned above (Spoke 0 and Spoke 10), and included in the Italian roadmap, amount to about EUR 50 million for a period of three years[120] and coupled with other relevant projects that can directly or indirectly affect the development of quantum technologies[121]. Overall, their size, despite increasing, is still limited compared to what other EU countries are committing. Regarding the private market, it was estimated that in Italy in 2023, investments from Venture Capitals in quantum technologies amounted to just EUR 6.6 million, and investments from enterprises in quantum computing remained below EUR 6 million[122].

Best practice: Quantum computing development at the University 'Federico II' of Naples

Under a measure supported by the RRP, the University of Naples Federico II participates in the National Centre on HPC, Big Data and Quantum Computing and specifically within Spoke No. 10 (dedicated to Quantum).

In this context, a 24-qubit superconductive quantum computer has just been installed and, by the end of 2024, the plan is to install a scalable 40-qubit computer. The computer will be open and cloud-accessible to students, researchers, and enterprises, and provide them with access to quantum technologies and computational capacity for various applications (chemistry, biology, drug-design, high energy and condensed matter physics, data-science, industrial optimization, etc.). It will also be interfaced with a high-performance computer (a brand new HPC system to be installed by CINECA at the campus San Giovanni, Naples) to develop classical/quantum hybrid computing architectures.

By 2024, the University also plans to complete a nano-fabrication centre for the manufacturing of superconductive quantum processors, funded with national resources (approximately EUR 10 million). This centre will allow the in-house manufacturing of superconductive chips and enabling components, including qubits, measurement devices and control electronics for quantum computers. It will contribute to the development and production of critical technologies throughout the Union, also safeguarding European technological sovereignty and strengthening the value chain in the sector of digital and deep tech innovations. The centre will be open for broad spectrum scientific and industrial applications requiring nano-electronic components, and will host collaborative projects with industries.

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[120] Considering the amounts budgeted for Spoke 0 and Spoke 10 (see footnotes above). The budget of WCRI-QCSC is not known.
[121] For example, the total budget dedicated to the ICSC National Research Centre for High Performance Computing, Big Data and Quantum Computing is EUR 320 million.
[122] Politecnico di Milano, Osservatorio Quantum Computing & Communication (https://www.osservatori.net/it/ricerche/comunicati-stampa/quantum-computing-italia-investimenti).

2.2 Supporting EU-wide digital ecosystems and scaling up of innovative enterprises

2.2.a SMEs with at least a basic level of digital intensity

Note 1: DII 2022 is version IV that is not comparable with DII 2021, that was version III. The EU-level ideal trajectory refers to DII version IV, as published in the 2023 Communication on EU-level trajectories

Note 2: The source of national forecast values is the 2023 country roadmap

Italy brings a positive contribution to the EU target (90% of SMEs with at least basic digital intensity), but it demonstrates a very limited dynamic. Italy performs above the EU average with 60.7% of SMEs with at least a basic level of digital intensity (EU: 57.7%). However, progress has stopped: the 2023 value represents an annual growth of just 0.3% over two years (i.e., from 2021, which is the last comparable year that used a similar methodology for measuring the digital intensity of enterprises).

In its roadmap, Italy presented a level of ambition in line with the EU 2030 target of 90% of digitalised SMEs. While Italy starts from a value just above the EU average, maintaining the growth rate currently observed will not enable the country to reach its target by 2030. The roadmap presents several existing and well-established measures as contributing to this target, from Transition 4.0 to regional measures funded under the EU's cohesion policy, to vouchers for the uptake of broadband by SMEs, to other measures more focused on advanced technologies.

Data related to the implementation of Transition 4.0 shows higher than expected uptake of tax credits, particularly for investments in tangible assets (rather than investments in intangibles and R&D&I). According to data for the tax year 2020-2021[123], Transition 4.0 reached almost 120 700 beneficiaries, already exceeding the intermediate target of 69 900 set in the RRP for 2024[124]. However, the situation varies significantly depending on the type of investment considered. The uptake of tax credits was higher than expected for investment in tangible Industry 4.0 assets (i.e., investment in machinery and equipment, which represents by far the highest component of the measure), standard immaterial assets (not specifically related to digital), and – importantly – in training in the area of Industry 4.0[125]. Instead, tax credits for intangible Industry 4.0 assets (e.g., advanced software, AI, and machine learning applications) and for

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[123] Data is based on tax declarations. In 2023, the last available data was related to tax year 2020-2021.

[124] The 2024 intermediate target is referred to data of the tax year 2021 and 2022.

[125] Especially in the area of training, the uptake of tax credits was higher than expected: the number of enterprises that used tax credits for Industry 4.0 training in 2020 and 2020 was 15 023, against a target of 2 000 enterprises set in the Recovery and Resilience Facility for 2025.

research, development, and innovation activities were less used by Italian enterprises[126]. The system of public incentives for enterprises is currently under revision.

Building capacity and supporting a widespread network of facilitation and technology transfer centres across the country remain key to maximising impacts. In 2023, Italy continued its policies in the area of digitalisation of businesses, supporting advanced technologies, capacity, and knowledge building, in line with last year's recommendation. In broad terms, stakeholders noted the general and stable increase in the digital maturity of enterprises, for example through the use of digital maturity self-assessment[127]. In Italy, there is a good network of facilitation centres (e.g., 37 European Digital Innovation Hubs[128], 8 Competence Centres, almost 90 'Punti Impresa Digitale'), supporting digitalisation at different levels of maturity and with different specialisations.

On the one hand, this network plays an important role in reach also those small-, micro- and/or family-owned enterprises that usually face difficulties in exploring and embracing innovation. On the other hand, creating synergies and leveraging this network to build capacity is a condition to maximise the impact of investment in digital assets promoted by other national measures (e.g., the acquisition of tangible assets under Transition 4.0, or the broadband vouchers for SMEs).

2.2.b Take up of cloud / Data analytics / AI

- **Cloud**

Note: The source of national forecast values is the 2023 country roadmap
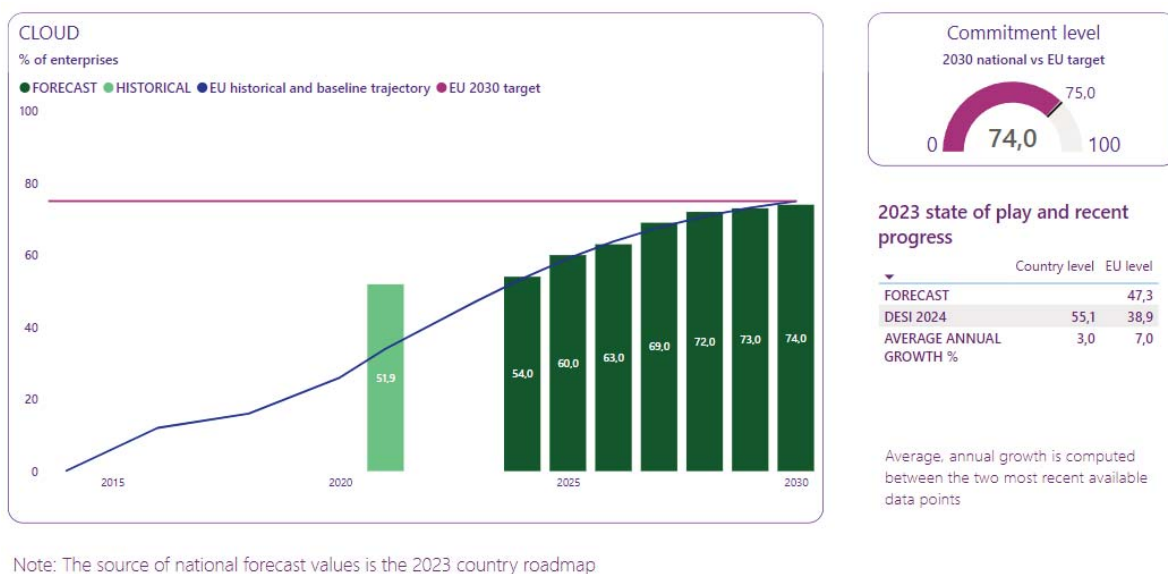
On the uptake of cloud services, Italy brings a very strong contribution to the EU's digital decade target of 75% of EU enterprises using cloud services by 2030, while demonstrating a limited dynamic. Italy performs above the EU average, with 55.1% of Italian enterprises use cloud services, standing well above the EU average of 38.9%. The growth rate is, however, lower than the one observed at the EU level.

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[126] All data reported in this paragraph is based on: Corte dei Conti, Rapporto sul coordinamento della finanza pubblica 2023 (Download (corteconti.it)), pages 356 to 359.

[127] Tools provided by Union Camere include Self I4.0 (digital maturity self-assessment), Zoom 4.0 (assessment involving a digital promoter), Check-Up Sicurezza IT (related to vulnerabilities to cyber threats).

[128] 13 funded under the Digital Europe Programme. The remaining have received the Seal of Excellence and are funded with other resources.

Italy set a target of 74% uptake by 2030, slightly below but substantially in line with the EU target. Despite the good starting point, at the current pace, reaching the target set in the roadmap may well be challenging.

To encourage the adoption of cloud by enterprises, the roadmap relies on measures generally aimed at supporting the uptake of advanced technologies, such as the projects started under the Houses of Emerging Technologies (see also point 2.1.b), grants launched in 2023 (for EUR 11 million) to promote R&D projects based on emerging technologies such as Blockchain, Artificial Intelligence, and Internet of Things (IoT), or Transition 4.0[129]. At the EU level, Italy participates in the recently approved (December 2023) IPCEI Next Generation Cloud Infrastructure and Services.

- **Data Analytics (Big Data)[130]**
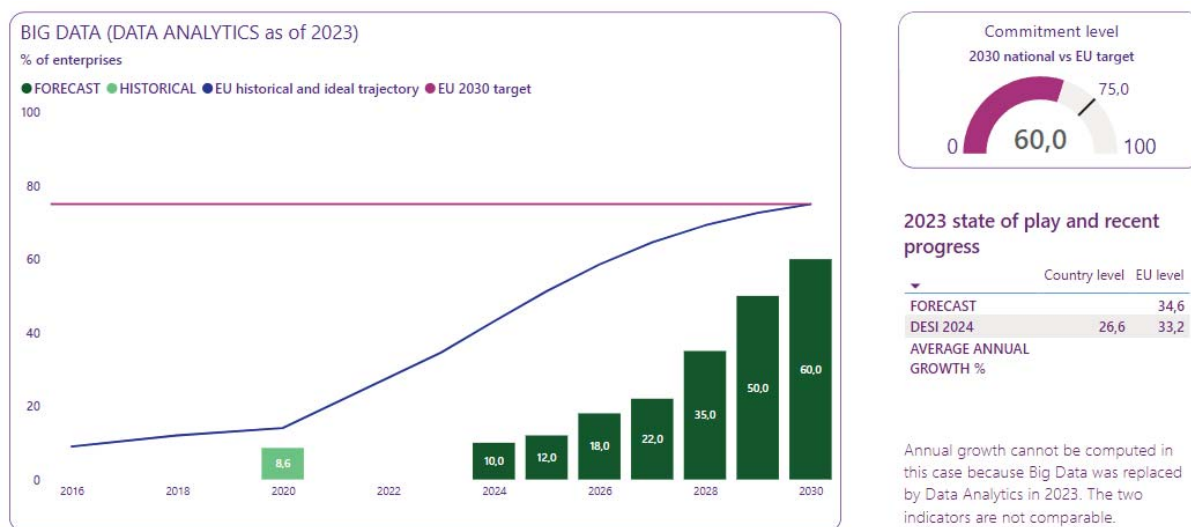
Note: The source of national forecast values is the 2023 country roadmap

On the use of data analytics by enterprises, Italy has untapped potential to contribute to the EU's digital decade target. Italy (with 26.6%) is below the EU average (33.2%). Progress cannot be assessed since the indicator's definition has evolved.

Italy presented in its roadmap a target for 2030 (60%) which is below the EU target (75% of enterprises adopting Big Data/data analytics), but still ambitious. Currently, given the starting point, the achievement of the target by 2030 appears challenging.

The Italian roadmap does not present specific measures to encourage the adoption of data analytics, counting on measures generally aimed at supporting the uptake of advanced technologies.

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[129] See section 2.3 as regards measures on cloud infrastructure and migration of public administrations to the cloud.
[130] As of 2023, Eurostat, in agreement with all the EU National Statistical Institutes, replaced the Big Data indicator with the Data Analytics indicator, that has a broader scope. Comparisons with previous years are not possible.

- **Artificial Intelligence**
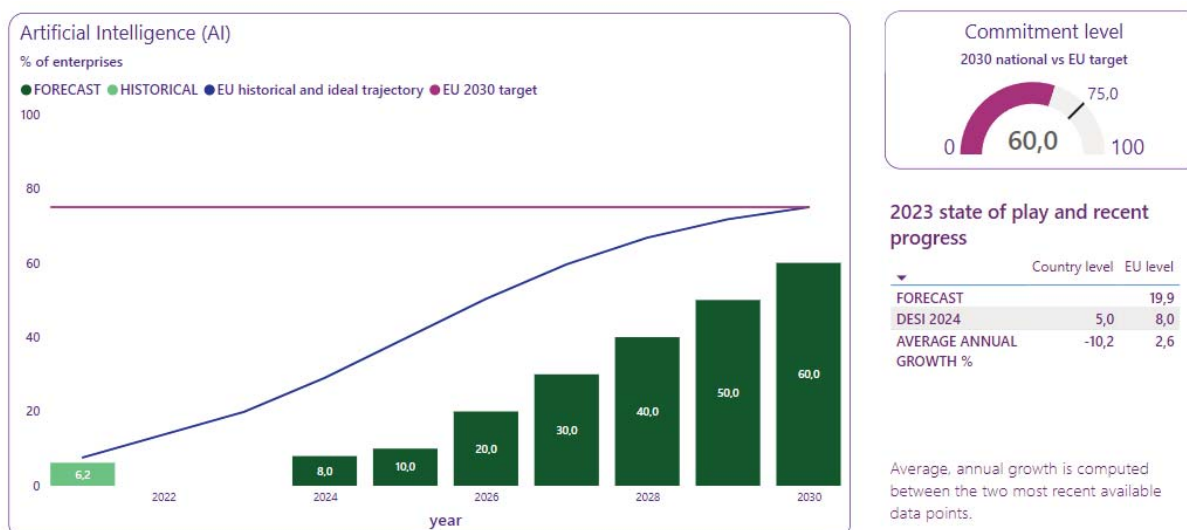
Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

Note 2: The source of national forecast values is the 2023 country roadmap

Italy has untapped potential to contribute to the EU's digital decade target on Artificial Intelligence and demonstrates a very limited dynamic. Only 5% of Italian enterprises adopt AI solutions in 2023, standing below the EU average that is also at a very low value, 8.0%. Compared to 2021, the percentage of enterprises adopting AI technologies decreased from 6.2% to 5%. This deviation is however not to be considered statistically significant but rather in line with the overall EU stagnation for this Key Performance Indicator (KPI).

The target set by Italy in its roadmap (60%) is below the EU ambition, but it seems difficult to reach when considering the starting point and recent dynamic observed. Additionally, it lacks backing from specific measures in the roadmap, apart from the general measures to support digitalisation of businesses and uptake of advanced technologies mentioned above.

The AI market is growing, but SMEs still lag behind and are not engaged in exploring the potential and possible impacts of Generative AI. According to an analysis by the Observatory for Artificial intelligence[131], in 2023, the AI market in Italy reached EUR 760 million. Spending by enterprises on AI projects saw a year-on-year increase of 52%, data which does not yet reflect the potential impact of generative AI. Such growth is essentially driven by large enterprises. Moreover, around half of large enterprises (49%) have started to consider the potential and possible impacts of Generative AI, with 17% already engaged in projects, while only 7% of SMEs are considering potential applications and only 2% starting specific initiatives.

Italy made progress in training researchers in AI, but still struggles to attract and retain talent. The report of the Observatory for Artificial intelligence also shows that, in 2022-2023, Italy made progress in the capacity to train researchers, thanks to the establishment of new doctoral scholarships and increased funding (+25%) for AI research positions. Nevertheless, attracting and retaining talents remains challenging, with 69% of the major Italian organisations considering foreign companies more attractive[132].

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[131] Contributo dell'Osservatorio Artificial Intelligence all'Indagine Conoscitiva sull'intelligenza artificiale: opportunità e rischi per il sistema produttivo italiano, 31/01/2024 (3._Osservatorio_Artificial_Intelligence.pdf (camera.it)).
[132] Ibidem.

The government is working on the new AI strategy, replacing the one adopted for the period 2022-2024. Expected initiatives include establishing a public-private venture capital fund to support Italian startups and creating a Foundation dedicated to AI, supporting research and development, innovative projects, and fund high-tech startups and companies to bring research results to the market[133]. The establishment of dedicated funding (missing in the previous AI strategy) will be an important element in determining the potential impact.

- **Take-up by enterprises of cloud or data analytics or AI**

Taking the three technologies together (adoption of either AI, Cloud, or Data analytics), Italy stands at 63.1%, significantly above the EU average of 54.6%. Italy's above-average performance is driven by the uptake of cloud and, partly, of data analytics.

2.2.c Unicorns, scale-ups and start-ups

Italy has seven unicorns, including two key players in the online payment segment.

There is a weak ecosystem supporting innovative start-ups and enabling them to secure funding from public entities, companies, business angels, or venture capital investments. In Italy, in 2022, venture capital investments (seed, start-up and other early stage investment) represented only 2% of GDP, well below EU countries of comparable size (such as France, Germany and Spain, where the share ranged from 6% in France, to 5% in Germany, and to 4% in Spain)[134]. Another obstacle is related to the economic structure of the country and the large prevalence of micro and small enterprises, that can play only a limited role in supporting innovative startups. More broadly, Italy also records a performance below other comparable economies when it comes to the size of the ICT sector (3.4% of the gross value added in 2019 vs. an EU average of 4.9%[135]) and the R&D intensity in the ICT sector (16.3%[136]), which translates to a low number of patents in ICT, in particular when compared to its advanced scientific knowledge.

The target set in the Italian roadmap is ambitious: reaching 16 unicorns in 2030. Initiatives that should support the achievement of this target include funds managed by Cassa Depositi e Prestiti (CDP)[137], such as the 'National Innovation Fund' that, set up in 2020, is supporting a considerable number of startups in accessing resources and fundamental skills for their growth and potentially turning them into new unicorns. CDP also manages a specific Fund dedicated to the digital transition, supported by the RRP. With EUR 300 million of initial capital, the fund supports start-ups and SMEs with high innovation potential and projects concerning, for instance, Artificial Intelligence, cloud, health, Industry 4.0, cybersecurity, fintech or blockchain. The funds are complemented by the National Network of Accelerators, including sector-specific accelerators, that aim to pool private national and international partners and provide mentorship programmes for start-ups.

There is as well an ongoing comprehensive review of the business incentive system. The review aims to ensure that public intervention supports the productive sector more effectively through incentive policies, ensuring better planning, organisation and implementation. In 2024, the Italian government also plans to revise the 2021 Start-up Act, which introduced measures in the fields of administrative simplification,

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[133] https://www.arenadigitale.it/2024/03/12/lintervento-del-sottosegretario-butti-allevento-lintelligenza-artificiale-per-litalia/.

[134] OECD, Going Digital Toolkit, 2024.

[135] Percentage of the ICT sector in Gross value added (isoc_bde15ag).

[136] Share of the ICT sector in business enterprise expenditure on research and development (isoc_bde15ar2).

[137] CDP Venture Capital SGR. There are nine different funds dedicated to start-ups and SMEs operating in strategic sectors for growth and competitiveness in the country, in particular the large Venture fund is dedicated to with minimum tickets of EUR 10 million in series B or C rounds worth more than EUR 20 million, again in co-investment with other entities.

labour market, tax incentives, and bankruptcy law. In 2024, with the first annual law on small and medium-sized enterprises, a review of the measures of the Startup Act will be carried out.

While there are many measures designed to support the start-ups, there are currently no specific measure on the development of champions, and supporting the scale up of new businesses.

2.3 Strengthening cybersecurity & resilience

Given the growing reliance on digital technologies, companies face an increasing risk of cybersecurity incidents and a greater need for preparedness. In 2022, 3.1% of enterprises in Italy reported ICT service outage due to cyberattacks (e.g., ransomware attacks, denial of service attacks), standing slightly below the EU average (3.5%). Most Italian enterprises (92.9%) reported using ICT security measures (EU average 92.4%), but only 16.4% reported being insured against ICT security incidents (EU average of 25%).

Looking into more detailed national data, in 2023, the subjects affected by Distributed Denial-of-Service (DDoS) attacks were mainly Central Public Administrations and enterprises in the transport and of financial services sectors. Even in the case of ransomware, in the vast majority of cases (84%) the victims are from the private sector. As regards the size of the impacted firms, approximately 23% of ransomware events affected large businesses, while in over 75% of the cases small (46.3%) and medium-sized enterprises (30.6%) were involved. Classifying, where possible, the victims according to sectors of economic activity, it emerges that the manufacturing sector was the most affected, in continuity with 2022, followed by retail and the healthcare and technology sectors[138].

Italy has a Cybersecurity Strategy **for 2022-2026 covering a wide range of domains.** Consisting of 82 measures to be implemented by 2026, it aims to strengthen the resilience in the digital transition of both public administrations and enterprises, achieve strategic autonomy, counter cyber threats and manage cyber crises. The strategy is supported by two funds: the Fund for the implementation of the National Cybersecurity Strategy, intended to finance investments for technological autonomy in the digital sector and for increasing the cybersecurity levels of national information systems (with an endowment of 420 million for 2023-2026); and the Fund for the management of cybersecurity, intended to finance operational management activities (with an endowment of 200 million for 2023-2026)[139].

Several measures were implemented during 2023 to strengthen cybersecurity of public administrations. Among the most notable initiatives was the strengthening of technical tools for cyber risk management and operational capabilities for the monitoring and analysis of malicious software, as well as of detection activities for the dissemination of safety events and early warnings. During 2023, the National Cybersecurity Agency (ACN) managed 422 cyber events against national public institutions. Considering the frequency and impact of the different types of events, in 2023 DDoS was the most frequent kind of attack against public institutions, followed by the exploitation of vulnerabilities and phishing[140].

Moreover, it was established a mechanism for the exchange of information on cyber-threats, through the so-called Indicators of Compromise (IoCs), to strengthen the responsiveness and defence capacity of public administrations. During 2023, CERT-AgID identified and countered a total of 1 713 malicious campaigns,

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[138] Annual Report to Parliament for the year 2023, available on the ACN website
(https://www.acn.gov.it/portale/documents/20119/446882/ACN_Relazione_2023.pdf).
[139] Information provided by Italian authorities.
[140] The source is the Annual Report to Parliament for the year 2023, available on the ACN website
(https://www.acn.gov.it/portale/documents/20119/446882/ACN_Relazione_2023.pdf).

sharing a total of 20 603 indicators of compromise (IoCs) with the public administrations participating in this network[141].

In addition, initiatives targeted training in cybersecurity and the strengthening of cybersecurity capabilities among public administrations and SMEs. At the beginning of 2023, the National Agency for Cybersecurity (ACN) launched a series of initiatives aimed at promoting cybersecurity training at the national level, defining a national reference framework. The strategy covers a wide range of measures tailored to specific needs and covering different levels and types of training, from schools and universities to industry-based training programs.

Several European Digital Innovation Hubs (EDIHs) established in Italy specifically address the development of cybersecurity capabilities, in specific sectors (e.g., DANTE for the healthcare sector, DIHCUBE for the construction sector) or across the board (I-NEST, MicroCyber, InnoVA).

Finally, it is worth mentioning the ongoing measures **to build resilient, secure and reliable cloud infrastructure**, starting with the creation of the National Strategic Hub, the qualification of public cloud providers and the migration of public administrations' data and services the most appropriate cloud solution.

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[141] Data available on the website of CERT-AgID (*https://cert-agid.gov.it/news/report-riepilogativo-sullandamento-delle-campagne-malevole-che-hanno-interessato-litalia-nel-2023/*).

3 Protecting and empowering EU people and society

## 3.1 Empowering people and bringing the digital transformation closer to their needs

The roadmap and policy developments in the recent years show that Italy is focusing on bridging the digital divide, boosting digital skills, digitalising public services and improving access, and protecting users online.

According to the Digital Decade Eurobarometer, 71% of Italians consider that the digitalisation of daily public and private services is making their life easier, standing broadly in line with the EU average (73%). The survey shows a general positive opinion on how digital rights and principles are applied in Italy. For example, there is a general positive opinion as regards: getting basic and advanced digital education, training and skills (for 60% of Italians this right/principle is well applied, in line with the EU average); getting easy online access to all key public services in the EU (61% in Italy vs. 58% in the EU); or control on own' data (54% in Italy; 47% in the EU).

However, Italy suffers from divides at different levels (geographical, socio-economic, educational) that are also reflected online. It is one of the EU Member States with the lowest levels of basic digital skills. In addition, efforts are still needed to make digital public services fully accessible to both citizens and businesses, advancing in all areas and all public administrations.

3.1.1 Equipping people with digital skills
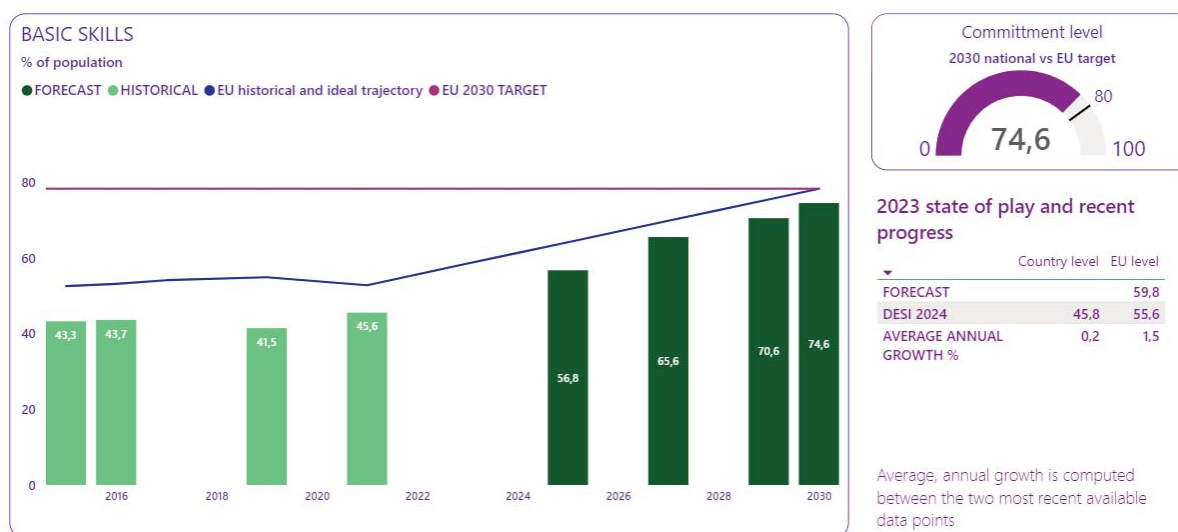
3.1.1.a Basic digital skills

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Italy has scope to improve its performance to contribute to the EU's digital decade target on basic digital skills, while demonstrating limited dynamic. In 2023, only 45.8% of the people in Italy had at least basic digital skills, against an EU average of 55.6%. In the last 2 years, there has been no overall significant improvement (the value increased by only 0.2% annually compared to 2021)[142].

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[142] Looking more in detail at the skill domains covered by the indicator, the low progress and performance has to be mainly attributed to people with poor skills in the area of 'Digital Content Creation' and 'Security'. In other areas, instead, there were improvements compared to 2021; in particular, the percentage of people with advanced digital skills in the 'Communication and Collaboration' domain increased by 4 percentage points and by nearly 3 percentage points in the 'Problem Solving' domain.

The indicator is particularly low for people who have low or no formal education, with only 22.6% of them having at least basic digital skills (versus 33.6% in the EU), and for people between 55 and 74 years old, for which the value is 30% (vs 37% in the EU). Population living in rural areas also records lower levels of digital skills, with 40.6% recording at least a basic level (vs 47.5% in the EU).

The gap between Italy and the rest of the EU is significant especially when considering the youngest generations and people living in urban areas, which are groups generally expected to have higher levels of digital skills. In Italy, only 59% of people aged 16-24 and 54% of those aged 25-54 have at least basic digital skills. The EU averages are 10 percentage points above with, 70% and 64% respectively. Similarly, only 51% of the population living in urban areas has at least basic digital skills, vs 63% in the EU, with a 12 percentage points gap. Italy only narrows the gap with the EU for people with medium and high education levels.

In its national roadmaps, Italy set a target of 74.6% by 2023, standing below the 80% EU target. The target remains very ambitious, considering the low starting point, the limited growth rate observed so far, and despite possible positive effects due to the population dynamics and the generational shift.

Italy has strengthened the focus on digital skills in the last 5 years and the roadmap supports measures addressing the general population, schools, and workers. A heightened focus started in 2019, when Italy introduced its first digital skills strategy, and launched the flagship initiative Digital Republic and the related fund. With the RRP, measures in the different areas of action have been strengthened. In particular, the RRP supports key investment measures in basic digital skills for the general population. Two of the main measures aimed at providing citizens with at least basic digital skills and helping them use digital services are: the digital civic service (EUR 60 million) that, in 2023, involved around 1 900 young volunteers who, in turn, reached about 80 000 citizens; and the network of digital facilitation services (EUR 135 million), with the opening of 504 facilitation services (Punti Digitale Facile) across the country in 2023, which supported about 6 000 people in using digital services[143].

Other measures presented in the roadmap, and also partly supported by the RRP, focus on schools, including strengthening teachers' skills; and on upskilling and reskilling of workers, with initiatives such as the New Skills Fund, that contributes to the cost of training borne by the employer, or the Digital Skills Syllabus, that targets public sector employees and is showing encouraging results.

In particular, the syllabus reached over 205 000 public sector employees on basic digital skills, providing personalised training. Data collected during its implementation shows that there are strong gaps in terms of skills, but also that there is high interest, including in small public administrations, and that those who start the training path are likely to continue and reach advanced levels. In general terms and following the RRP, the digital competences of public sector employees have acquired an increasing attention, translated in specific targets (e.g., training on digital skills of employees is part of the criteria to measure the performance of managers; employees should receive at least 24 hours of training per year; 75% of employees should be trained on digital skills by 2025).

Overall, strengthening basic digital skills and overcoming the significant shortcomings remain a priority. Basic digital skills receive most of the support in the roadmap, with 16 measures and EUR 7.8 billion of planned investment until 2026. Measures also target re-skilling and upskilling of the workforce, aligning with last year's recommendation. However, data clearly shows that Italy faces a wide gap and progress is

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[143] Data updated in September 2023. The objectives are: on digital civil service, to train 1 million citizens by 2025; on the network of digital facilitation services, reaching more than 2 million of citizens by 2026.

very slow, a combination that requires significant and targeted efforts, covering all sections of the population including young people.

3.1.1.b ICT specialists
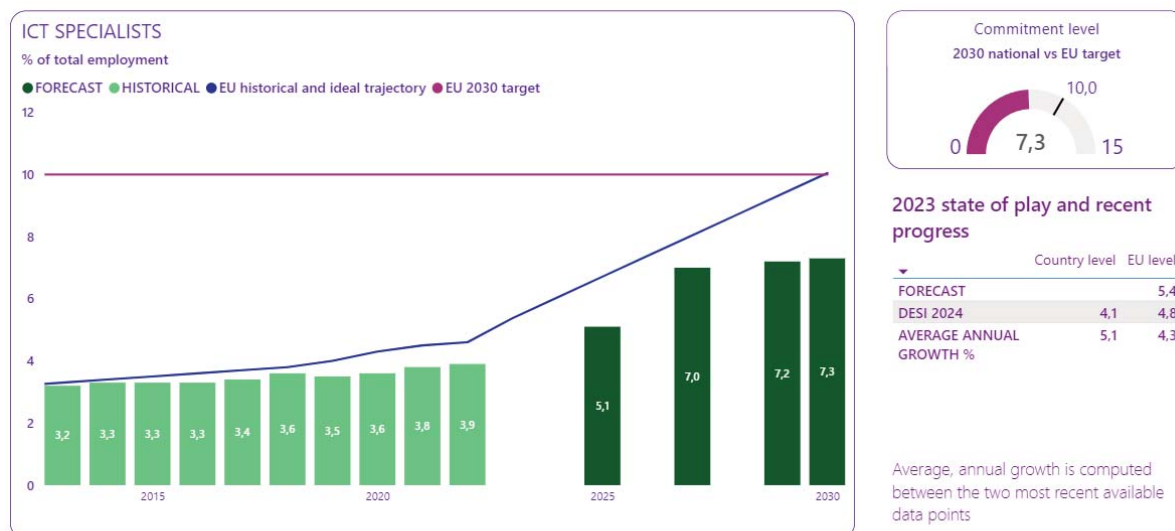
Note: The source of national forecast values is the 2023 country roadmap

Italy has scope to improve its performance to contribute to the EU's digital decade target on ICT specialists, despite it shows a positive dynamic. In 2023, ICT specialists in Italy were 4.1% of the people employed, standing behind the European average of 4.8%. Moreover, women represent only 15.7% of ICT specialists, against an EU average of 19.4%.

The target set in the roadmap is difficult to reach if the current trends continue. The trajectory set by Italy aims at reaching 7.3% by 2023, below the EU target of 10% and requiring to significantly accelerate the current trend. Due to its large population, the efforts of Italy will have decisive consequences on the achievement of the ICT specialist 2030 target at EU level.

The demand for ICT professionals has significantly increased in the last 5 years and largely exceed the offer of ICT specialists on the job market. According to national research, the number of job postings to hire ICT professionals has increased from about 20 000 in early 2019 to about 60 000 in April 2023. Most of the demand comes from large enterprises and focuses on professions like software developers and experts in network and systems engineering. This demand, however, largely exceed the offer (by 5 times, according to estimates of the research)[144]. This gap is confirmed by the data on the share of Italian enterprises that tried to recruit ICT specialists and found difficulties, which is also on an increasing path: from 54% in 2019 to 60% in 2022 (latest data available)[145].

Italy has a low share of ICT graduates, while the academic offer seems to increase too slowly. Few people in Italy undertake ICT studies, with about 1.5% of all graduates being classified as ICT graduates in 2022 (EU average is 4.5%)[146]. The ability of the educational offer (including Universities, ITS academies, and high schools) to meet the growing needs is a key factor. For example, according to the research, in Italy

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[144] AICA, Anitec-Assinform, Assintel, ICT: Talenti Cercasi, December 2023.

[145] Eurostat, Enterprises that recruited or tried to recruit ICT specialists by size class of enterprise (isoc_ske_itrcrs).

[146] Distribution of graduates at education level and programme orientation (Eurostat), considering the ISCED code 'Information and Communication Technologies'. According to national data (Laureati - Informazione sui file relativi ai laureati - Open Data dell'istruzione superiore (mur.gov.it)), if also graduates in computer science engineering are considered, this share would increase to 4.3%, however this data cannot be used for comparison with the EU average.

Universities still show limited growth in ICT courses (these courses represent 7% of the educational offer) and strong gender imbalances; while the existing specialised Tertiary Education Institutes (Istituti Tecnologici Nazionali or ITS) can give a strong contribution, to date, there are only 19 programs in ICT with about 30 students each per year . Increasing the number of ICT specialists in the Italian labour market will require acting on both these factors, i.e., participation in ICT studies and educational offer. In parallel, issues related to the low attractiveness of Italian enterprises for digital talents also deserve proper attention, as a dynamic that might further exacerbate the lack of ICT specialists in the Italian market.

Efforts to boost results in this area are supported by measures to encourage access to and participation in ICT programmes, and initiatives for technological transfer and capacity building in SMEs. Most of the measures included in the RRP, however, will give results only in 2024-2025. Actions to increase the number of ICT specialists cover, for example, scholarship programmes for doctoral students[147], and financial support to universities to increase enrolments in ICT-related courses through guidance activities in secondary schools, teacher training, mentoring and guidance in the first years of their studies, or financial contributions to students[148]. Part of the efforts are also targeted at strengthening digital programmes dedicated to university students, professionals, and businesses, by facilitating the activation of inter-university digital educational programmes and exchanges[149].

Finally, the national roadmap presents measures to strengthen the availability of advanced skills in SMEs, for example, through vouchers giving SMEs the possibility to hire innovation managers. In the industry landscape, an important role is also played by the Competence Centers, delivering demonstrations and training courses especially in relation to industry 4.0 technologies.

The participation of women in the ICT sector is streamlined in the general measures promoted by the Italian roadmap.

Overall, there is still a need to increase the capacity to train ICT specialists, attract and retain talents, and ensuring Italy's strong contribution to the EU target.

3.1.2 Key digital public services and solutions – trusted, user-friendly, and accessible to all

3.1.2.a e-ID

Italy has two certified eIDAS digital identity schemes, SPID and CIE, which are widely adopted in the country. The number of SPID and CIE issued continued to increase. In 2023, the total number of active SPIDs exceeded 37 million (from 34 million in 2022), and the total number CIE stood at 39 million. In other words, most adults have at least one of the two e-ID schemes. The national authorities also highlighted the continuous rise in the access to digital public services through SPID and CIE[150].

A positive picture is also provided by Eurostat data showing that, in Italy, in 2023 about 40% of individuals reported having used their e-IDs to access online public services in their country, and 47% had used their e-IDs to access online services for private purposes. Both these figures are above the EU average (36% and 41%, respectively)[151]. If coupled with the low level of digital skills in the country, these figures represent a remarkable achievement.

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[147] Measure under the RRP (Mission 4, Component 1, investment 3.4), with the overall objective of providing 500 scholarships.
[148] ICT Graduates Plan, funded with national resources for a budget of about EUR 1 million per year.
[149] Digital Education Hubs.
[150] Based on information provided by Italian authorities, in 2023, there were more than 1 billion accesses with SPID to public and private services, while the number of accesses with CIEs reached 34.999.181 (up 67% from 2022).
[151] Eurostat, Use of electronic identification (e-ID), isoc_eid_ieid.

Also, with the support of the Recovery and Resilience Facility, Italy has taken many initiatives to increase the number of services integrated in SPID and CIE and incentivise their use among citizens. In particular, as part of the measure 'Citizen experience', the Plan allocates EUR 285 million to foster the adoption of e-IDs, setting two targets: 42.3 million citizens having an e-ID by 2026; and 16 500 public administrations adopting an e-ID scheme[152]. Moreover, in March 2023, AGID issued a regulation identifying technology intermediaries with the task of simplifying the onboarding of public and private service providers in the SPID system.

Italy is contributing to the development of the regulatory and technological framework of the European Digital Identity Wallet (EUDI Wallet) participating in the international consortia for the development use cases. In particular, the country is actively engaged in: NOBID, a consortium involving a set of Nordic and Baltic countries, Germany and Italy, for a large-scale pilot for the payment use case in the EU Digital Wallet; and Potential, bringing together 19 Member States (plus Ukraine) for the development of six use cases (e-Government services, e-Prescriptions, bank account opening, SIM card registration, driving licences, and eSignatures).

Italy has initiated the development of a national wallet, 'IT Wallet', in line with the framework being defined at the EU level. The IT Wallet is aimed at rationalizing the digital identity ecosystem in Italy and facilitating access to public services. In line with the EU Digital Identity Wallet, the IT Wallet will provide a single place where to securely store most important documents and will allow people to authenticate and access the digital space while maintaining full control of their data. With this project, Italy intends to develop the wallet ahead of the roll-out of the EU Digital Identity Wallet, expected by 2026.
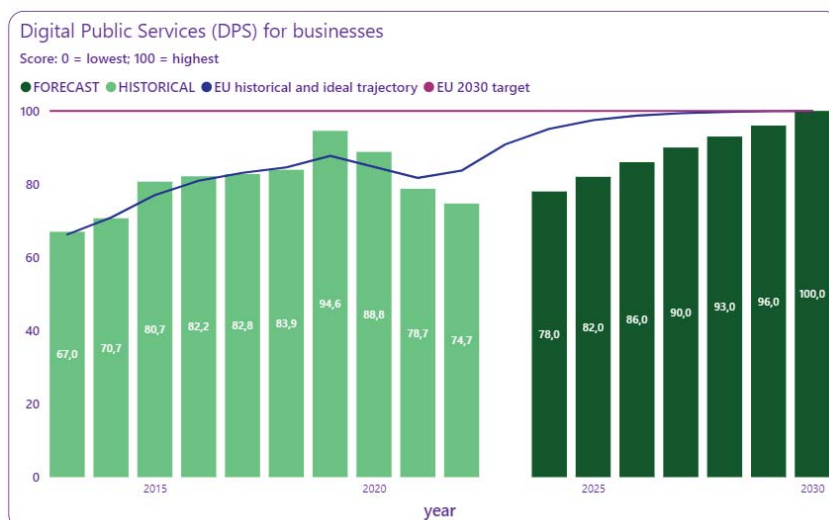
3.1.2.b Digitalisation of public services for citizens and businesses
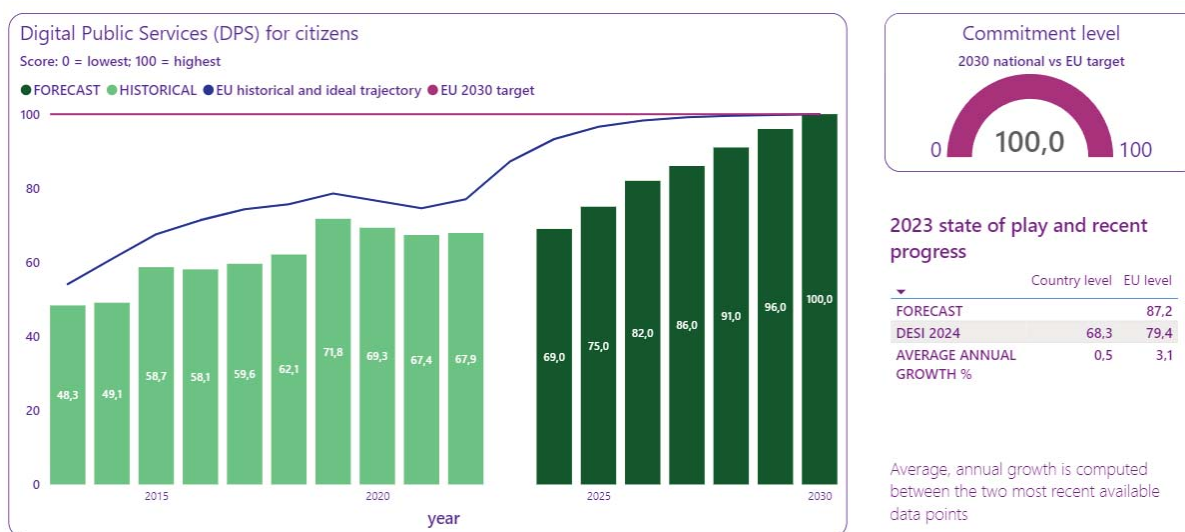
Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

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[152] Mission 1, Component 1, Investment 1.4.4: Adoption scale up of the National Digital Identity platforms (SPID, CIE) and the national registry (ANPR).

Note 1: Data break-in-series in 2020

Note 2: The source of national forecast values is the 2023 country roadmap

Italy has scope to improve its performance to contribute to the EU's digital decade target on making accessible online key digital public services to citizens and businesses. On the availability of digital public services for citizens, in 2023 Italy scored 68.3, against an EU average of 79.4, with a limited dynamic in term of progress. On the availability of digital public services for businesses, the score was 76.3 in 2023, also below the EU average of 85.4 but showing an increase of about 2% compared to last year. The gaps in terms of cross-border availability of services, for both citizens and businesses, negatively affect the overall score of the country[153].

In its roadmap, Italy aims to reach the EU level target of 100% of key digital public services available to citizens and businesses by 2030. The current data and limited growth make the achievement of this target within the defined time period challenging.

The digitalisation of public services, however, has been an important area of focus for Italy's digital policies in recent years and it benefits from significant investment supported by the Recovery and Resilience Facility. Measures supported with the RRP build on major e-government projects that are at the cornerstone of the Italian strategy to digitise public services, encourage their take up and increase the efficiency of public administration, notably: the integration of services in enabling platforms like appIO (as one-stop-shop for access to public services), PagoPA (for digital payments towards the public administration) and SEND (for notifications of acts with legal value), which provide user-friendly interfaces for interaction between citizens/businesses and the public administration; the development of interoperability and exchange of data between public administrations, with further progress in the implementation of the national digital registry (ANPR) and the national data platform (PDND); the resilience of infrastructure of public administrations, with the advancements in the migration to the most appropriate cloud solutions (in line with the Italian Cloud Strategy 2021). These measures are also part of the national roadmap along with other initiatives, such as those for the implementation of the Single Digital Gateway and POLIS (which supports the use of digital public services by citizens, with dedicated support services and infrastructure located in post offices).

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[153] In 2023, in cross-border availability of digital public services for citizens, Italy scores 47, against an EU average of about 68; the score for businesses is 58, against an EU average of 73.

In 2024, Italy published a new Digital Plan for the public administration, which re-affirms the objective of building a more efficient and accessible system for citizens. It aligns the interventions with the measures supported under the RRP and places particular focus on the monitoring of digitalisation across the public administrations[154].

Some issues related to complexity and lack of user-friendliness of digital public services remain and are raised by stakeholders, such as the non-intuitive design of websites, the lack of consistency between the online and physical channels, insufficient user support, or need to provide documents more than once[155]. These issues were still raised despite the efforts made by the government through projects such as the Designers Italia (which produces guidelines, models, and resources for designing and implementing public services)the accessibility guidelines, and a number of measures covering monitoring, guidance and training. In 2023, AgID conducted in-depth monitoring of 100 websites and mobile applications of public entities, next to the quarterly automated monitoring of approximately 25,000 public entity websites which provides feedback on the level of accessibility and mistakes detected. In addition, the agency organized specific training sessions to promote the culture of accessibility and usability.

3.1.2.c e-Health
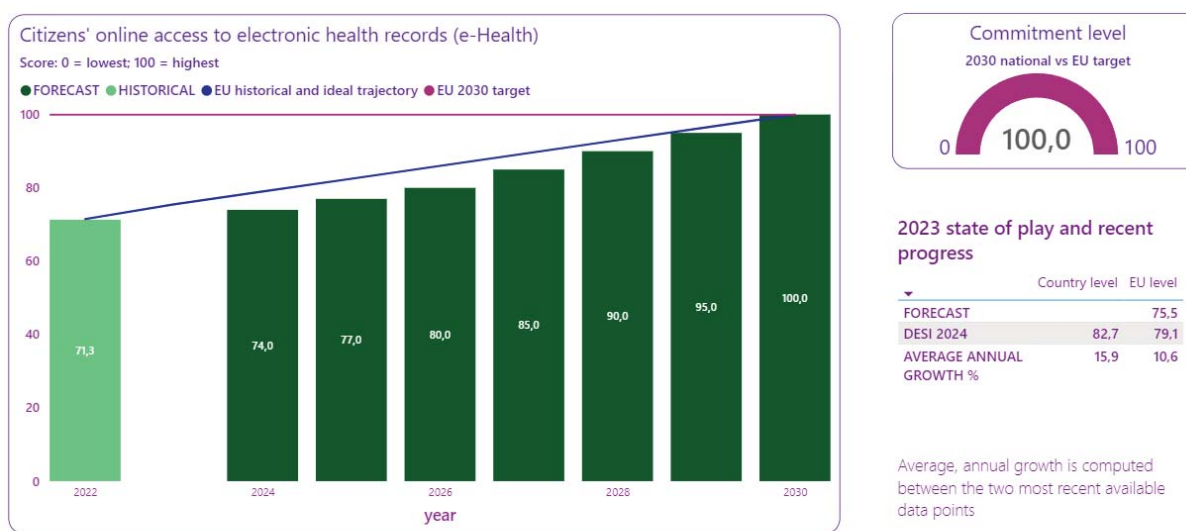
Note: The source of national forecast values is the 2023 country roadmap

Italy brings a very strong contribution to the Digital Decade target of making Electronic Health Records (EHR) accessible to all citizens, showing a positive dynamic. The country has an overall eHealth maturity score of 83 out of 100 in 2023 (EU average is 79/100). Italy significantly improved its performance, moving from a maturity score of 71/100 in 2022.

The EHR has been introduced in all regions and between 80% and 100% of the national population is technically able to access online eHealth records through both native mobile application(s) and online portal(s), logging in using an eID compliant with eIDAS Regulation. The Web Content Accessibility Guidelines are generally followed. Over 40% of the regions have implemented a functionality to put legal provisions for access opportunities into practice.

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[154] Piano Triennale per l'Informatica nella Pubblica Amministrazione 2024-2026 (https://www.agid.gov.it/sites/default/files/repository_files/piano_triennale_per_linformatica_nella_pa_2024-2026.pdf).

[155] These issues are also reflected in the results of the e-government benchmark on the indicators related to the use of pre-filled forms, user support and transparency (Study 'eGovernment benchmark 2024': https://digital-strategy.ec.europa.eu/en/news-redirect/833346).

Most of health data types are made available in a timely manner, although there is room for improvement[156]. The main gap, however, is related to the limited uptake by healthcare providers supplying health data. Only 3 out of 11 applicable categories of healthcare providers supply relevant data[157].

For 2030, Italy aims to score 100 in e-health, in line with the EU target. The target seems achievable if efforts are sustained.

As part of the RRP, Italy has started a specific measure on the EHR. The aim is to improve services provided by regional EHRs, ensuring that Italian citizens have access to their medical file regardless of where they seek assistance within the country.

Emphasis is currently on improving interoperability, promoting consistency in content, services, and user experience, as well as standardisation and portability between regions. In 2023, two 'crash programmes' were launched in a sample of regions: one focused on implementation, particularly in terms of inputting data into the EHR by healthcare professionals, and another on interoperability between regions. The programme gave good results. For instance, in Campania, as result of the crash programme, implementation rates of the EHR surged from 2% before the program to 70% afterwards. Regarding interoperability, following the programme, it was decided to launch a mapping of the applications used by different regions and the establishment of a national accreditation system to ensure that the applications used were interoperable.

3.2 Building a safe and human centric digital environment and preserving our democracy

The Eurobarometer reveals that Italians are concerned about risks encountered online, but there is also limited awareness regarding the continuity of offline rights online. According to the results of the Eurobarometer[158], Italians are especially concerned by the impacts of fake news and disinformation (flagged as important by 43% of the respondents), misuse of personal data (40%) and insufficient protection of minors (33%) on their daily lives[159]. Another important element, that public authorities should focus on, is the development of AI and other digital technologies in compliance with our rights and values. This aspect is mentioned as important by 82% of the respondents in Italy (against 78% in the EU).

However, almost half of the people interviewed in Italy (49%) declared to be not aware that their offline rights apply also online (versus an EU average of 39%).

The Italian roadmap emphasises aspects such as bridging the digital divide, encouraging digital inclusion and participation as principles that guide digital transformation efforts. Various working groups, coordinated by the government and involving stakeholders are tackling issues such as bridging the digital divide, encouraging digital inclusion and facilitating access to digital public services, and boosting specialised ICT skills. Notable initiatives include programmes for digital literacy education aired on the national public broadcasting network, the Digital Skills Award, or the work of the National Coalition for Digital Skills and Jobs ('Digital Republic'), which has trained millions of people. Furthermore, ongoing trials with electronic voting aim to empower Italians living abroad by enabling them to vote remotely, showcasing a commitment to embracing digital innovations to boost democratic processes.

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[156] Data about medical images are unavailable in most regions, and data about allergies, current problems, medical devices/implants, procedures/operations and current/past medicines are available in most regions but not in a timely manner.

[157] Study 'Digital Decade eHealth Indicator Study': https://digital-strategy.ec.europa.eu/en/news-redirect/833348.

[158] Special Eurobarometer on the Digital Decade 2024.

[159] Answer to the question: 'The European Union has regulated the behaviour of online platforms, such as social media and online marketplaces, in the EU. In the context of the enforcement of this legislation, which one of the following issues do you feel has the biggest personal impact on you? Firstly? And then?'. The answer options mentioned in the text are those that were mentioned by most of the respondents (out of a total of 9 answer options).

Efforts have been addressed to safeguard users from various forms of illicit content, protect minors and users in the evolving digital landscape. Over the years, in the context of the EU legislative framework, Italy has developed instruments spanning legislation banning secondary ticketing[160] and advertising associated with gambling[161], age verification systems to protect minor from access to pornographic content[162] and guidelines for protection of minors in the cyber space[163], copyright law to combat online piracy of live events, particularly sport events[164], and to increase the protection of works with high digital content[165].Additional initiatives are ongoing in the area of protection of minors and influencers: a consultation on technical and procedural actions that website operators and providers of video-sharing platforms shall adopt in order to verify users' age and ensure an appropriate level of protection; a public consultation and the establishment of a technical committee to draft a code of conduct on influencers.

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[160] Law no 232 of 11 December 2016 – Budget Law 2017.

[161] Law Decree n. 87 of 12 July 2018 ('Dignity Decree').

[162] Law Decree n. 159 of 15 November 2023.

[163] Decision No. 9/23/CONS, implementing the art. 7-bis of the legislative decree of 30 April 2020, n. 28, regarding 'Systems for the protection of minors from cyberspace risks'. The guidelines, implementing legislation on the protection of minors from cyberspace risks, mandate parental control systems for Internet service providers, irrespective of the delivery technology, to filter inappropriate content for minors and to block content reserved for an audience over the age of 18.

[164] Law n. 93 of 14 July 2023, and Decision N. 189/23/CONS.

[165] Article 27, paragraph 2, of Law No. 206 of December 27, 2023, 'Organic provisions for the enhancement, promotion and protection of the made in Italy' provided for the establishment of an inventory of the works of digital creators in the general public register of protected works, referred to in Article 103 of Law No. 633 of April 22, 1941.

4 Leveraging digital transformation for a smart greening

Italian enterprises are generally attentive to matters related to the impact of the digital devices, while Italian citizens consider the digital transition as important in supporting the green transition. In 2022, 59.9% of enterprises in Italy declared to consider the environmental impact of ICT services, or ICT equipment, before selecting them and applied some measures, affecting the paper or energy consumption of the ICT equipment. This figure is well above the EU average of 48.7%.

However, the propensity of people to recycle old digital devices is slightly lower in Italy than in the rest of the EU. About 10.7% of the population recycling mobile phones, 5.9% laptops and tablets and 9.7% desktop computers (10.4%, 9.7% and 12.8% respectively at EU level). However, Italian citizens support the relevance of digital as means to fight climate change and support the green transition. According to the Eurobarometer survey 'Digital Decade 2024', 81% of respondents in Italy consider that digital technologies are important to help fighting climate change compared to the EU average of 74%). 80% of Italian respondents also think that ensuring that digital technologies serve the green transition should be an important action for public authorities (in line with the EU average of 81%).

In 2024, Italy approved the 'Transition 5.0' Plan, to encourage enterprises to invest in green and digital technologies. Supported under the REPowerEU chapter of the RRP, the plan supports investments in digitization and the green transition of businesses through a tax credit scheme. With a total budget of about EUR 6.3 billion for 2024-2025, the tax credit will be granted to enterprises of any size for investments in tangible and intangible assets, provided that a reduction in energy consumption of the production unit of at least 3% is achieved (or 5% if calculated on the process affected by the investment). In addition, within the framework of innovation projects resulting in the reduction in energy consumption mentioned above, the tax credits will also apply to investments in new instrumental assets necessary for self-production of energy from renewable sources, and expenses for training of employees aimed at acquiring or consolidating skills in technologies for the digital and energy transition of production processes.

This plan will scale up and consolidate actions in this direction that had been already launched. For example, the implementation of 'Sustainable Investments 4.0' is supporting innovative and sustainable investments by businesses, leveraging digital technologies as outlined in the Transition 4.0 Plan. This initiative primarily benefits micro, small, and medium-sized enterprises across seven regions[166].

Ongoing projects in Italy also aim to use advanced technologies to mitigate the environmental impact of human activities or combat climate change by leveraging data. For instance, an initiative of the RRP is to implement an advanced and integrated monitoring and forecast system, identifying and predicting risks as a result of climate change and inadequate spatial planning through the use of advanced technologies (e.g., spatial data using satellite observation systems, drones, remote sensors). Another example under the RRP is a measure to develop large-scale mobility services based on the Mobility as a Service (MaaS) paradigm. These services optimise public and private transportation relationships, boosting more efficient, sustainable, inclusive, and digital mobility options. It has been launched in three pilot cities.

Overall, the interconnection between digital and green transitions is streamlined in various policies, which tackle multiple aspects. Another area of action is to promote green solutions through innovative public procurement strategies. The ENEA (National Agency for new technologies, energy and sustainable economic development) has been promoting innovation in the management process of energy-intensive and strategically important infrastructure at local level, in a 'smart city' perspective. Leveraging innovative

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[166] Basilicata, Calabria, Campania, Molise, Puglia, Sicilia, and Sardegna.

technological and digital solutions, it has initiated the development of a management model and related tools for Public Lighting infrastructure. It developed the PELL Platform (Public Energy Living Lab) as a tool for collecting, organizing, managing, processing, and evaluating data for the monitoring of the infrastructure and its efficient and effective management. Recently, in collaboration with AgID, ENEA has defined the specification of the PELL IP data model to ensure the interoperability of data and systems, extending the application to other energy-intensive public infrastructures such as schools and hospitals.

Annex I – National roadmap analysis

Italy's national Digital Decade strategic roadmap

On 31 January, Italy submitted its national strategic roadmap, in line with Article 7 of the Digital Decade Policy Programme Decision. The roadmap in itself has not been consulted on, but measures are the result of consultation processes in place for different areas of action. Government approval is pending, as is its publication.

The Italian roadmap is very comprehensive and presents 14 targets and 12 trajectories until 2030. To be noted that, in Italy, the indicators on VHCN and FTTP coincide. A trajectory is missing for unicorns, although the target value for 2030 is provided. Most of national targets match the 2030 EU targets, including the commitment to achieve 100% VHCN coverage by 2026, building on the measures of the Recovery and Resilience Plan. Basic digital skills, ICT specialists, the adoption of technologies by enterprises (cloud, AI, data analytics), taken separately, are set below the EU target values (with the target on cloud uptake set at 74%, thus broadly in line with the EU target). The trajectories have been computed on the basis of the correct KPI definitions but might require adjustments as regards the years taken as starting value/baseline.

The table below reflects a best-effort attempt to categorise the measures and budget as presented in the Italian roadmap in line with the Digital Decade targets. While some targets lack specific measures, it is reasonable to assume that they will benefit from different measures of the roadmap, as elaborated further below.

Digital Decade Target/objective	Budget (EUR Million)	Number of measures
Connectivity Gigabit	5 400	3
Connectivity 5G	2 000	1
Semiconductors	3 292.0	2
Edge nodes	50.0	1
Quantum computing	49.9	4
SME take up	1 532.5	4
Cloud/AI/Big Data uptake	136.0	3
Cloud only uptake	900.0	1
AI only uptake	-	-
Big data uptake	-	-
Unicorns	-	-
Basic Digital Skills	9 222.9	15
ICT Specialists	1 173.2	12
e-ID	259.7	1
Key Public Services	7 147.3	13
e-Health	1 300.0	1
Objectives	-	-
Total	**32 507**	**61**

The roadmap describes policies, measures and actions supporting each of the targets. In the table above, the targets on AI and big data do not have measures nor budget. However, those targets are considered to be broadly supported by the measures contributing to the targets related to SMEs digitalisation and uptake of cloud/AI/Big data taken together.

The roadmap also provides an **overview of regional measures** that are relevant to each target, although

quantifications are not available in all cases.

While not reported in the table above, **objectives and digital rights and principles are also addressed** with an overview of some of the existing measures outlining the efforts made towards inclusion, accessibility and participation, technological leadership (with a narrow focus on cybersecurity), and the green and digital transitions.

Measures related to **basic digital skills** and **ICT specialists** are the **most prominent**, **in line with the positioning of the country and the ambition of the national trajectory**. The document outlines a variety of proposed measures, aimed at boosting digital skills across the population, encouraging inclusivity, and supporting re-skilling and upskilling. Efforts are also directed towards improving **connectivity**, building on the measures planned as part of the Recovery and Resilience Plan, and advancing the **digitalisation of businesses**, including support for emerging technologies like AI and blockchain. There is a strong focus on improving **digital public services**, next to initiatives for the development and deployment of e-ID and electronic health records, with specific targets for practitioner adoption. The targets on **semiconductors, edge-nodes and quantum** are supported by a **limited number of targeted measures**, which represent part of the initiatives and capabilities on which the country can build.

Overall, the roadmap presents a coherent effort to increase the digitalisation of the country, also addressing its weaknesses (e.g., in the area of digital skills) and answering to challenges identified in the previous State of the Digital Decade report 2023. However, some aspects **might require more targeted efforts**. While there are general measures addressing the uptake of technologies by businesses, measures aimed at facilitating the **adoption of specific technologies, starting from AI**, should be considered. The **ambitious target on unicorns**, in addition, does **not appear to be supported by specific measures**, including action to address framework conditions and encourage private investment. A more **comprehensive approach** could be taken to strengthen the country's position in **key areas such as semiconductors, edge computing, and quantum technologies**. In addition, given the magnitude of the challenge and the existing gaps, the **scale of efforts directed towards skills development and ICT specialists** should be carefully considered.

The roadmap strongly builds on the Recovery and Resilience Plan, which determines the timespan of the measures presented, in most of the cases until 2026.

Annex II – Factsheet on multi-country projects (MCPs) and funding

Multi-country projects (MCP) and EDICs

Italy is member of the following EDICs already set up: the Alliance for Language Technologies (ALT-EDIC), European Blockchain Partnership and European Blockchain Services Infrastructure (EUROPEUM-EDIC) and is finalising negotiations to become member of the CitiVERSE EDIC. Italy is participating in the working groups of the following possible future EDICs: Cybersecurity Skills Academy, Cancer Image Europe (EUCAIM EDIC), AGRIfood EDIC, Mobility and Logistics Data EDIC, Genome EDIC. It participates as an observer in the working group for the possible future Digital Commons EDIC.

Moreover, Italy participates in the IPCEI on Next Generation Cloud Infrastructure and Services (IPCEI-CIS), the IPCEI in Microelectronics (IPCEI-ME) and the IPCEI on Microelectronics and Communication Technologies (IPCEI-ME/CT).

All in all, Italy is active in 3 IPCEIs and in 9 EDICs that are **set up or in the making.**

Moreover, as highlighted in the roadmap, Italy is active in a number of multi-country projects and initiatives, such as the **EuroHPC JU, EuroQCI, Chips Joint Undertaking**, the network of **Testing and Experimentation Facilities**, of **European Digital Innovation Hubs**.

EU funding for digital policies in Italy

The Italian Recovery and Resilience Plan (RRP) devotes EUR 47 billion (26% of the total) to the digital transformation. According to a JRC study, EUR 41.8 billion directly contribute achieving Digital Decade targets[167].

The largest digital measure of the RRP is dedicated to the digitalisation of enterprises (Transition 4.0), which provides tax credits for the acquisition of industry 4.0 tangible and intangible assets. Measures also aim to strengthen technology transfer centres, in complementary with the network of European Digital Innovation Hubs.

Significant reforms and investments contribute to the transformation of the public administration. This includes measures for the uptake of cloud across all administrations, interoperability of national systems and registers, the improvement of digital public services through the uptake of enabling platforms. The RRP also aims to strengthen the healthcare system through digital technologies, including a measure focused on the deployment and uptake of the Electronic Health Record.

The RRP addresses digital-skills development with measures aimed at improving the basic digital skills of the general population, increasing the offer of training on advanced digital skills, and upskilling and reskilling the workforce.

Finally, the Plan allocates EUR 5.3 billion to the deployment of VHCN and 5G (primarily with the two key measures 'Italia 1 Giga' and 'Italia 5G') and supports the development and deployment of advanced technologies, such as microelectronics.

As of March 2024, Italy has submitted five payment requests and has received disbursement for EUR 102.5 billion (including pre-financing and the positive assessment of four payment requests).

According to the JRC study mentioned above, Italy also received EUR 3.5 billion of Digital Decade-relevant

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[167] Based on an estimation of the possible contribution to the Digital Decade (Joint Research Centre report 'Mapping EU level funding instruments to Digital Decade targets - 2024 update' (Signorelli et al., 2024)).

budget from cohesion policy funds with an accent given to digitalisation of public services and of enterprises.