Council of the
European Union

Brussels, 3 July 2024
(OR. en)

11893/24
ADD 1

TELECOM 231
DIGIT 171
CYBER 218
COMPET 757
RECH 347
PI 117
MI 670
EDUC 289
JAI 1164
ENFOPOL 329
COSI 126

COVER NOTE

From:	Secretary-General of the European Commission, signed by Ms Martine DEPREZ, Director
date of receipt:	2 July 2024
To:	Ms Thérèse BLANCHET, Secretary-General of the Council of the European Union
No. Cion doc.:	SWD(2024) 261 final
Subject:	PART 2/6 COMMISSION STAFF WORKING DOCUMENT Digital Decade country reports Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions State of the Digital Decade 2024

Delegations will find attached document SWD(2024) 261 final.

Encl.: SWD(2024) 261 final

EUROPEAN
COMMISSION

Brussels, 2.7.2024
SWD(2024) 261 final

PART 2/6

COMMISSION STAFF WORKING DOCUMENT

Digital Decade country reports

Accompanying the document

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions

State of the Digital Decade 2024

State of the Digital Decade 2024

Cyprus

1 Executive summary

Cyprus 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, Cyprus made notable progress in gigabit connectivity infrastructure (notably FTTP), and in the share of ICT specialists in employment. However, **important challenges** persist in at least basic digital skills and e-health.

Cyprus has made significant progress over the last few years. The country's National Digital Strategy 2020-2025 aims to make Cyprus 'a fit-for-the-future society and knowledge-based economy'. Implementation of the strategy is showing positive results, in particular the deployment of the gigabit connectivity infrastructure reaching 77.1% coverage in 2023. Although Cyprus made progress in almost all indicators compared to 2022, half the population still lacks at least a basic level of digital skills. But the results for ICT specialists in employment with 5.4% shows a very strong dynamic, exceeding the expectations. Building a solid, secure, integrated, and modern digital government architecture is at the core of Cyprus's digital transition to provide safe and inclusive digital services for people and businesses.

According to the Special Eurobarometer 'Digital Decade 2024'[1], 79% of respondents in Cyprus consider that the digitalisation of daily public and private services is making their lives easier, considerably above the EU average of 73%. However, only 56 % of respondents are aware that rights that apply offline should also be respected online, below the EU average (62%).

Cyprus is actively collaborating at EU level, being member of the European Digital Infrastructure Consortium (EDIC) on Blockchain, EUROPEUM-EDIC (already set up). It is also developing the Statute and other relevant documents of the possible future Cybersecurity Skills Academy EDIC, within an informal working group. In addition, the country is participating in Multi-Country Projects (MCPs) such as EuroHPC and the European consortium POTENTIAL (Pilots for European digital Identity Wallet).

Cyprus's Recovery and Resilience plan (RRP) allocates 24.6% of its total budget to the digital transformation (EUR 274 million). A high priority is given to digitalising public services and upgrading connectivity infrastructure in line with the European Semester country-specific recommendations[2]. Under Cohesion Policy, an additional EUR 0.1 billion (12% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[3].

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

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

[3] 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]	Cyprus			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	CY	EU
Fixed Very High Capacity Network (VHCN) coverage	60.0%	77.1%	28.5%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	60.0%	77.1%	28.5%	64.0%	13.5%	100%	-
Overall 5G coverage	100.0%	100.0%	0.0%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		7		1 186		x	10 000
SMEs with at least a basic level of digital intensity	66.2%	67.3%	0.8%	57.7%	2.6%	90.1%	90%
Cloud	42.2%	45.5%	3.8%	38.9%	7.0%	75%	75%
Artificial Intelligence	2.6%	4.7%	34.5%	8.0%	2.6%	75%	75%
Data analytics	NA	33.5%	NA	33.2%	NA	75%	75%
AI or Cloud or Data analytics	NA	58.0%	NA	54.6%	NA		75%
Unicorns		3		263		x	500
At least basic digital skills	50.2%	49.5%	-0.7%	55.6%	1.5%	80%	80%
ICT specialists	4.6%	5.4%	17.4%	4.8%	4.3%	9%	~10%
eID scheme notification		Yes					
Digital public services for citizens	63.6	74.0	16.3%	79.4	3.1%	100	100
Digital public services for businesses	84.7	86.1	1.6%	85.4	2.0%	100	100
Access to e-Health records	70.2	68.1	-3.0%	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 **Cyprus's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating a **high ambition** but, based on this document, intends to allocate **some effort** to achieve the Digital Decade objectives and targets.

The national strategic roadmap of Cyprus is well aligned with the vision of the Digital Decade and is nearing full completion. It sets out measures for the majority of the targets, and 12 national trajectories to help reach the corresponding targets by 2030. Only trajectories and targets for edge nodes and unicorns are missing. The 5G target has already reached 100% coverage. The national targets are in line with the EU's 2030 target values, except for the percentage of ICT specialists in employment: the national target is cautiously set at 9%, and the EU's is 10%. Some parts of the roadmap could benefit from additional focus and effort, given the current results and the slow annual growth. This particularly concerns improving the population's digital skills, encouraging business take-up of AI, and digitalising public services for citizens. The broad objectives of the Digital Decade are presented alongside existing strategies. In particular, a green digital transition is part of the National Digital Strategy 2020-2025, with a target to reduce the digital sector's environmental impact by 20% by 2025. However, no specific measures are described in the roadmap to accelerate progress on these objectives, even though several initiatives are on-going at national level. The Digital Decade and the Declaration of Digital Rights and Principles are implicitly included in the national strategies for the country's digital transition.

The total budget of the measures presented is estimated at EUR 497.1 million (about 1.7% GDP), with priorities set on digitalising public services, promoting the digital transformation of SMEs and creating an innovative ecosystem for start-ups and scale-ups. Funding the digital transformation relies heavily on EU funding (the Recovery and Resilience Facility (RRF) and cohesion policy funding).

Recommendations for the roadmap

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

- **TARGETS:** Provide a target and trajectory for **unicorns** and **edge nodes**
- **MEASURES:** (i) Review and strengthen measures to contribute to the targets that are the most challenging to reach, such as **digital skills for all** and **business take-up of AI;** (ii) Provide **more information on the implementation of the 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 Cypriot perceptions of digital rights. While 43% of Cypriots believe the EU protects their digital rights effectively, a decrease of 10 percentage points from last year, it is slightly below the EU average of 45%. Concerns are notable, with 54% worried about children's online safety, up 15 points, and 47% concerned about control over personal data, up 12 points. Positively, 58% appreciate access to online public services and freedom of assembly and association in the online environment. 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[4].

A competitive, sovereign and resilient EU based on technological leadership

On technological leadership and competitiveness, Cyprus recently made good progress in deploying gigabit connectivity infrastructure and has already reached the 5G coverage 100% target for 2030. On advanced digital infrastructure, Cyprus's contribution to reaching the Digital Decade targets is currently limited in scope. Technological advancements are a challenge to an economy specialised in service industry, even though technology continues to play an essential role in making digital services resilient to cyberthreat. Cyprus has recently taken a significant step in building capabilities to strengthen cybersecurity with the establishment of the National Security Operations Centre (SOC). Furthermore, Cyprus brings a positive contribution to the EU's Digital Decade target on digitalisation of SMEs: 67.3% of SMEs have at least a basic level of digital intensity. The country is also committed to developing its innovation ecosystem for start-ups and scale-ups. It created the country's first equity fund with the support of the RRF.

Recommendations – Cyprus should

- **CONNECTIVITY INFRASTRUCTURE:** (i) Maintain the pace of VHCN roll-out, with a special attention to reach the underserved areas; (ii) Regularly assess emerging market demand for the remaining unassigned spectrum in the 26GHz band; (iii) 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.

[4] 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.

- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.
- **SEMICONDUCTORS:** Draw up a strategy to support research and innovation to contribute to the European semiconductor ecosystem.
- **EDGE NODES:** Continue to assess the market to develop measures or actions in the short term to contribute to the EU edge nodes target.
- **CLOUD/AI/DATA ANALYTICS:** (i) Consider if additional targeted measures for facilitating the adoption of AI by enterprises, in particular SMEs, would be necessary to reach the target by 2030; (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.

Protecting and empowering EU people and society

Equipping people with digital skills is a priority for Cyprus which put the digital transformation of schools at the core of the overall digital transition policy. A major reform includes revising the curricula, developing educational material and training teachers. The reform is on track to contribute to the Digital Decade target for basic digital skills and lay the groundwork for nurturing future ICT specialists. In 2023, Cyprus already made a positive contribution to the EU's Digital Decade target with ICT specialists making up 5.4% of the population in employment, above the EU average (4.8%). However, in 2023, half the population lacked at least a basic level of digital skills, which is a challenge given the pace of society and the economy's digital transformation. In its roadmap, Cyprus has also planned to develop a solid, secure, integrated and modern government digital architecture to provide safe and inclusive digital services to improve people's quality of life and the business environment. Nonetheless, in 2023, Cyprus demonstrated it had untapped potential to contribute to the Digital Decade targets for digital public services for citizens, scoring lower (74 out of 100) than the EU average (79.4). However, Cyprus has shown significant progress since 2022 when the score was 63.6.

Recommendations – Cyprus should

- **BASIC DIGITAL SKILLS:** Consider, based on the current moderate results, strengthening the strategy for developing the population's basic digital skills, especially by training people over 55.
- **DIGITAL PUBLIC SERVICES:** Consider focused measures, after further analysis of the e-government benchmarking methodology, to ensure that the benchmarking results reflect the current status of the country's digital public services.
- **E-HEALTH**: (i) Enhance the authentication method for logging into the online access service by using a notified e-ID; (ii) Make the data types of medical images and hospital discharge reports available to citizens through the online access service; (iii) Ensure that the online access service complies to web accessibility guidelines.

Leveraging digital transformation for a smart greening

The National Digital Strategy 2020-2025 commits Cyprus to the objective of a green digital transition. The plan sets out a target to reduce the digital sector's environmental impact by 20% by 2025 and promote the use of digital technologies to support sustainable development. Several actions, notably in R&D, have been undertaken in 2023.

Recommendations – Cyprus should

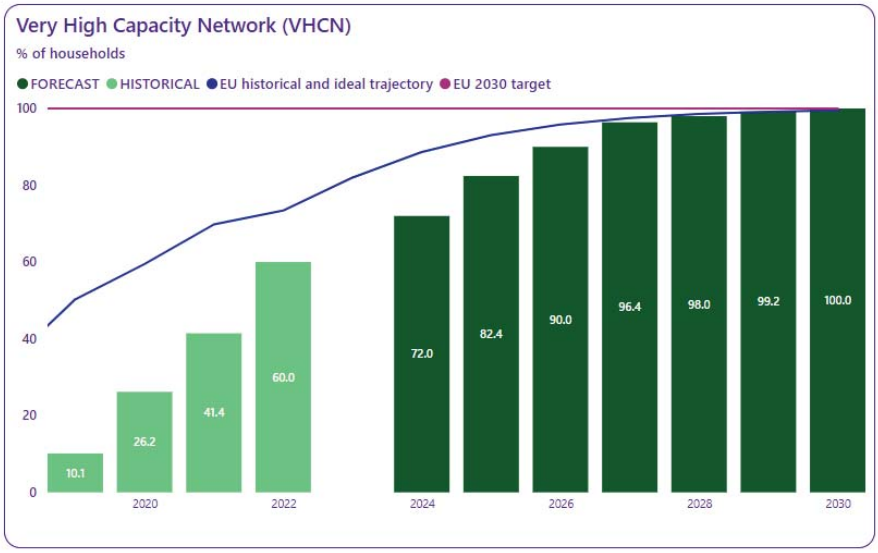
- Develop a coherent approach to twinning the digital and green transitions. First, promote improvements in energy and material efficiency of digital infrastructures, in particular data centres. Second, support the development and deployment of digital solutions that reduce the carbon footprint in other 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 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

Cyprus is making good progress in deploying gigabit connectivity infrastructure and has already reached the 5G coverage target for 2030. Although Cyprus's VHCN coverage (77.1%) was slightly lower than the EU average (78.8%) in 2023, the latest data show an average annual growth of 28.5%. On advanced digital infrastructure, the country's contribution to reaching the Digital Decade targets is currently limited in scope. Cyprus brings a positive contribution to the EU's Digital Decade target on the digitalisation of SMEs: 67.3% of SMEs had at least a basic level of digital intensity in 2023, above the EU average (57.7%). Furthermore, access to finance in Cyprus has been challenging for high-risk enterprises, such as start-ups. In response, Cyprus's first equity fund was created in 2023. On technological leadership and resilience, Cyprus has taken significant steps in building its capabilities to strengthen cybersecurity, including setting up the National Security Operations Centre (SOC) in 2023.

2.1 Building technological leadership: digital infrastructure and technologies

2.1.a Connectivity infrastructure (gigabit)

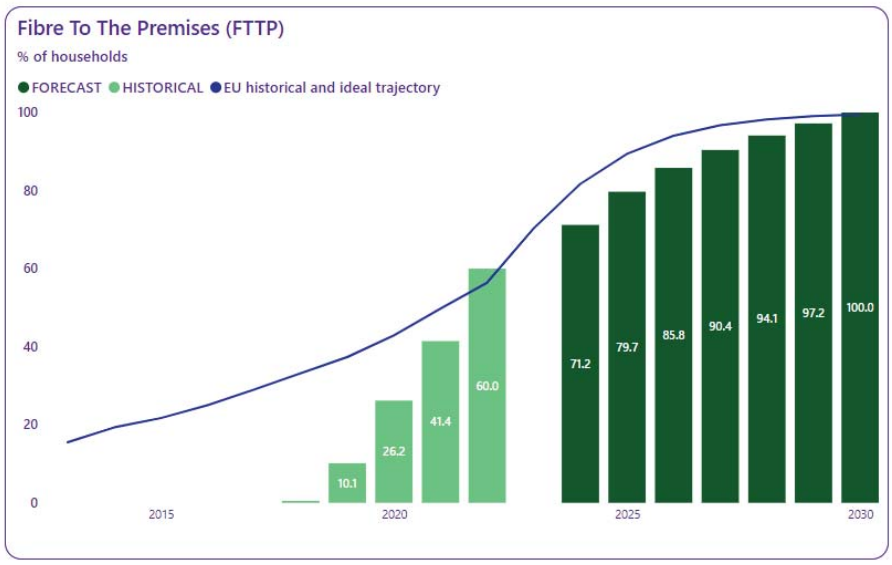


2023 state of play and recent progress

	Country level	EU level
FORECAST		82.0
DESI 2024	77.1	78.8
AVERAGE ANNUAL GROWTH %	28.5	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



2023 state of play and recent progress

	Country level	EU level
FORECAST		70.3
DESI 2024	77.1	64.0
AVERAGE ANNUAL GROWTH %	28.5	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

Cyprus has untapped potential to contribute to the EU's Digital Decade target for Very High-Capacity Network (VHCN) coverage in 2023, while showing a very strong dynamic. VHCN coverage in Cyprus (77.1%) was slightly below the EU average (78.8%), but the recent average annual growth of 28.5% shows a pace of progress almost four times faster than the EU average of 7.4%. VHCN coverage of households living in sparsely populated areas (55.7%) is slightly above the EU average (55.6%), which also demonstrates the fast growth since 2022 (35%). Furthermore, Fibre-to-the-Premises (FTTP) coverage in the country stands at 77.1%, above the EU average (64.0%), showing a positive dynamic. However, the share of fixed broadband subscriptions of at least 1 Gbps services (2.1%) is much lower than the EU average (18.5%), and the share of fixed broadband subscriptions of at least 100 Mbps (63.6%) is also below the EU average (65.9%).

In its national roadmap, Cyprus aims to reach 100% gigabit connectivity coverage by 2030, in line with the EU target of 100%. Given the annual progress, the trajectory presented and the national target for 2030 seems achievable. Moreover, the results for VHCN coverage in 2023 (77.1%) is already higher than the annual forecast presented in Cyprus's national roadmap for next year (i.e., the projected rate for 2024 is 72%).

Cyprus's roadmap mentions two investment measures funded by the RRP to expand coverage of VHCN in areas where there are no private investments and to increase the take-up of VHCN services. Two reforms are also set out to tackle administrative barriers to investments in connectivity by allowing for a better integration of information on connectivity and streamlining permit-granting procedures. The roadmap also refers to the National Broadband Strategy 2021-2025, which takes the 2030 Digital Decade targets into account.

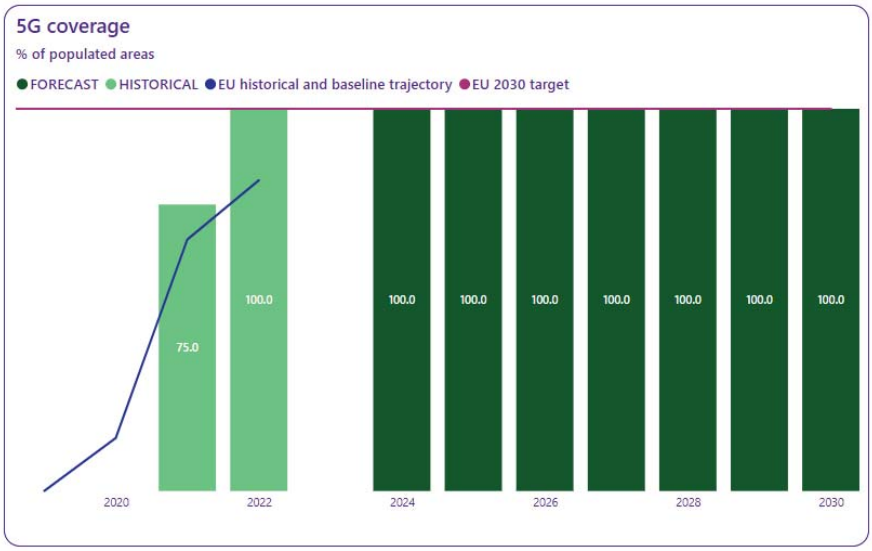
The vouchers programme to upgrade internet connections to be 'Gigabit-ready' and promote connectivity take-up was launched in 2023. The voucher is expected to benefit 82 000 households by Q2-2025.

In 2023, discussions about the copper switch-off started between the incumbent telecommunications provider and the national regulator, aiming for a switch-off by 2029. However, there is no concrete plan yet. Certain services in Cyprus are still using the copper network.

In 2023, the national regulator, the Communications Commissioner (CC), focused on implementing symmetric regulation. This approach resulted in reduced rates for duct access, thereby promoting fair and equal access for Fibre to the Home (FTTH) deployment by alternative operators. FTTH deployment by alternative operators leads to deregulation of the wholesale local access (market 1/2020), as long as the

criteria set by the last market analysis are fulfilled (i.e., three VHCNs operating in a given postal code area). A mechanism for continuous market assessments and monitoring was set up to assess geographic coverage of competitive VHCN networks and identify the deregulated areas.

2.1.b Connectivity Infrastructure (5G)



2023 state of play and recent progress

	Country level	EU level
FORECAST		
DESI 2024	100.0	89.3
AVERAGE ANNUAL GROWTH %	0.0	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

Cyprus brings a very strong contribution to the EU's 2030 Digital Decade target on 5G connectivity, having already reached the target of 100% coverage of populated areas in 2022. Only 35% of populated areas in Cyprus are covered by the 3.4-3.8 GHz band, below the EU average (50.6%). This band enables advanced applications requiring large spectrum bandwidth. The Mobile broadband uptake in Cyprus was at 91.1% in 2023, above the EU average (89.9%).

In Cyprus, the 26 GHz band has not yet been allocated. According to a public consultation in 2019, the market showed no significant interest for this band. There has been no new consultation since, even though this band is crucial for creating an innovation ecosystem for the 5G verticals. The Office of Electronic Communications and Postal Regulation (OCECPR) is currently conducting an independent study for 5G verticals (use cases, demand in different sectors). The results will be shared with the Deputy Ministry of Research, Innovation and Digital Policy (DMRID) to draw up a policy for 5G verticals.

The CC and the Digital Security Authority (DSA) participate in the EU project 5G-TACTIC **on 5G networks Cybersecurity and Trust.** The project brings together 15 partners from 8 different EU countries. The activities of the project focus on cybersecurity aspects for 5G services with emphasis on Open and disaggregated RAN solutions aiming to strengthen the EU 5G Cybersecurity Toolbox. As part of this project, the OCECPR will create a platform to provide regulatory support to stakeholders to test and ensure that solutions (network, devices, apps) are validated and meet all the main cybersecurity requirements.

2.1.c Semiconductors

Although Cyprus currently lacks a semiconductor manufacturing base, its active participation in the European semiconductor ecosystem is vital. By aligning with the coordinated efforts under the EU Chips Act, Cyprus stands to benefit significantly from increased investments in research and development, as well as enhanced training and workforce development initiatives. Additionally, Cyprus can engage in EU-wide initiatives aimed at boosting technological capabilities and fostering innovation, thereby strengthening its position within the European semiconductor landscape.

Cyprus has expressed its commitment to contributing to the EU's security of supply, resilience, and technological leadership in semiconductor technologies and applications through the European Chips Act and the work of the Semiconductor Board. This collective European approach is crucial for ensuring that all member states, including smaller ones like Cyprus, can contribute to and benefit from a robust and secure semiconductor supply chain.

2.1.d Edge nodes

The first report by the Edge observatory estimates seven edge nodes deployed by Cyprus in 2023. In total, the EU estimate is 1186. The national roadmap of Cyprus does not present a target value for edge nodes, while the estimation done by the Edge observatory is of 51 edge nodes in Cyprus by 2030.

Cyprus is closely following the work of the newly established EU Edge Observatory, exploring use cases for edge nodes, and assessing the market potential for their development. While the current national roadmap does not include specific activities in edge node development, Cyprus anticipates incorporating relevant activities in its next national roadmap to support the growth and deployment of edge nodes.

2.1.e-Quantum technologies

Quantum computing in Cyprus is still at an early stage of development. The EU-funded QUEST project, 'Quantum computing for Excellence in Science and Technology', started running in 2023 for 5 years with funding of EUR 2.5 million. This initiative will set up a research group in quantum computing at the Computation-based Science and Technology Research Center at The Cyprus Institute. The project also aims to create the necessary expertise in Cyprus, equipping specialists with the skills to harness the potential of quantum computing. The Department of Physics at the University of Cyprus is coordinating the European joint doctorate project AQTIVATE, 'Advanced computing, quantum algorithms and data-driven approaches for science, technology and engineering'. This interdisciplinary programme aims to train researchers and ICT professionals to use, develop and deploy cutting-edge methodologies in exascale computing, AI, and quantum computing for scientific and engineering applications.

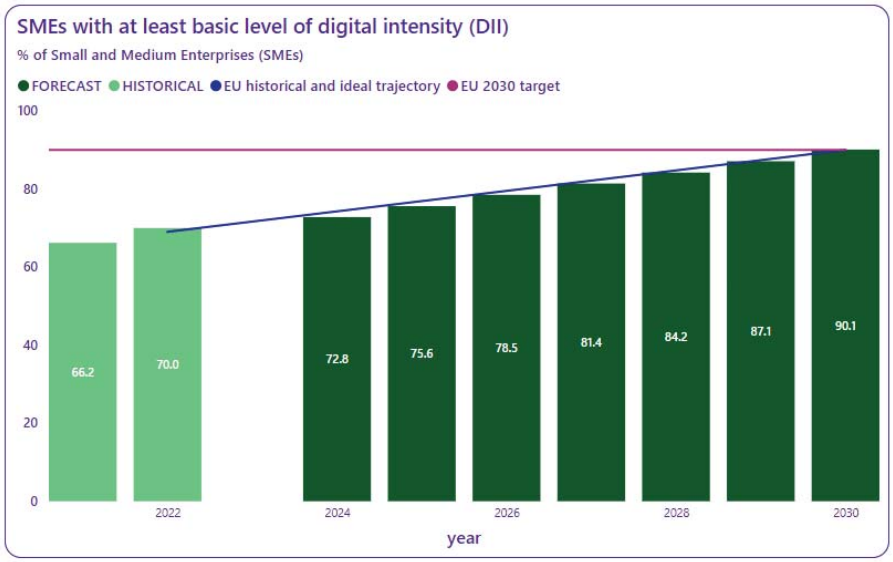
In addition, the Cyprus Quantum Communication Infrastructure (CYQCI) project is laying the foundations for the country's participation in the European Quantum Communication Infrastructure (EuroQCI). The project, co-funded by the EU, started in 2023 and will run for 36 months (with a total budget of EUR 7.5 million).

In 2023, the DMRID contributed to the National Quantum Initiatives Joint Risk Assessment Report on quantum technologies. This followed the Commission's recommendations to carry out risk assessments in critical technology areas for the security and resilience of systems and infrastructures in the EU.

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

In 2023, Cyprus took several measures to boost the digital transition of its economy and to further develop the ecosystem for start-ups and scale-ups. This work is based on two complementary strategies and is supported by EU funds (the RRF and cohesion policy funding). In 2023, the percentage of SMEs having at least a basic level of digital intensity in Cyprus increased substantially, reaching 67.3%, well above the EU average. On access to finance for innovative enterprises, the first Equity Fund was created in Cyprus, with the support of the RRF. An initiative to create a Knowledge Transfer Office has also been funded by the RRF.

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



2023 state of play and recent progress

	Country level	EU level
FORECAST		71.6
DESI 2024	67.3	57.7
AVERAGE ANNUAL GROWTH %	0.8	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

Cyprus brings a positive contribution to the EU's Digital Decade target on the digitalisation of SMEs while showing a limited dynamic. In 2023, with 67.3% of SMEs having at least a basic level of digital intensity, Cyprus was above the EU average (57.7%). This is an average annual growth of 0.8% compared to 2021 (the last comparable year in terms of the methodology for measuring this indicator). The EU average growth rate is 2.6%.

In its roadmap, Cyprus aims for 90.1% of SMEs to have at least a basic level of digital intensity in line with the 2030 EU target. The national trajectory is ambitious and might be unattainable given the annual growth rate of the indicator and the value forecast for next year (72.8%).

Cyprus's DMRID developed two complementary strategies to create a framework to guide the country's private sector smoothly through the digitalisation process. The New Cyprus Industrial Strategy Policy 2022 prioritises digitalising businesses and industry and plans creating smart factories equipped with digital production systems. The Cypriot National Digital Strategy 2020-2025 contributes to creating a digital ecosystem for enterprises, including a target to raise the percentage of businesses using e-commerce to 80% by 2025.

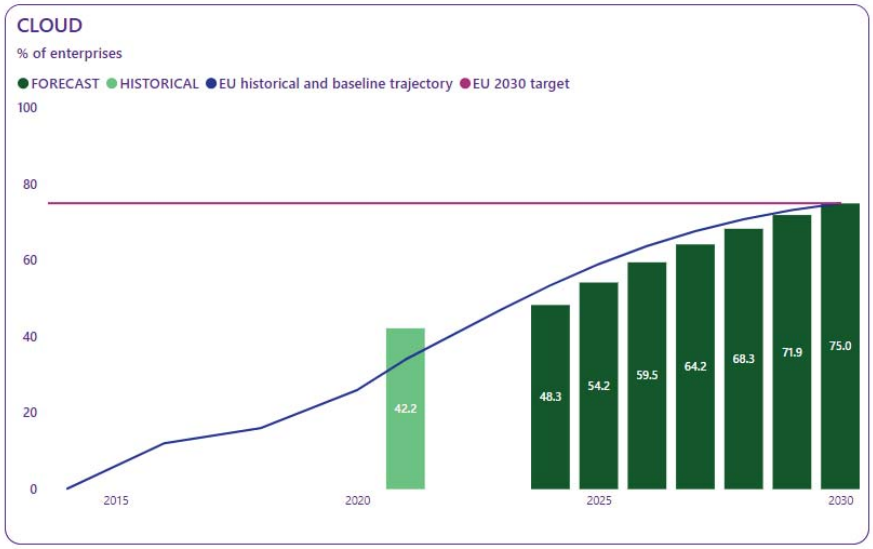
In 2023, the 'Digital Upgrade of SMEs' programme continued with a second call to provide funding of EUR 10 million. Both calls, saw demand for funding far exceed the available budget. A third call will take place in Q3-4 of 2024. The main requirement is to demonstrate the intended digital improvement regardless of the applicant's digital maturity. This could significantly contribute to improving basic levels of digital maturity. The Ministry of Commerce and Industry is currently assessing the impact of the programme on SMEs' digitalisation.

The 'Cyprus DIGital INNovation Hub' (DiGiNN) started operation in December 2022, providing training and different services to raise the level of SMEs' digital maturity. Overall, the Digital Innovation Hub (DIH) supports the whole digital transformation chain for SMEs and public organisation, from raising awareness to creating solutions, and supporting prototyping, business start-ups, pilot production, access to markets and scaling up. Cyprus is actively investing in its EDIH, fostering collaboration between organisations like the Cyprus Human Resource Development Authority (HRDA) and the Ministry of Commerce to drive digital innovation and business digitalisation.

In 2023, projects aiming to upskill and reskill SME managers and employees, such as the European Level Up project**,** (funded by the Digital Europe Programme and in which Cypriot bodies are partners), will also play a role in raising awareness and empowering SMEs in their digital transformation.

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

- **Cloud**



2023 state of play and recent progress

	Country level	EU level
FORECAST		47.3
DESI 2024	45.5	38.9
AVERAGE ANNUAL GROWTH %	3.8	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

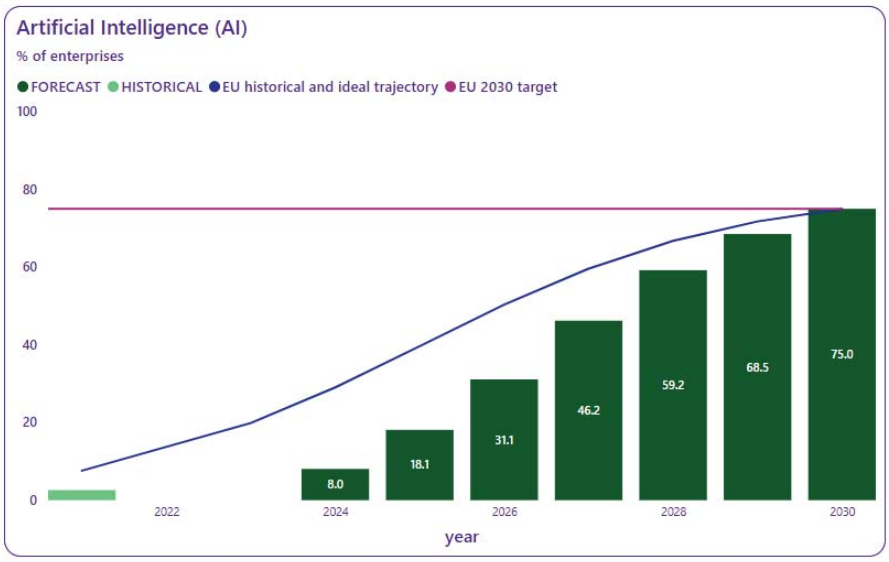
Cyprus brings a positive contribution to the EU's Digital Decade target while demonstrating a limited dynamic. The business take-up of cloud services in Cyprus progressed in 2023 to reach 45.5%, above the EU average (38.9%). This is an average annual growth of 3.8%, while the EU average annual progress is of 7%.

In its roadmap, Cyprus sets a national target for 2030 in line with the EU target of 75% of enterprises having adopted cloud services. This is ambitious, given that some challenges still need to be addressed. These include a lack of awareness among small and very small companies of the benefits of the digital transition on their business results, and a general lack of knowledge on how to implement and use cloud services effectively.

Cyprus is currently implementing the National Digital Strategy (2020-2025) that sets a target to raise the percentage of businesses that use cloud computing to 60% by 2025. Cyprus's roadmap does not have

dedicated measures to encourage the uptake of cloud services by businesses. However, measures to support enterprises' adoption of advanced digital technologies (which include cloud) were taken in 2023 (see below).

- **Artificial Intelligence**



2023 state of play and recent progress

	Country level	EU level
FORECAST		19.9
DESI 2024	4.7	8.0
AVERAGE ANNUAL GROWTH %	34.5	2.6

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

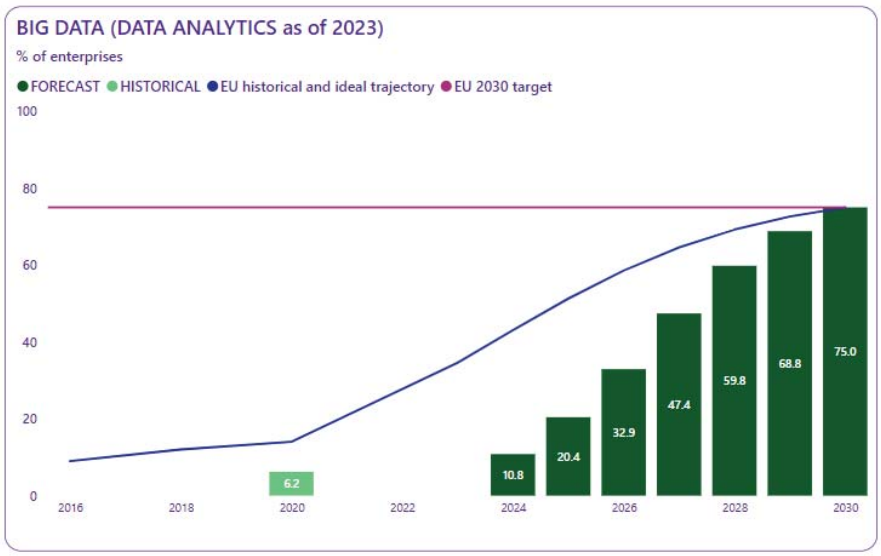
Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

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

Cyprus has untapped potential to contribute to the EU's Digital Decade target while showing a very strong dynamic. The business take-up of AI in Cyprus progressed in 2023 to reach 4.7%, still below the EU average (8%), but showing an average annual growth of 34.5%, much higher than the EU average (2.6%).

In its roadmap, Cyprus's 2030 national target for enterprises adopting AI is in line with the 2030 EU target of 75%. The trajectory is very ambitious, considering the current results, although there are no historical data for this indicator. In 2023, the deployment of generative AI tools, which facilitates task automation and offers new capabilities in personalisation and creative content design seems to have contributed to the progress. Cyprus's roadmap has no dedicated measures to encourage the uptake of AI by businesses. However, measures to support enterprises' adoption of advanced digital technologies (which include AI) were taken in 2023 (see below).

- **Data analytics (Big Data)[5]**



2023 state of play and recent progress

	Country level	EU level
FORECAST		34.6
DESI 2024	33.5	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

Cyprus has untapped potential to contribute to the EU's Digital Decade target. In 2023, 33.5% of enterprises in Cyprus reported using data analytics, slightly above the EU average (33.2%). Progress cannot be assessed as the indicator's definition has changed.

In its roadmap, Cyprus aligned the national target of enterprises using data analytics with the 2030 EU target of 75%. The current result is encouraging, although there are no historical data to assess if the target can be reached on time. Cyprus's roadmap has no dedicated measures to encourage the uptake of data analytics by businesses. However, measures to support enterprises' adoption of advanced digital technologies (which include data analytics) were taken in 2023 (see below).

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

Cyprus has an adoption rate of 58% when measuring AI, cloud and data analytics together, which is higher than the EU average (54.6%).

The Service of Industry and Technology (part of the Ministry of Energy, Commerce, and Industry) has introduced a support scheme to boost the digital capabilities of SMEs. This scheme supports the uptake of cloud services and using big-data, data analytics and AI, provided that the proposed project has an overall upscale impact on the digital level of the enterprise. The scheme, running since 2019, has been successful in raising awareness and facilitating and promoting SMEs' investments in the uptake of these advanced digital technologies and other technologies. In 2022 and 2023, the last two calls for proposals which totalled EUR 20 million, were focused on promoting advanced digital technologies. In total, the two calls received 916 proposals. The second call has seen an increase in the uptake of advanced digital technologies compared to the first one indicating a potential positive trend.

In 2023, a close and productive collaboration was maintained between public and private stakeholders in the information technology ecosystem. The collaboration between the Ministry of Energy, Commerce and Industry, the Deputy Ministry of Research, Innovation and Digital Policy, the Digital Security Authority, the

[5] 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.

Cyprus Information Technology Enterprises Association (CITEA) and other parties allowed for a more efficient promotion of the uptake of digital technologies, including cloud, big data, and AI.

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

In 2023, Cyprus had three unicorns[6]**.** The Cypriot National Digital Strategy 2020-2025 sets out the goal to increase the number of digital start-ups by 50% by 2025, although Cyprus's roadmap has not set a specific target for unicorns.

Cyprus's first equity fund was set up in December 2023 with the support of the RRF. Access to finance in Cyprus has been challenging for high-risk enterprises, such as start-ups, and for funding research and innovation projects. State financing amounts to EUR 30 million and the fund is open to investment from private investors.

The Research and Innovation Foundation (RIF) has launched several calls for proposals to expand innovative scale-ups, funded by the RRF. The DISRUPT programme aims to connect enterprises, which develop cutting-edge innovations with the potential to create new markets or disrupt existing ones, with venture capital which can support further developing and scaling-up these enterprises in international markets.

In 2023, calls for proposals to support services to create a Knowledge Transfer Office were launched, also funded by the RRF**.** The Knowledge Transfer Office will have two components: (i) providing ecosystem training and capacity building to move research beneficiary inventions, knowledge, and know-how into industry and (ii) supporting the transfer of specific inventions and innovation from research organisations to product and service companies. It will also provide patent vouchers to subsidise the cost of protecting intellectual property, including digitalisation inventions.

In 2023, the Ministry of Finance commissioned a study with technical assistance from the Commission's Directorate-General for Structural Reform Support to set up a national promotional agency (NPA) in Cyprus to support businesses. The study is under way, and recommendations are on track to be submitted to the Council of Ministers for approval in 2024. The launch of the agency is estimated in 2026.

2.3 Strengthening cybersecurity & resilience

Cyprus has taken significant steps to strengthen cybersecurity, in recent years, building up capabilities for a safe and secure digital environment.

In 2023, the National Security Operations Centre (SOC) was created which boasts monitoring capabilities for essential public sector bodies and has plans for future expansion. Furthermore, the Digital Security Authority (DSA) has been strengthened with additional staff, covering the following departments: regulatory, computer security incident response teams (CSIRT), cybersecurity certification and cybersecurity coordination. A public consultation on the national transposition of the NIS2 Directive also took place in 2023. Many EU co-funded projects were approved with local and international partners, covering areas such as sectoral SOCs, cross-border SOC infrastructure, cybersecurity certification, cybersecurity coordination, 5G testing and security, quantum key distribution and cybersecurity awareness.

Cyprus organised many awareness-raising and training activities aimed at security and IT professionals, operators of essential services, government staff, schools, and relevant authorities. Activities to improve resilience to cyberattacks for essential and important bodies also took place, such as the monitoring and supervision of the implementation of cybersecurity risk management measures, together with relevant business continuity and disaster recovery considerations.

[6] Source: Dealroom (date of extraction 29/01/2024).

The country developed and published a cyber-hygiene certification scheme, which is aimed at SMEs but available for free use by any organisation and incentivised through the announcement of a funding scheme for strengthening cybersecurity in SMEs.

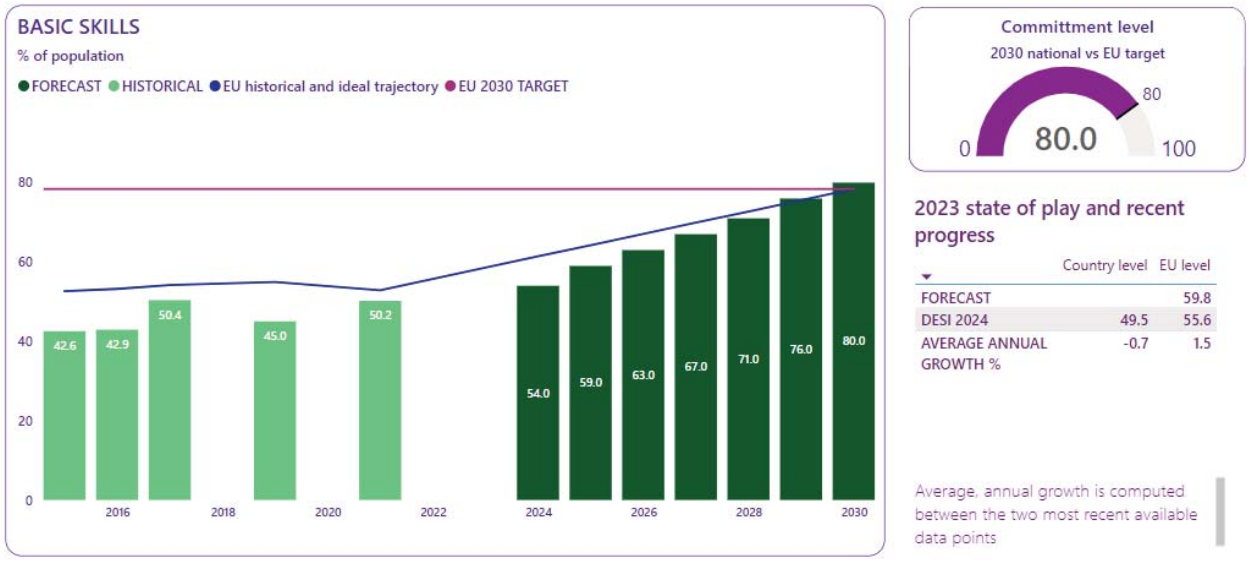
3 Protecting and empowering EU people and society

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

Equipping people with digital skills is a priority for Cyprus, which put the digital transformation of schools at the core of the overall policy for the country's digital transition. A major reform includes revising the curricula, developing educational material and training teachers. It is expected to contribute to the Digital Decade target for basic digital skills and to lay the groundwork for nurturing future ICT specialists. In 2023, Cyprus already brought a positive contribution to the EU's Digital Decade target with ICT specialists making up 5.4% of the population in employment, above the EU average of 4.8%. Building a solid, secure, integrated and modern digital government architecture is at the core of Cyprus's roadmap to offer safe and inclusive digital services to improve people's quality of life and the business environment. In 2023, Cyprus also took measures to protect online consumers, and to educate and protect children online through projects on cyber safety.

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

Cyprus has untapped potential to contribute to the EU's Digital Decade target with 49.5% of the population having at least a basic level of digital skills in 2023, below the EU average of 55.6%. This is a very slight decrease of 0.7% compared to 2021 (50.2%), while the EU average has shown an annual growth of 1.5% in the same period. This decrease could partially be explained by post-COVID-19 effects, such as reduced digital activity due to less telework, distance learning or e-commerce and schools discontinuing remote learning. However, the digital divide persists across age groups: although 71.8% of young people (16-24 years old) have at least a basic level of digital skills, only 59.6% in the 25-54 age group and 18.4% in the 55-74 age group have at least a basic level of digital skills.

In its national roadmap, Cyprus set the target to have 80% of the population with at least a basic level of digital skills in 2030, in line with the EU's 2030 target. The target seems ambitious considering the 2023 results and the lack of recent progress. However, Cyprus sets out several measures in the roadmap aiming to develop and continuously update digital skills across all population groups and at all levels. The measures on training and upgrading skills cover starting, intermediate and advanced learners and offer training tailored to the specific needs of each group. The National Coalition for Digital Skills and Jobs Platform provides an additional platform for the development of digital skills for everyone.

In 2023, a new programme focusing on training programmes for digital skills for women in rural and remote areas began. The programme is run by the DMRID with several partners, including the Cypriot Commissioners for Gender and Environment and the two ministries responsible for agriculture and entrepreneurship. The initial step will involve conducting a survey to assess training needs of the target group.

In 2023, a measure for schools to transition to the e-classroom environment was decided upon with a budget of EUR 9 million. This initiative will help create 1 000 digital classrooms and provide the necessary equipment to another 8 000 classrooms across Cyprus. This action covers pre-primary, primary, secondary, and tertiary schools. In 2023, the Department of Primary Education began structuring the plan, which will eventually lead making digital material available for Greek, mathematics and physical science. The Cyprus Pedagogical Institute (Ministry of Education, Sport, and Youth) implemented several measures in 2023 aiming to contribute to developing teachers and students' digital skills.

3.1.1.b ICT specialists

2023 state of play and recent progress

	Country level	EU level
FORECAST		5.4
DESI 2024	5.4	4.8
AVERAGE ANNUAL GROWTH %	17.4	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

Cyprus brings a positive contribution to the EU's Digital Decade target and shows a very strong dynamic. ICT specialists make up 5.4% of the Cypriot population in employment, above the EU average (4.8%). This is a remarkable annual growth of 17.4%, well above the average EU annual growth of 4.3%. However, the number of ICT graduates (2.3%) is one of the lowest (the EU average is 4.5%). On gender convergence, the percentage of female ICT specialists in Cyprus (24%) is above the EU average (19.4%), showing progress since 2021 when it was 21.6%.

In its national roadmap, Cyprus sets a 9% target of ICT specialists as a percentage of the population in employment by 2030, below the EU target of 10%. Given that the 2023 result (5.4%) is already higher than the annual forecast point presented by Cyprus in its national roadmap for next year (i.e., projected point for

2024 is 5.2%), the set target seems to be an achievable goal. Recognising that the original target of 9% was a conservative estimate, Cyprus is considering setting a more ambitious goal, aligning it with the EU average.

In 2023, DMRID started implementing a new pilot programme 'ICT RE-UP SKILLING' for the labour force qualified in science, technology, engineering, and mathematics STEM and economics in the area of data analytics. The objective is to give people the opportunity to continue their professional life in an ICT related labour field. High-profile companies have already expressed their interest in employing ICT experts who successfully complete the programme, obtain the certifications, and pass a job interview. Based on the analysis of the pilot, the programme will be expanded on a larger scale in 2024. Furthermore, implementation of large programmes for upskilling and reskilling the labour force, led by the Human Resource Development Authority of Cyprus (HRDA), is ongoing, as well as implementation of a programme to develop digital skills in the public sector led by the Cyprus Academy of Public Administration (CAPA).

Best practice: ICT RE-UP SKILLING

The 'ICT Re-Up Skilling' programme is a pioneering collaboration between the government and businesses in Cyprus, aimed at addressing digital skills gaps and fostering economic resilience, leveraging funding from the European Union's Recovery and Resilience Plan. It stands out as the first of its kind in Cyprus, emphasising a strategic approach to training selection.

More specifically, the programme was conceived, planned, and communicated in an inclusive manner, following an analysis of the market needs survey carried out in 2022, whilst ensuring the participation of a diverse public. This pilot initiative focuses on Data Analytics and targets individuals with academic qualifications in STEM and economics, reflecting a broad spectrum of educational backgrounds.

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

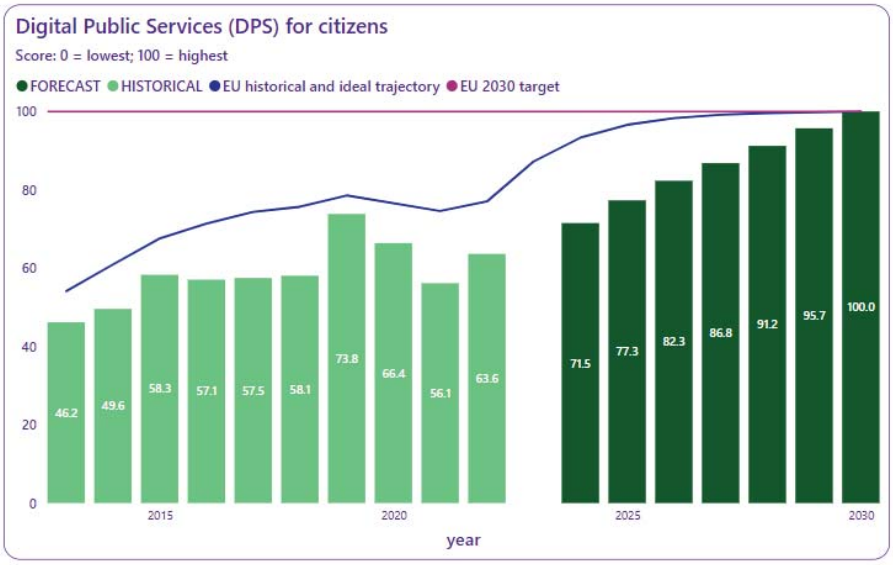
3.1.2.a e-ID

Cyprus notified an e-ID scheme to the European Commission under the eIDAS Regulation[7] on electronic identification on 13 July 2023, which received an 'Assurance level high' in December 2023. The next step is to prepare the required tender to provide e-IDs for the population of Cyprus above 18.

Cyprus participates in the European consortium POTENTIAL (PilOTs for EuropeaN digiTal Identity wALlet) that is developing the European Digital Identity Wallet. Public and private bodies are involved in pilot projects on electronic identification and authentication for e-government services, e-prescriptions, and e-signature.

[7] Regulation (EU) 910/2014.

3.1.2.b Digitalisation of public services for citizens and businesses



2023 state of play and recent progress

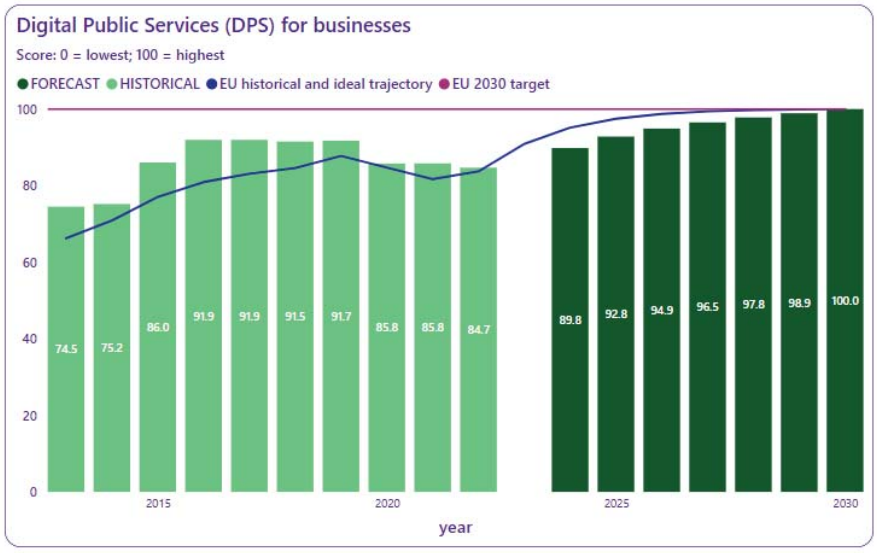
	Country level	EU level
FORECAST		87.2
DESI 2024	74.0	79.4
AVERAGE ANNUAL GROWTH %	16.3	3.1

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

Cyprus has untapped potential to contribute to the EU's Digital Decade target for digital public services for citizens scoring 74 out of 100, while showing a strong dynamic with a recent average annual growth rate of 16.3%. The country scores below the EU average (79.4) but the annual growth rate is much higher than the EU average (3.1%).



2023 state of play and recent progress

	Country level	EU level
FORECAST		90.9
DESI 2024	86.1	85.4
AVERAGE ANNUAL GROWTH %	1.6	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

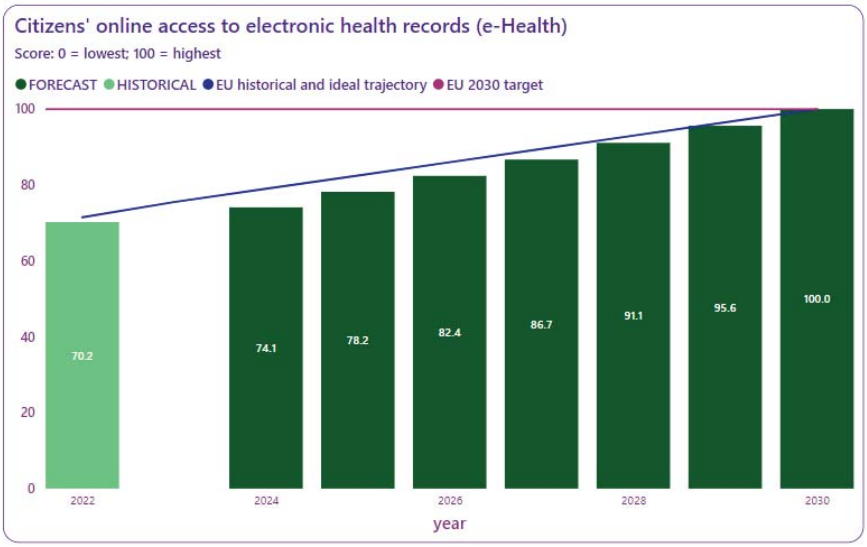
Cyprus has untapped potential to contribute to the EU's Digital Decade target for digital public services for businesses scoring 86.1 out of 100 and demonstrates a limited dynamic. With recent average annual growth of 1.6%, Cyprus scores slightly above the EU average (85.4), but other EU countries progressed faster on average (2.0%).

Building a solid, secure, integrated, and modern government digital architecture is at the core of Cyprus's roadmap. The goal is to provide safe and inclusive digital services to improve people's quality of life and the

business environment through several planned and on-going measures. The service delivery model of the Digital Services Factory (DSF) promotes the transformation of digital public services in a standardised way, ensuring security, uniformity, and user- centricity across Government. Funded by the RRP the DSF foresees the digitalisation of 70 public services by 2026.

Cyprus is also further analysing the e-government benchmarking methodology to ensure that the benchmarking results reflect the current status of the country's online services. In 2023, several additional online services were launched, including: (i) e-Law, the new case management information system of the Law Office of the Republic; and (ii) the electronic submission system for the minimum guaranteed income of the Deputy Ministry of Social Welfare.

3.1.2.c e-Health



2023 state of play and recent progress

	Country level	EU level
FORECAST		75.5
DESI 2024	68.1	79.1
AVERAGE ANNUAL GROWTH %	-3.0	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

Cyprus has scope to improve its performance to contribute to the EU's digital target with a score of 68.1 out of 100 in 2023, lower than the EU average of 79.1. Overall Cyprus slightly decreased compared to 2022 (70.2), due to enhanced reporting.

In its national roadmap, Cyprus set a target for the e-health score to reach 100% in line with the EU's 2030 target. Given its current performance, reaching the EU target could be challenging. The main gaps in Cyprus's e-health maturity are the inability to authenticate with a notified e-ID scheme and the access service not following web accessibility guidelines. However, as mentioned above, Cyprus notified an e-ID scheme to the Commission in 2023.

In 2023, the national e-health authority (NeHA) endorsed a plan to introduce an EU interoperable mobile health application (MyHealth@CY) for the Cypriot population. It will give them access to their health data and control how that data are used. The application will also enable healthcare providers to access people's health summaries (with the consent of the individual) and support the use e-prescriptions.

The NeHA has also started setting up the national health registries which will increase interoperability between e-health services. Furthermore, it began implementing the requirements and regulations for the national electronic health record (EHR). The work includes appointing a national contact point (NCP) that will serve as the infrastructure to transfer health data cross-border. The NCP was approved by the Commission, and it is on-track to go live by the second quarter of 2024. The main objectives of the EHR are functional

interoperability, Improved patient care, better accessibility, lower cost reduction, data accuracy and completeness, and security and privacy.

Cyprus is also active in recently approved EU co-funded research projects (Xt-EHR, CY-EHDS-2ND, X-Share). These contribute to achieving the objectives of the European Health Data Space Regulation, such as the primary and secondary use of health data across the EU.

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

Cyprus has taken many measures to help build a safe and human-centric digital environment. In its roadmap, Cyprus recognises that the online accessibility of public services under fair and non-discriminatory conditions for all individuals and businesses is crucial. User-friendly online tools adhering to robust security and privacy standards are a growing need.

On online hate speech, 33.5% of people in Cyprus who used the internet in the last 3 months encountered messages online that were considered hostile or degrading towards groups of people or individuals. This figure aligns with the EU average of 33.5% in 2024 according to Eurostat.

Cyprus has legislation[8] criminalising racist and xenophobic acts online, but enforcement faces challenges due to anonymous posts and platform policies on user information. The Ministry of Justice and Public Order proposed legislative amendments to enable court-ordered content removal or blocking access, addressing prosecutorial difficulties and delays. In October 2023, discussions in Parliament on these amendments highlighted the need to balance free speech with hate speech regulation.

Cyprus's Ministry of Energy, Commerce and Industry is responsible for consumer protection. In 2023, it implemented key measures to protect online consumers, including (i) providing targeted education to vulnerable groups about online shopping risks; (i) conducting surveillance and regulatory enforcement of online marketplaces, including removing illegal content and informing consumers about their rights and the nature of their transactions (business-to-consumer (B2C) or consumer-to-consumer (C2C)); (iii) joining a Commission-led social media sweep to detect misleading influencer testimonials, aiming to protect consumers from unfair practices, ensure online transparency, and assess the need for legislation to harmonise digital and offline market safety.

Best practice: Cyprus Safer Internet Centre

The 'Cyprus Safer Internet Centre' (SIC) operates since 2016 with the support of EU fundings, under the coordination of the Cyprus Pedagogical Institute of the Ministry of Education, aiming to inform and protect children online, while contributing to the development of knowledge, skills, and attitudes in relation to the responsible, creative, and safer use of digital technologies and the Internet.

In 2023, in the context of the European project CYberSafety IV, the Cyprus SIC carried out several activities focused on raising awareness, educating, and providing advice and support. To empower children, young people, parents, carers and teachers with skills and knowledge on how to be safe online, the Cyprus SIC developed rich educational/informational material, games, resources, tools, offered educational programmes, and organised workshops and campaigns. Helpline and Hotline services, operated by the Cyprus SIC, ensure that all users can receive expert advice and support on issues such as cyberbullying, excessive use of internet, online grooming etc.

[8] Law 26(III)2004.

4 Leveraging digital transformation for a smart greening

The Cypriot National Digital Strategy 2020-2025 commits to the objective of a green digital transition. The plan sets a national target to reduce the digital sector's impact by 20% by 2025 and promotes the use of digital technologies to support sustainable development. The roadmap also refers to Cyprus's recovery and resilience plan (RRP), which includes a specific policy pillar aiming to contribute to the green transition and environmental sustainability by meeting national targets on climate neutrality, energy efficiency and renewable energy sources. However, the roadmap lacks a description of specific measures, although many concrete actions started in 2023.

In 2023, Cyprus made progress towards a green digital transition with contributions from the Cyprus Research and Academic network (CYNET). CYNET updated its infrastructure by incorporating greener equipment, resulting in a considerable reduction in its energy footprint. In particular, CYNET strategically increased its lines capacity while minimising power consumption at the same time, showing a commitment to energy efficiency. Moreover, CYNET moved to green datacentre providers, strengthening its commitment to environmentally conscious practices.

Cyprus launched a digital platform **(one-stop shop) to digitalise and simplify licensing procedures for renewable energy source projects**. This is expected to accelerate the adoption of renewable energy in the country, especially solar energy.

In 2023, the Research Innovation Foundation launched calls for proposals, funded under the RRF. Innovation research centres in Cyprus help create synergies between the green and digital transitions. The KIOS Centre of Excellence, building on the digitalisation priorities in Cyprus's RRP, is involved in several initiatives to develop smart solutions to support the country's green and digital transitions. These initiatives include: (i) a collaboration with the Ministry of Transport to develop an intelligent transportation system (ITS) using digital twin technologies; (ii) a new European Research Council consolidator project launched in 2023, focused on preventing congestion and its associated socio-economic and environmental effects; (iii) a collaboration with the **Electricity Authority of Cyprus and the Transmission System Operator of Cyprus** to install advanced measurement devices allowing for highly detailed monitoring of Cyprus's power system.

The Cyprus Marine and Maritime Institute (CMMI) is another research centre working to create synergies between the green and digital transitions. It coordinates the Maritime Digitalisation Research Infrastructure project (MDigi-I), which runs from 2023 to 2026. The project aims to stimulate synergies and foster the development and uptake of maritime digitalisation technologies to improve safety, security and efficiency for the shipping industry's economic and environmental sustainability. It will contribute to digitalising ship, port, and marina operations, with the goal of optimising those operations to contribute significantly to decarbonisation efforts. Moreover, the MAritime Data ShAring for Port CongesTion MinimisATION (ADAPTATION) project, running from 2023 to 2025 aims to reduce waiting times for incoming traffic at ports through intelligent data acquisition processing and decision support tools. The ADAPTATION project has a direct positive impact on sustainable transport, fuel consumption and emissions.

Annex I – National roadmap analysis

Cyprus's national Digital Decade strategic roadmap

Cyprus submitted its national strategic roadmap to the Commission in October 2023 and published it https://www.dmrid.gov.cy/dmrid/research.nsf/all/927EA351714F99EDC22587CE0028C090/$file/DD%202030%20Cyprus%20Report_final.docx.pdf?openelement. The roadmap is mostly complete. It sets out 12 national trajectories to help reach targets by 2030. The 5G target of full coverage has already been reached. Only the trajectories and targets for edge nodes and unicorns are missing. The national targets set on connectivity, basic digital skills, the digital transformation of businesses, the digital transformation of public services and e-health match the EU's 2030 targets. The only exception is the target for ICT specialists as a percentage of the population in employment, which cautiously stands at 9%, slightly below the EU target of 10%. Cyprus consulted stakeholders, in the public and private sectors on the roadmap's different targets and objectives, during the elaboration phase. The table below reflects a best effort attempt at categorising the measures and budget presented in Cyprus's roadmap.

Digital Decade Target/objective	Budget (EUR million)	Number of measures
Connectivity gigabit	296.0	6
Connectivity 5G	-	-
Semiconductors	-	-
Edge nodes	-	-
Quantum computing	7.5	1
SME take up	30.0	1
Cloud/AI/Big data uptake	8.2	7
Cloud only uptake	-	-
AI only uptake	-	-
Big data uptake	-	-
Unicorns	-	-
Basic digital skills	22.0	8
ICT specialists	0.5	3
e-ID	10.6	3
Key public services	100.5	10
e-Health	21.8	8
Objectives	0.0	4
Total	**497.1**	**51**

Cyprus's roadmap includes an analysis of the status of the country's digital transition and existing strengths and challenges. It describes the national strategies currently implemented, as well as corresponding measures designed to reach the Digital Decade targets. The broader objectives are less prominent in the roadmap. Funding of the digital transformation relies heavily on EU funding (the RRF and cohesion policy funding.

Overall, Cyprus's roadmap is well aligned with the vision of the Digital Decade and sets out measures for most of the targets. However, some aspects of the roadmap may require attention and more action, given the current results and the slow annual growth. This concerns, in particular, digital skills for the population, the take-up of AI by enterprises, and digitalising public services for citizens. The broad

objectives of the Digital Decade are only mentioned in the roadmap in relation with existing strategies, in particular the green digital transition, which is part of the National Digital Strategy 2020-2025.

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

MCPs and EDICs
Cyprus is a member of the EUROPEUM-EDIC on blockchain (already set up). It is also developing the Statute and other relevant documents of the possible future Cybersecurity Skills Academy EDIC, within an informal Working Group.[9]

EU funding for digital policies in Cyprus
The EU funds action on digitalisation across all Member States. The Cyprus's recovery and resilience plan (RPP) allocates 24.6% (EUR 274 million) of its total budget to the digital transformation. According to the Joint Research Centre's study 'Mapping EU level funding instruments to Digital Decade targets', EUR 253.7 million of Cyprus's RRP directly contributes to achieving the Digital Decade targets. Of the cohesion policy funding received by Cyprus, EUR 66 million is expected to contribute directly to the Digital Decade targets, according to this mapping study[10]. The largest digital investment area in Cyprus's RRP is dedicated to measures contributing to the digitalisation of public services and the administration (EUR 100.8 million). The plan also sets out measures for VHCN coverage, the uptake of gigabit connectivity, and the digitalisation of enterprises. The measures should contribute to the digital transformation of the economy and the public sector, improve competitiveness, and boost the resilience, agility and security of enterprises and public bodies. In terms of implementation, the Commission made the first payment to Cyprus in October 2022 and is assessing two further instalments under one single payment request.

[9] Information updated on 31 May 2024.

[10] 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

Czechia

1 Executive summary

Czechia 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, Czechia made notable progress in enhancing digital skills and up-take of AI. Significant efforts were made to digitalise key public services. However, important **challenges persist in** the roll out of FTTP networks and the digitalisation of SMEs.

Czechia aims to excel in cutting-edge technologies like quantum, microchips, and AI, as well as upskill its population to keep up with innovation. To nurture its ambitions and keep up with the growing adoption of AI by its enterprises, Czechia is updating its National AI Strategy of the Czech Republic, its National Quantum Strategy 2030 and its National Semiconductor Strategy 2030. Czechia also continues to improve children, students and workers' **digital skills** and to make more online public services available and increase their use. Improving online public services is essential as, according to the **Special Eurobarometer 'Digital Decade 2024'**[11], 78% of Czechia's population consider that digitalising everyday public and private services makes their lives easier.

However, Czechia faces big challenges with the **digitalisation of businesses**, especially SMEs, **recruiting ICT experts** and expanding fixed **very-high capacity networks (VHCN)**, particularly in rural areas. Tackling these challenges is needed: the European Declaration on Digital Rights and Principles states that 'everyone, everywhere in the EU should have access to high-speed digital connectivity'. Small enterprises need access to a good network infrastructure and resources to embrace digitalisation. Czechia introduced several initiatives to improve connectivity and business digitalisation to improve the situation.

Czechia is active in several multi-country projects, such as **the IPCEI on Microelectronics and Communications Technologies**, and is a member of the **European Digital Infrastructure Consortia** (EDIC) on **Language Technologies (ALT-EDIC)** and on **Local Digital Twins towards the CitiVERSE**. The country is also engaged in the discussions related to the setting up of the Genome and Digital Commons EDICs. In quantum technologies Czechia participates in EuroQCI, EURHPC-LUMI-Q, CLONETS and EPIQUE[12].

Czechia's **recovery and resilience plan** (RRP) allocates 22.8% of the total budget to digital (EUR 1.94 billion)[13]. Under cohesion policy, an additional EUR 1.9 billion (9% of the country's total cohesion policy funding) is allocated to the country's digital transformation[14].

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

[12] Information last updated on 31 May 2024.

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

[14] 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]	Czechia			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	CZ	EU
Fixed Very High Capacity Network (VHCN) coverage	53.2%	50.5%	-5.0%	78.8%	7.4%	95%	100%
Fibre to the Premises (FTTP) coverage	37.4%	36.1%	-3.7%	64.0%	13.5%	x	-
Overall 5G coverage	82.6%	94.6%	14.5%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		10		1 186		x	10 000
SMEs with at least a basic level of digital intensity	52.5%	49.3%	-3.1%	57.7%	2.6%	80%	90%
Cloud	40.0%	35.2%	-6.2%	38.9%	7.0%	60%	75%
Artificial Intelligence	4.5%	5.9%	14.5%	8.0%	2.6%	16%	75%
Data analytics	NA	19.5%	NA	33.2%	NA	25%	75%
AI or Cloud or Data analytics	NA	43.1%	NA	54.6%	NA		75%
Unicorns		4		263		6	500
At least basic digital skills	59.7%	69.1%	7.6%	55.6%	1.5%	80%	80%
ICT specialists	4.5%	4.3%	-4.4%	4.8%	4.3%	7%	~10%
eID scheme notification		Yes					
Digital public services for citizens	76.2	76.3	0.2%	79.4	3.1%	100	100
Digital public services for businesses	83.8	83.8	0.0%	85.4	2.0%	100	100
Access to e-Health records	46.6	51.1	9.5%	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 **Czechia's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating **a very high ambition** however, based on this document, intends to allocate **limited effort** to achieve the Digital Decade objectives and targets.

Overall, Czechia's roadmap is consistent with the efforts needed to support the country's digitalisation, but the specific targets could be more detailed. The roadmap includes 2030 targets for all indicators, except for Fibre to the Premises (FTTP) and edge nodes which will be introduced next year. In total, 5 of the national targets are aligned with the EU's 2030 targets, and 7 are lower: VHCN, ICT specialists, SMEs with at least a basic level of digital intensity, the number of unicorn companies, and take-up of AI, data analytics and cloud. There are no trajectories for FTTP and edge nodes. Moreover, on skills, Czechia could make a distinction between basic and advanced skills and set out targeted measures to increase the number of ICT specialists. Although the roadmap partially covers Digital Decade objectives such as online safety, sovereignty, representation of women working in ICT and online access to public services, it does not cover the green transition. The total budget for the roadmap's 58 measures **is estimated at EUR 1.77 billion** (about 0.6% of GDP), prioritising ICT specialists, connectivity, and key public services. Some aspects require more action, especially the aim of business digitalisation (in terms of both basic intensity and the rate of adoption of advanced technologies).

Recommendations for the roadmap

When adjusting its national roadmap in accordance with Article 8(3) of the Digital Decade Policy Programme (DDPP) Decision, Czechia should tackle the additional recommendations below:

- **TARGETS:** (i) Propose a target and trajectory for **edge nodes** and formalise the trajectory for **FTTP**; (ii) Distinguish and align **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 most difficult to achieve the **digitalisation of enterprises and distinguish measures contributing to basic digital skills and advanced ones**; (ii) Review the **budget description** of all presented measures, duly highlighting EU sources such as the 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.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' sheds light on Czech perceptions of digital rights. 46% of Czechs doesn't believe the EU protects their digital rights well, a decrease in confidence of 5 percentage points from last year. Concerns have escalated, particularly with 58% worried about children's online safety and 44% about control over personal data, both experiencing increases in concern. On the positive side, 57% value freedom of expression and 55% appreciate the availability of privacy-friendly technologies, both figures aligning closely with 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[15].

A competitive, sovereign and resilient EU based on technological leadership

To underpin its technological leadership and competitiveness, Czechia could strengthen its fixed network infrastructure and boost business digitalisation. Czechia's infrastructure has problems in reaching 100% coverage for VHCN due to the slow roll-out of fibre and a very low take-up of fixed broadband capable of 1 Gbps speed. 5G coverage is rapidly expanding, with nearly 95% of households now covered. However, in 2023, only 39.3% of Czech households had 5G in the 3.4-3.8 GHz band, which was slightly below the EU average (50.6%). Digitalisation indicators for businesses are all below the EU average, including the basic intensity of SMEs and the adoption of data analytics, AI and cloud technologies. A revised strategy for AI is being drawn up, with the aim to raise business interest and promote its adoption. Improving the start-up ecosystem could be achieved by helping entrepreneurs raise funds and access consulting services. The country can also count on technology-intensive companies in areas such as microelectronics, quantum computing and AI start-ups. Lastly, on cybersecurity, Czechia is facing an increasing number of threats. The country's agency, the National Cyber and Information Security Agency (NUKIB), is actively trying to address them and disseminates best practices and supporting materials to stakeholders through its websites and conferences to facilitate the transition to post-quantum encryption.

Recommendations – Czechia should:

- **CONNECTIVITY INFRASTRUCTURE:** (i) Accelerate the rollout of FTTP, among others by raising awareness on the benefits of Gigabit networks, by simplifying processes and permits for rolling out networks, and by promoting the construction of fibre-ready buildings. (ii) Ensure sufficient

[15] 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.

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.

- **DIGITALISATION OF ENTERPRISES:** Continue and scale up the subsidy calls for digitalisation of SMEs to increase their capacity building through supporting services in the implementation of their project.
- **UNICORNS:** (i) Support applied research for patents and ideas to be adapted to the market and create a business case for innovation; (ii) Facilitate access to capital for start-ups, including venture and growth capital.
- **AI/CLOUD/DATA ANALYTICS:** (i) Review the mix of measures to support the adoption of advanced digital technologies including AI, Cloud and big data to understand the decline in adoption. (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.
- **EDGE NODES:** As edge computing is an important component of AI, future network deployment, and the Internet of Things, member states should consider edge node deployment when creating investment programmes and strategies in these areas.
- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

Protecting and empowering EU people and society

Czechia is well equipped to deliver an inclusive digital transition thanks to continuous efforts to increase digital skills. However, there could be a stronger focus on training ICT specialists. The population's level of digital skills is well above the EU average. Since 2022, Czechia has been implementing a reform of its primary and secondary school curricula to integrate digital subjects and equip schools with digital tools. ICT specialists as a percentage of the population in employment is below the EU average, partly due to a shortage of workers in the country; moreover, of the 4.3% of ICT specialists in the workforce, only 12.4% are women. **Progress on the digitalisation of public services and e-health development needs to pick up as Czechia's scores are below the EU average.** The creation of the Digital and Information Agency (DIA) is a promising development as it centralises e-government decisions. This has helped make initiatives more consistent with each other and accelerate the roll-out of the Czech digital wallet. However, the number of projects to be managed could be carefully assessed, and more staff might be needed.

Recommendations – Czechia should:

- **ICT SPECIALISTS:** Increase the attractiveness of science, technology, engineering and mathematics (STEM) studies and ICT careers especially among women.
- **DIGITALISATION OF PUBLIC SERVICES:** Accelerate efforts for the digitalisation of public services, also ensuring sufficient administrative resources to support these.
- **e-HEALTH:** (i) Expand the coverage of the online access service to ensure that all citizens can access their electronic health data online. (ii)Expand the data types made 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

Czechia has not set a strategy to bring the digital and green transitions together. The country has only started to reflect how to calculate the ICT sector's environmental footprint, promote responsible energy use among consumers and advance the eco-design of ICT equipment and services.

Recommendations – Czechia 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 the methodology developed by the European Green Digital Coalition, in view of future policy development, as well as of attracting relevant financing.

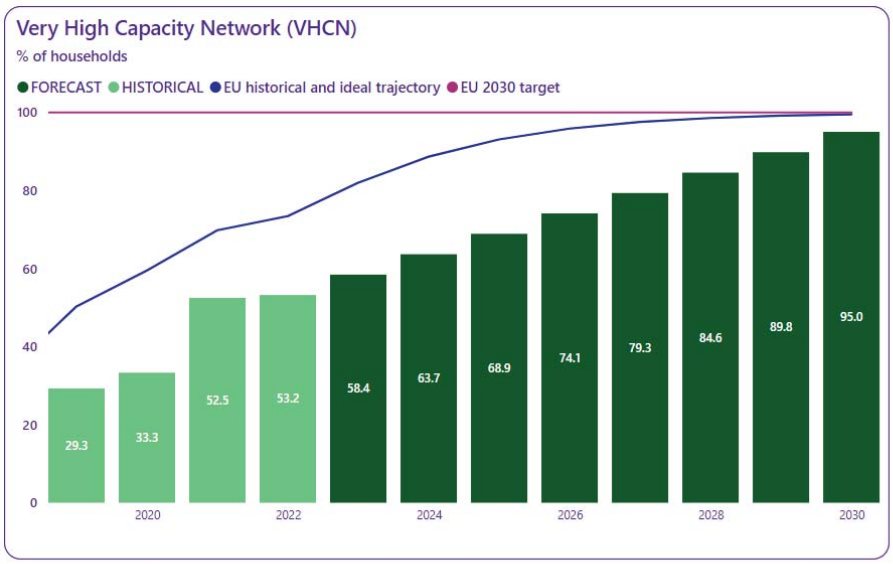
2 A competitive, sovereign and resilient EU based on technological leadership

Czechia has the ambition to become a leading one of the technological forces and has set ambitious goals in its Innovation Strategy 2019-2030. Czechia is home to two microchip companies and is set to install a LUMI-Q quantum computer. However, Czechia faces two challenges. First, there is a difference in businesses' levels of digitalisation: cutting-edge technology companies are thriving but traditional enterprises are not investing in digital tools that could be to their advantage. Only 43.1% of enterprises use AI, cloud services or data analytics, compared to the EU average of 54.6%. Second, there is a need to close the gap between theoretical and practical research to nurture the development of technological start-ups. Although universities and the government are investing in advanced technologies and achieving impressive results in fundamental research, and despite several funding programmes, Czechia still struggle with patent applications and related product development. The country also needs to set out a supportive framework for innovation to flourish, including a robust gigabit infrastructure. As recommended in last year's Digital Decade report, the rapid roll-out of very-high capacity networks (VHCN) is also crucial for enterprises as they would be able to use digital services effectively, building a truly interconnected digital ecosystem.

2.1 Building technological leadership: digital infrastructure and technologies

Czechia is very active in deploying mobile connectivity infrastructures, but the fibre roll-out and cable upgrade is not happening fast enough to meet the 2030 target. Difficulties in rolling out fixed infrastructure are mainly due to lengthy building permit procedures. Furthermore, the market is characterised by large number of small local operators who have difficulties to find sufficient demand for gigabit connectivity and thus a profitable business case for further deployment.

2.1.a Connectivity infrastructure (Gigabit)

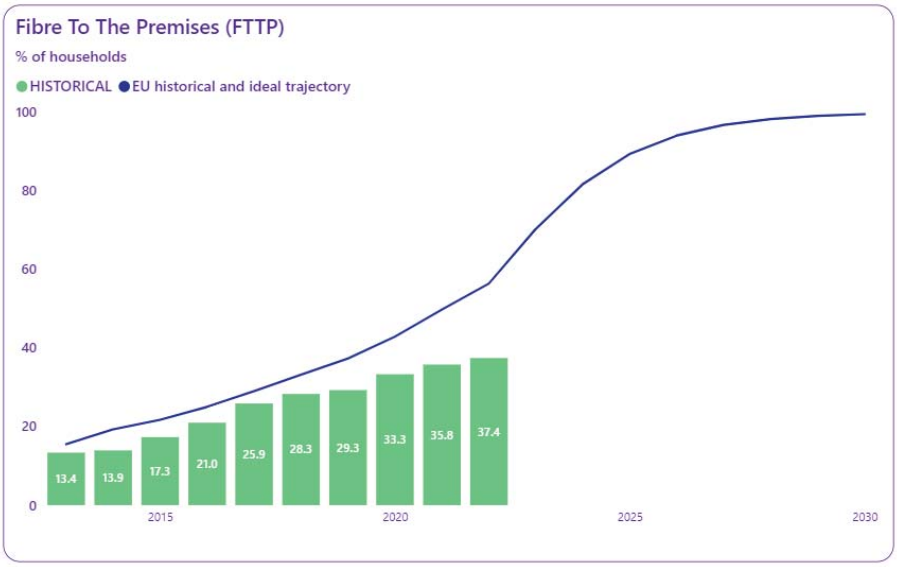


2023 state of play and recent progress

	Country level	EU level
FORECAST	58.4	82.0
DESI 2024	50.5	78.8
AVERAGE ANNUAL GROWTH %	-5.0	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



2023 state of play and recent progress

	Country level	EU level
FORECAST		70.3
DESI 2024	36.1	64.0
AVERAGE ANNUAL GROWTH %	-3.7	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

With 50.5% of households currently covered by VHCNs, Czechia has significant scope to improve its contribution to the EU's Digital Decade target and shows very limited dynamic. This trend is due to the slow roll-out of fibre and the lengthy time to upgrade cables to DOCSIS 3.1 technology. At 36.1%, Fibre-To-The-Premises (FTTP) coverage is very low compared to the EU average of 64%. It is not developing fast enough. The decrease indicated has to be assessed in relation to the steep increase in number of households (by more than 437 000) obtained by new census in 2021. This trend is exacerbated by the low take-up of subscriptions above 1 Gbps speeds: only 2.95% of households have subscribed, compared to the EU average of 18.52%.

Czechia's target for gigabit connectivity is 95%, close to the EU target. However, this value is a high target given Czechia's starting point. Considering the current rate of progress, reaching the target by 2030 would require stepping up efforts. The current measures do not guarantee that the 2030 targets will be met.

Czechia's deployment of fibre is still behind other Member States for several reasons: (i) slow take-up from consumers who prefer cheaper but slower technologies; (ii) lengthy building permit procedures; (iii) coordination difficulties between local and regional authorities; and (iv) the high cost of deployment in small and medium-sized towns. The Gigabit Infrastructure Act (GIA) proposes making it mandatory that all new and substantially renovated buildings to be fibre-ready , and could thus contribute to the roll-out and facilitate the availability of such service, as well as to shorten the lengthy permit granting procedures, as mentioned above. Improving connectivity infrastructure is crucial as, according to the Eurobarometer survey on Digital Decade, 82% of Czechs believe that more readily available and affordable high-speed internet would facilitate their daily use of technologies.

Despite these challenges, the telecommunications market in Czechia appears to be showing more dynamism. This is evident from the spin-off of mobile infrastructure to dedicated infrastructure companies, consolidation in the fixed internet retail market and a greater focus on developing 5G applications. The deregulation of market 3b/2014 (fixed location for mass-market products) also indicates that the market is becoming more competitive.

Under Czechia's Recovery and Resilience Plan (RRP), a national measure supporting the deployment of VHCN was launched in 2023 for the implementation phase, with a budget of CZK 2.85 billion (EUR 113 million). This measure aims to ensure the widespread roll-out of VHCN across Czechia, targeting at least 23 000 connections in the first quarter of 2026.

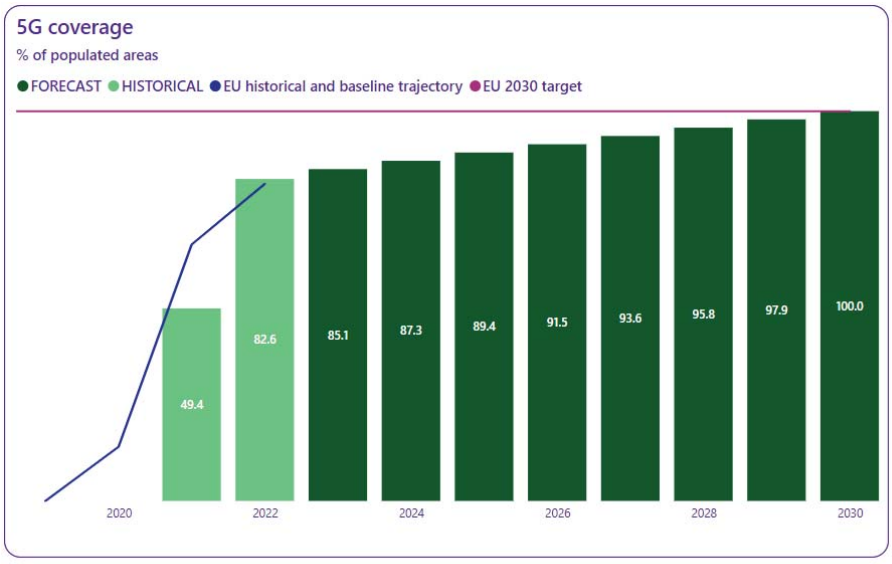
Best practice: V-Portal - mapping of all the infrastructure

In 2023, new tools were made available to consumers and operators to identify local connections around them and compare different operators' prices.

VPortal is a visualisation platform enabling users to assess telecommunications services in Czechia. It is divided into modules by service type and provides data from field measurements by the Czech Telecommunications Office and other sources, including coverage simulations and development criteria. Users can download data in preferred formats for further analysis.

This tool improves transparency and fosters an environment conducive to investment. Additionally, it enables consumers to compare the quality of the country's telecommunication services.

2.1.b Connectivity Infrastructure (5G)



2023 state of play and recent progress

	Country level	EU level
FORECAST	85.1	
DESI 2024	94.6	89.3
AVERAGE ANNUAL GROWTH %	14.5	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

Czechia brings a positive contribution to the EU's Digital Decade target and shows a positive dynamic: **5G roll-out has been accelerating, rising from 83% coverage in 2022 to nearly 95% in 2023, compared to the EU average of 89.3%.** With a national target of 100% for 5G coverage, the country's target is up to the EU's ambition. Based on the current rate of progress and assuming ongoing efforts are sustained, Czechia's contribution to this EU Digital Decade target will be significant. However, coverage of 5G in the 3.4-3.8 GHz band, a potential band for enabling advanced applications requiring large spectrum bandwidth, was at 39.3% of Czech households in 2023, below EU average of 50.6%.

The country has put in place several measures to facilitate 5G roll-out and is now focusing on remote access and innovative applications of the technology. Czechia has taken steps to extend 5G and fibre coverage to underserved areas known as 'white spots' – these are areas where market conditions alone would not ensure sufficient coverage without government assistance. In 2023, a call for proposals was launched to tackle coverage gaps in rural areas ('5G venkov' or '5G countryside'), and the projects are currently under review before being approved for implementation.

In 2023, five projects showcasing the use of 5G-based solutions for smart cities received Recovery and Resilience Facility (RRF) funding. The next step is to fund another 47 projects that are exploring 5G applications for cities and industrial use. This measure will help foster research, create synergies between private and public infrastructure and strengthen the start-up ecosystem.

In its roadmap, Czechia presents seven measures running until 2030 supporting VHCN and 5G roll-out from spectrum allocation auctions to subsidies for unpopulated areas. The roadmap, however, does not outline any measure to assign the 26 GHz band as recommended in the 2023 State of the Digital Decade report even though operators are more and more interested in how it can be used. The RRF measures mentioned above will also help stakeholders reflecting on its application.

2.1.c Semiconductors

In 2023, Czechia's Ministry of Industry and Trade mapped the semiconductor value chain and started developing the National Semiconductor Strategy. This strategy is expected to be completed by 2024, with the primary objective of increasing the production of cutting-edge semiconductors in the Union to constitute 20% of the world production value by 2030. According to a McKinsey study, global semiconductor sales are projected to surpass EUR 1 trillion by 2030. Czechia is already producing 10 million chips daily.

The market is dynamic. Czech industry collaborates with partners from Taiwan, Japan and the USA, investing in production capabilities and research. Czechia is also implementing the European Chips Act to strengthen its semiconductor capabilities. A notable result is the Czech National Semiconductor cluster, which produces 3 million wafers a year.

Best practice: the Czech National Semiconductor Cluster

In 2023, Czechia created the Czech National Semiconductor Cluster, a collaboration between the government and Czech enterprises. This cluster brings all key players in the semiconductor value chains together, from top universities to major companies and start-ups, to coordinate ideas and decisions. This collaborative effort seeks to leverage Czechia's expertise in optoelectronics and photolithography to participate in both front-end and back-end semiconductor production, further strengthening the country's position in the semiconductor industry.

The cluster is integrated into an EU clusters network and the new EU Semiconductor Regions Alliance under the European Chips Act. It works with the Czech government on top priorities for the semiconductor industry, such as the Important Project of Common European Interest (IPCEI) for Microelectronics and Communication Technologies, partly funded under the RRP. This initiative strengthens the synergies between private and public sector investments.

2.1.d Edge nodes

In 2023, Czechia is estimated to have deployed 10 edge nodes. These nodes account for approximately 1% of the total climate-neutral highly secure edge nodes estimated in the EU (1 186). However, the Czech roadmap does not set out any national trajectory for such edge nodes to contribute to the EU target of 10 000 climate neutral and secure edge nodes by 2030 due to missing data. The trajectory will be set for next year.

Although the implementation and operationalisation is only beginning, the Edge Deployment Data Report **suggests that Czech enterprises, particularly telecommunications companies and cloud services and data centres providers, show great interest in the technology**. These enterprises aim to use edge nodes to optimise bandwidth and improve the performance of systems and applications. Czechia has positioned itself at the forefront of edge hardware spending, Czech technology vendors are earmarking 41% of their budgets for investments in edge for hardware. This strategic investment highlights a real commitment to strengthening the physical infrastructure required to effectively deploy edge computing technologies.

2.1.e Quantum technologies

Czechia is currently drafting its national strategy for quantum technologies and setting out its ambitions to be one of the leading countries participating on development and deployment a large-scale universal quantum computer, the LUMI-Q. In 2024, the European High Performance Computing Joint Undertaking

(EuroHPC JU) launched a call for tender for the installation of LUMI-Q, a new EuroHPC quantum computer to be located in Czechia and integrated into the EuroHPC supercomputer KAROLINA. The system will be hosted and run in Ostrava by the IT4Innovations National Supercomputing Centre (IT4I).

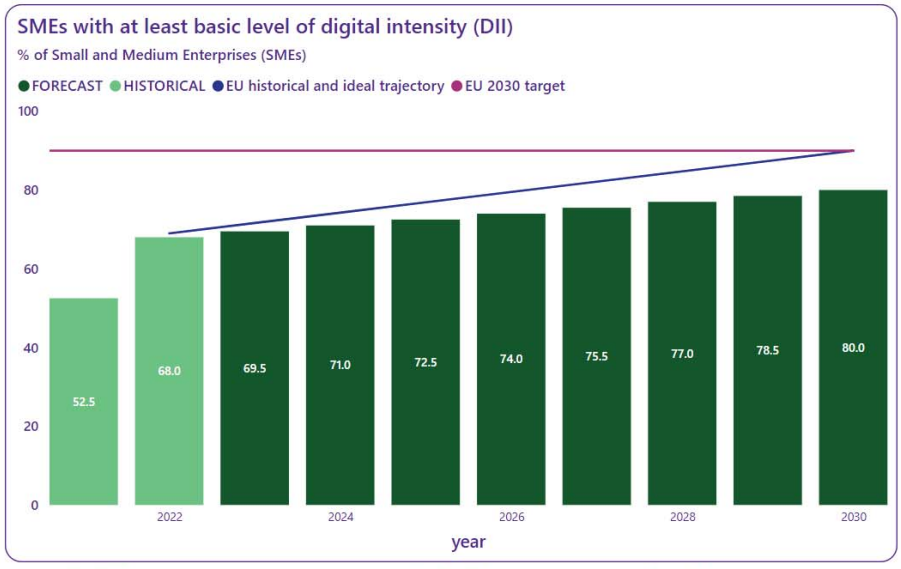
Moreover, within the EuroQCI project occurring from 2023 to 2026, **the Czech National Quantum Communication Infrastructure will work on development of a quantum communication infrastructure in Czechia.** The European Quantum Communication Infrastructure (EuroQCI) initiative aims to build a secure quantum communication infrastructure spanning the entire EU. The infrastructure will feature advanced experimental European quantum key distribution devices and will include: (i) a backbone connecting the cities of Prague, Brno and Ostrava, serving as the country's first long distance quantum communication network; (ii) several urban side branches connecting public authorities to help test use cases; and (iii) advanced testing and training infrastructure based in a single laboratory.

The Czech Technical University also participates in the European consortium on optical quantum computer EPIQUE and the Institute of Scientific Instruments of the Czech Academy of Sciences participates in the CLONETS project. Czechia has also strong research base in quantum sensing, quantum metrology and quantum materials fields that are tightly connected with quantum computing and communication.

On the education front, Czechia brought in new master and Ph.D. programmes in quantum computing, communication and quantum materials to train new ICT Quantum specialists. There are various courses in quantum physics, mechanics, quantum materials preparing future experts able to work and do research in quantum technologies and use the related equipment. The Czech Technical University is also participating in the EU DigiQ training program. These students will benefit from a great ecosystem also supported by private initiatives such as the QCzech community. This community is made up of experts, educators, and enthusiasts and aim to raise awareness and improve the overall understanding of quantum solutions in the Czechia. The community is confident that individuals with an open mind and programming skills can acquire the basic knowledge required to operate quantum devices.

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

2.2.a SMEs with at least basic 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

2023 state of play and recent progress

	Country level	EU level
FORECAST	69.5	71.6
DESI 2024	49.3	57.7
AVERAGE ANNUAL GROWTH %	-3.1	2.6

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

On SMEs' digital intensity, Czechia has significant scope to improve its contribution to the EU's Digital Decade target and shows a very limited dynamic. From 2021 to 2023, the percentage of SMEs with at least a basic level of digital intensity fell from 52% to 49%, missing its trajectory's target. These results might be influenced in part by a shift in the technology mix underlying the digital intensity index.

At 80%, the country's target for the digitalisation of SMEs is below the EU target. The national target is linked to a low starting point. Based on the current rate of progress, it appears that, without a faster pace of progress in the coming years, Czechia's contribution to this EU target will be limited.

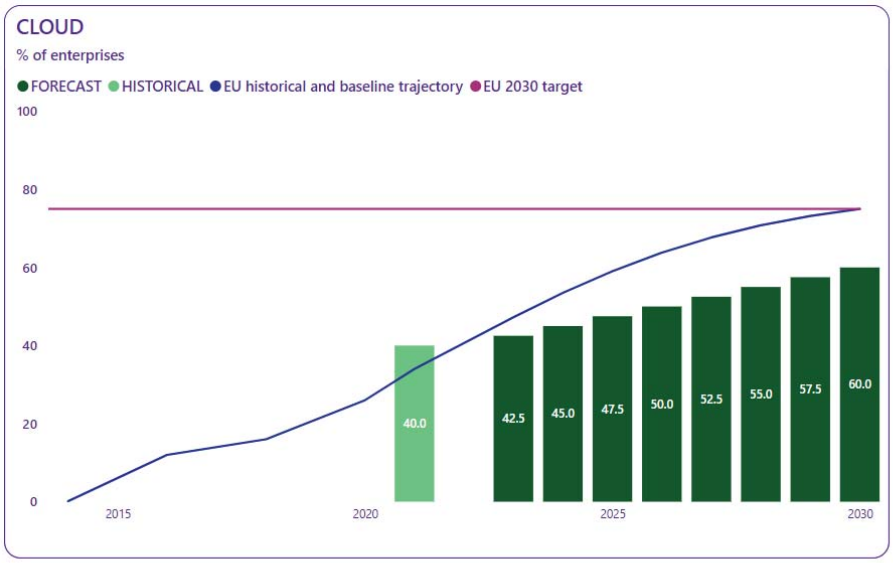
Traditional SMEs are reluctant to embrace digitalisation as they are unaware of the advantages. According to the Strategy to support SMEs in Czech Republic, published in 2019, there are four main barriers to accelerating the roll-out of digital technologies in Czechia: (i) uncertainty about the return on investment; (ii) a lack of information on the benefits of digitalisation; (iii) high acquisition costs; and (iv) a skills gap for implementation. Even though the Czech population is digitally skilled, SME employees still lack the specific skills to master business IT tools, and enterprises in general face a shortage of ICT experts. The Global Arena Research Institute suggests that a key solution, besides upskilling the workforce, involves planning investments to build a better business case thanks to market data provided by regional and local experts, such as European Digital Innovation Hubs and Czech Digital Innovation Hubs. The strategy also underlines the need to enable high-speed VHCN internet access with minimum speeds of at least 100 Mbps, scalable to 1 Gbps for everyone, and minimum speeds of 1 Gbps for enterprises.

Six Czech European Digital Innovation Hubs (EDIH) launched their activities in 2023; four of them focus on AI, one on cybersecurity, and one on high performance computing. These EDIHs are funded under the Digital Europe Programme, with the aim to create a framework for SMEs to flourish thanks to the setup of a network of such entities. They are one-stop-shops for digitalisation, providing SMEs and public sector organisations with digitalisation support services such as testing-before-investing, access finance, skills and training, and networking.

At national level, Czechia is supporting SMEs through several funding calls. Thanks to the Recovery and Resilience Facility (RRF), Czechia plans to invest EUR 575 million in business digitalisation, in particular, digital innovation hubs supporting SMEs. In 2023, as part of the Technology and Applications for Competitive Programme (OPTAC), action was taken to introduce SMEs to the benefits of digitalisation and support the purchase of technological equipment. Moreover, under the 'Digital and Virtual Enterprise' call in 2023, the Ministry of Industry and Trade launched funding calls for SMEs in the areas of advanced technologies (such as AI, cloud and data analytics), digital skills, cybersecurity and logistics. Over 550 projects were supported with approximately CZK 1.8 billion (EUR 70 million).

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

- **Cloud**



2023 state of play and recent progress

	Country level	EU level
FORECAST	42.5	47.3
DESI 2024	35.2	38.9
AVERAGE ANNUAL GROWTH %	-6.2	7.0

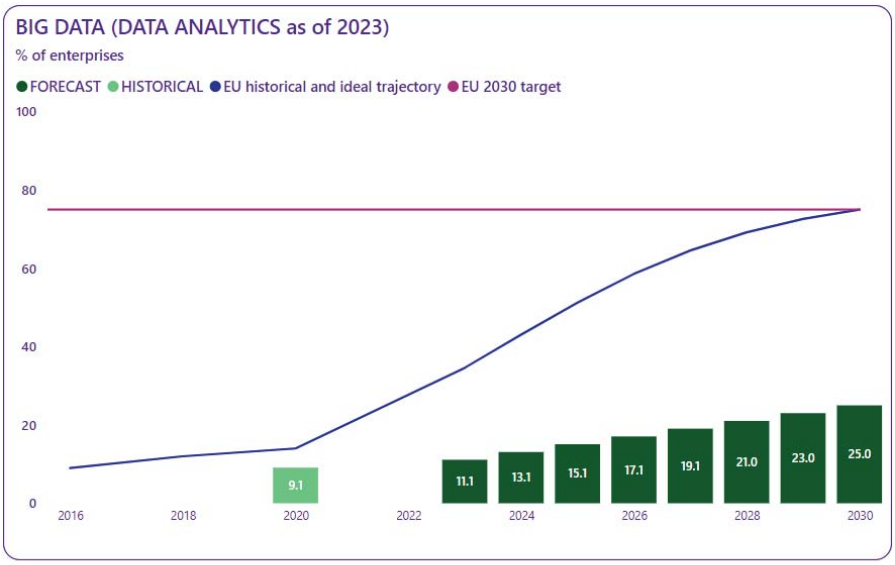
Average, annual growth is computed between the two most recent available data points

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

Concerning the take-up of cloud solutions, Czechia has untapped potential to improve its contribution to the EU's Digital Decade target and shows a very limited dynamic. The take-up of cloud solutions by Czech enterprises (at 35.2% in 2023) is below the EU average (38.9%). Take-up has fallen sharply compared to 2021 (40%), while the overall EU rate is improving (+7% a year on average).

Czechia presented in its roadmap a level of ambition (60%) below the 2030 target for the EU of 75% of enterprises adopting cloud. The value is linked to a modest starting point. Based on the current rate of progress, it appears that, in absence of an intensification of efforts over the coming years, Czechia's contribution to the EU target will remain limited. One measure in the roadmap targets enterprises adopting computing services and data analytics tools funded under the OPTAC.

- **Data Analytics (Big Data)**



2023 state of play and recent progress

	Country level	EU level
FORECAST	11.1	34.6
DESI 2024	19.5	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.

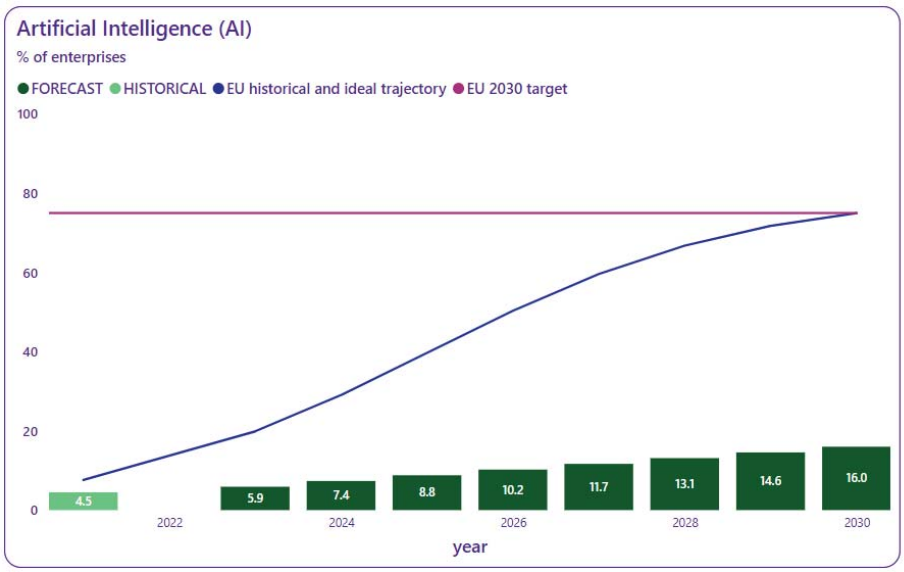
Note: The source of national forecast values is the 2023 country roadmap

On the use of data analytics by enterprises, Czechia has scope to improve its performance to contribute to this EU Digital Decade target. The adoption rate in Czechia (19.5%) is well below the EU average (33.2%). Progress cannot be assessed since the definition of this indicator has changed.

The level of ambition in Czechia's roadmap (25%) is below the EU 2030 target for 75% of enterprises to adopt data analytics. If action is not intensified, Czechia's contribution to this EU target will be insufficient.

Besides the measure mentioned above, there are no specific programmes and measures to increase the use of data analytics.

- **Artificial Intelligence**



2023 state of play and recent progress

	Country level	EU level
FORECAST	5.9	19.9
DESI 2024	5.9	8.0
AVERAGE ANNUAL GROWTH %	14.5	2.6

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

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

Czechia has untapped potential to contribute to the EU's Digital Decade target for AI but demonstrates a very strong dynamic. Only 5.9% of enterprises took-up AI in 2023, compared to the EU average of 8%; however, this figure is a significant increase, up 14.5% from 2022.

At 25%, the country's target for adopting AI is below the EU target of 75%. The national target is linked to a modest starting point. However, based on the current rate of progress, Czechia could consider a higher level of ambition for this target.

Czechia's National Artificial Intelligence Strategy, adopted in May 2019, is currently being evaluated and updated by the Ministry of Industry and Trade. The revision, prompted by rapid advancements in AI and ongoing negotiations on AI regulation, is focusing on practical implementation in industry and enterprises. Collaboration with stakeholders, including the business sector, is crucial for developing new objectives and measures.

In 2023, the Czech Ministry of Industry and Trade allocated approximately EUR 5.6 million to co-fund the **European Testing and Experiment Facilities project** as part of the Digital Europe Programme. This project is part of the AI-MATTERS consortium, coordinated by a French university aiming to boost the European manufacturing sector through AI and robotics. The Czech Technical University in Prague, the Technical University of Ostrava and Brno University of Technology are leading Czechia's involvement. The project seeks to strengthen Europe's leadership in AI systems, robotics and advanced technologies in manufacturing.

- **Take-up by enterprises of AI or Data analytics or Cloud**

Combining the adoption of these three technologies (AI, cloud or data analytics), Czechia's take-up rate is 43.1%, significantly below the EU average of 54.6%. This below-average performance is the consequence of the low rate of adoption of these technologies.

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

Czechia is home to four unicorn companies, which is a great contribution to the EU's Digital Decade target. The ICT sector has a great weight in the economy, accounting for 5.5% of GDP. In 2019, according to the study Innovation Strategy of the Czech Republic 2019-2030 (coordinated by the Council for Research, Development, and Innovation), Czechia's total R&D and innovation expenditure was 1.79% of GDP. Public support has been crucial, with 60% of the expenditure coming from company resources and 40% from government and EU sources.

However, fact-finding missions reveal that Czech entrepreneurs have identified significant gaps and indicate a disconnect between fundamental research and product development for the market, with a lot of innovative ideas stuck in the lab due to a lack of funding. This has been particularly challenging in the aftermath of the COVID-19 crisis and the current adverse economic conditions. This problem also occurs at a later stage when a company is looking to scale up. According to the study on the State of the start up and innovation environment in Czech Republic, published in 2021, there is a lack of business angels and venture capital firms in the country. Czechia is among the EU countries with the lowest amount of funds raised through venture capital, even though the country is the 31st most innovative country in the world according to the Global Innovation Index 2023. Czechia was better ranked in the past, but its lack of market depth impedes the innovation process, creating market failure.

Public support is already available for start-ups through Czechinvest, the Business and Investment Development Agency. In 2023, through its Technology Incubation Programme, the agency started supporting the incubation of 91 start-ups in sectors such as AI, creative technologies, mobility and ecotech. In 2024, under the RFF, a fund of funds was also launched for the development of pre-seed investments in strategic technologies, aiming to help start-ups prepare their spin-off.

2.3 Strengthening cybersecurity & resilience

As companies rely more and more on digital technologies, their risk of exposure to cybersecurity incidents is increasing, highlighting the need for more preparedness in this area. According to Eurostat**, at the end of 2022,** in Czechia, 91.9% of enterprises with 10 or more employees had reported that they had adopted ICT security measures. A small portion of those (11.6%) reported being insured against ICT security incidents.

Cybersecurity is a key topic in Czechia and is actively addressed by the relevant state institutions. Similar to other countries in the region, the cyber threat situation remains a major concern. As also highlighted by Eurostat in 2021, 4.7% of enterprises have experienced ICT security incidents that have caused service disruptions due to attack from outside from cyberattacks, such as denial-of-service attacks and ransomware, compared to an EU average of 3.5%. Additionally, 24.9% have reported incidents due to hardware or software failures, indicating the need for strong security protocols and resilient infrastructure compared to an EU average of 18.7%. These data show the high risk of operational disruptions and highlight the importance of continued investment in cyber security measures and upgrading ICT systems.

Furthermore, Eurostat underscores that, in 2021, 9.0% of Czech enterprises had to deal with data destruction or corruption. These statistics emphasise the need for comprehensive security strategies that focus on prevention, damage minimisation and quick recovery.

The new Security Strategy of the Czech Republic 2023 highlighted cybersecurity as one area of strategic concern, especially since Russia's invasion of Ukraine. The current National Cyber Security Strategy covers 2021 to 2025 and is accompanied by an action plan. The document, drafted by NUKIB, describes the main principles on which the Czech Republic's cybersecurity is based and defines its future strategic direction in the field of cyber security. Czechia participates actively in EU-level networks focusing on cybersecurity, including the Network and Information Systems (NIS) Cooperation Group, EU-CyCLONe and CSIRT´s Network.

To share knowledge and exchange best practices, Czechia's cybersecurity agency NUKIB organises several conferences where public and private partners can meet and discuss cybersecurity. For instance, in June 2023, the Prague Cyber Security Meeting highlighted the private sector's role in managing major cyber incidents and crises, as well as the influence of emerging disruptive technologies on cybersecurity. Additionally, NUKIB's annual CyberCon event serves as a valuable platform for networking and raising cybersecurity awareness among the public, academia and the private sector.

In 2023, the public administration strengthened its IT tools' security. First, under the RRF, in line with the National Cybersecurity Strategy, information systems deemed critical under The Cybersecurity, Act No. 181/2014 Coll. were upgraded, for example security software solutions for threat detection were introduced in the information system of the Police of the Czech Republic. The Czech police force also saw an increase in staff dedicated to protecting information systems. This Act provides a legal basis for the protection of Czech cyberspace and communication infrastructure. The primary purpose of the Act is to increase the security of cyberspace and support state's efforts to protect those parts of the infrastructure that, if breached, would lead to damage or endanger the Czech Republic's interests.

A new Act on Cybersecurity is currently being prepared in view of the EU NIS2 Directive. In terms of resilience, supply chain security is crucial and the new Act on Cybersecurity will introduce an **'Assessment Mechanism for Supply Chain Security'** to screen suppliers to strategically important ICT infrastructure.

Moreover, from 2021 to 2023, NUKIB drew up a catalogue of cloud computing service providers from which the administration is required to choose. These providers are considered safe and are verified. The verification process has two stages that assesses the trustworthiness of providers and evaluates the service's technical aspects, taking into account both legal and non-legal factors. A specialised team is responsible for monitoring complaints about the catalogue.

3 Protecting and empowering EU people and society

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

Digital education, digital skills development in the context of lifelong learning and digital inclusion are priorities for Czechia. This is clearly reflected in the newly established strategy for digital education within the Digital Czechia Programme that focuses on digital skills development in a lifelong perspective, readiness for the changing needs of labour market and the reduction of the risks of digital exclusion. The strategy also acknowledges the vital role of education in the digital era and how students should use technologies in an efficient and responsible way. The Strategy focuses on measures boosting the digital skills development among students and teachers in the context of the modernisation of educational content and support to schools. To upskill the workforce and tackle the shortage of ICT specialists, Czechia introduced the Innovation Strategy of the Czech Republic (2019 - 2030) in 2019 to focus on knowledge-based production, technological solutions and innovation. It also addresses developing digital competencies and skills not only for students but also for the workforce and ICT professionals. In addition, Czechia adopted the National Artificial Intelligence Strategy (NAIS) in May 2019 that highlights the role of education, training and retraining so that AI is developed in a safe and human-centric manner. As recommended in the 2023 State of the Digital Decade report, online public services could be more user-friendly. The 2023 initiative of reusing the COVID-19 vaccination app for new e-health services is a good example of being close to people and providing new services on an app they already master.

3.1.1 Equipping people with digital skills

The new Strategic Framework for Employment Policy for 2030 was drawn up to address the challenges of digital skills, including the need to digitalise and improve employee training.

3.1.1.a Basic digital skills

2023 state of play and recent progress

	Country level	EU level
FORECAST	62.2	59.8
DESI 2024	69.1	55.6
AVERAGE ANNUAL GROWTH %	7.6	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

Czechia brings a very strong contribution to the EU's Digital Decade target for basic digital skills and is showing a very strong dynamic. In 2023, 69.1% of the people had at least a level basic of digital skills, an annual increase of 7.6%.

Based on the current rate of progress and assuming ongoing efforts are sustained, Czechia's contribution to this EU target will continue to be very significant. More than 80% of people aged below 44 have a basic level of digital skills; however, this falls to below 60% for people aged 55-64 and to 25% for people over 64. Czechia is aware of the need to expand digital access to older people when designing its policies.

To reach the target of 80% of the population with basic digital skills by 2030, a Strategic framework for digital education was set out in 2023. This framework reflects on other adopted strategic frameworks and previous strategies focused on digital education; and stems from a complete analysis of how the impact of Industry 4.0 on the job market can transform the education system, a goal set out in Czechia's Innovation Strategy. The new plan is set to be implemented from 2023 to 2027 and coordinated by the Committee for Digital Education under Government Council for Information Society (RVIS). Monitoring implementation will be crucial to identify and address any issues, but the availability of financial resources is the main concern. Efforts are being made to maximise the effective use of national and EU resources to benefit as many schools and students as possible.

One of the central measures running since 2022 has been the implementation of a new curriculum in primary and secondary education, with new classes focusing on digital skills development and ICT. This comprehensive plan is backed by various measures, including RRF funding for purchasing digital equipment and teaching aids for schools, with a particular focus on supporting disadvantaged students to ensure an inclusive digital transition. Courses to introduce AI in schools are also given by stakeholders and scientists, with a focus on preventing its misuse.

Under the RRP, EUR 280 million has been allocated to upskilling and reskilling the workforce. By 2025, several initiatives aim to help **130 000 participants** improve their digital skills. For example, in 2023, Czechia launched the pilot test of a new instrument of active employment policy by proposing a digital training course payment allowance. This allowance enables applicants to reimburse up to 82% of the cost of digital learning courses. The allowance can be used to pay for both basic digital skills courses and advanced specific digital skills courses. It can be used by anyone who is interested in improving their digital skills. In addition, support for the development of digital skills of employees in companies was also launched in 2024.

The government's goal for 2024-2025 is to start setting up 14 regional training labour offices that will provide modern equipment and technical support to help individuals develop essential digital skills. These centres will collaborate with regional vocational schools and focus on supporting mothers, older people, people with disabilities and those at risk of being left behind in the digital age.

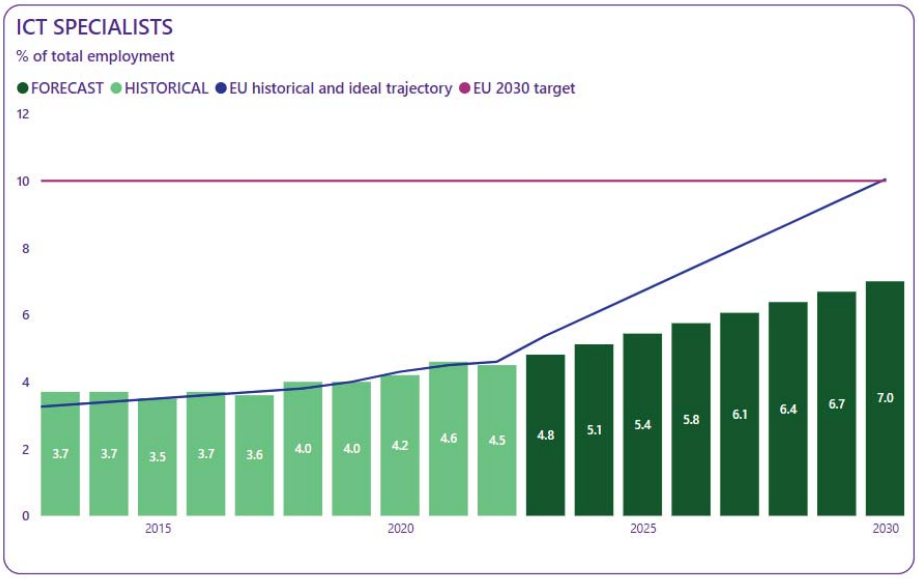
Czechia continues to take action to upskill the population. In the Strategy to support SMEs 2021-2027, Czechia acknowledges that upskilling is crucial for enterprises to embrace digitalisation as many fear they do not have skilled employees to use digital tools. Digitalisation is also vital given the Czech economy's industrial focus and the associated risk of automation. Therefore, according to the report, new skills in the workforce are needed to adapt to the manufacturing sector's digital transition.

Best practice: the Mobile Technology Classroom

In 2022, the Ministry of Industry and Trade launched the Mobile Technology Classroom project, aiming to spark students' interests in new technologies and technical areas. A converted truck goes around the country and serves as a mobile classroom where eighth and ninth graders can learn about new technologies, gaining practical knowledge, skills and competencies. Students can try 3D printing and augmented and virtual reality and receive career counselling.

In the 2022-2023 school year, 43 schools benefited from the project, involving over 1 000 students and 500 teachers. Participating schools have seen a heightened interest in technology among students. Teachers and school principals are also integrating technology and digital tools into educational processes more regularly.

3.1.1.b ICT specialists



2023 state of play and recent progress

	Country level	EU level
FORECAST	4.8	5.4
DESI 2024	4.3	4.8
AVERAGE ANNUAL GROWTH %	-4.4	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

Czechia has untapped potential to contribute to the EU's Digital Decade with regards to ICT specialists and demonstrates very limited dynamic. ICT specialists represent only 4.3% of the total employment, a decrease of 4.4% compared to last year, accentuating the shortage of such profiles.

With 7%, the country's target for ICT specialists is below the EU target value of 10%. The value is linked to a modest starting point. Moreover, based on the current rate of progress, it appears that, in absence of an intensification of efforts over the coming years, Czechia's contribution to this EU target will remain limited. In 2023, among the 4.3% of ICT specialists out of the total employed population, only 12.4% were women, even though an increase of nearly 2 points of percentage since 2022 can be underscored. Due to the shortage of ICT specialists and the current high level of employment, the country's target for ICT specialists is not that ambitious despite the demand from industry. However, new programmes might accelerate progress in this area.

Measures in the RRP aim to transform universities so that they can meet evolving learning methods and the changing needs of the job market. In line with the goal set in the Innovation Strategy of Czech Republic 2019-2030 of 'Promoting lifelong learning and reskilling – preparing for the use of breakthrough technologies', Czechia is boosting university capabilities and updating study programmes to be aligned with emerging trends and the job market's changing needs. In particular, study programmes that will be introduced by 2026 under

the RRP are expected to address the shortage of highly-skilled specialists in rapidly growing and high-value sectors. At least 20 new career-oriented study programmes are planned to be created.

Already in 2023, under these RPP measures, several new ICT study programmes have been developed, including a doctoral study programme in applied informatics, a bachelor's degree programme in information and network security, a master's programme in quantum informatics and a research-oriented master's programme with a focus on AI. The framework for these new study programmes has been successfully set out, and the structure of compulsory and optional subjects for full-time study is currently under development.

In its roadmap, Czechia presents seven measures for ICT specialists, which have a bigger budget than those for other targets, showing the priority given to this area. Czechia is reflecting on how to improve training ICT and cybersecurity professionals, with a focus on recruiting more women in the field. Although measures to improve digital skills, such as the reform of the education programme, will have a spillover effect in increasing the number of ICT specialists, this increase is not expected until after 2030.

Czechia also benefits from the involvement of organisations such as DigiKoalice, which has 259 members. DigiKoalice, the Czech National Coalition for Digital Skills and Jobs, was set up in 2016 to promote digital skills and job opportunities in the country. Launched by the Ministry of Education, Youth and Sports, it collaborates with various partners and is currently affiliated with the National Pedagogical Institute. As an open platform, DigiKoalice welcomes contributions from a wide range of stakeholders, including state institutions, ICT companies, educational and academic institutions, municipalities, non-profit organisations, school founders and others – they all work to advance the Czech population's digital literacy and skills.

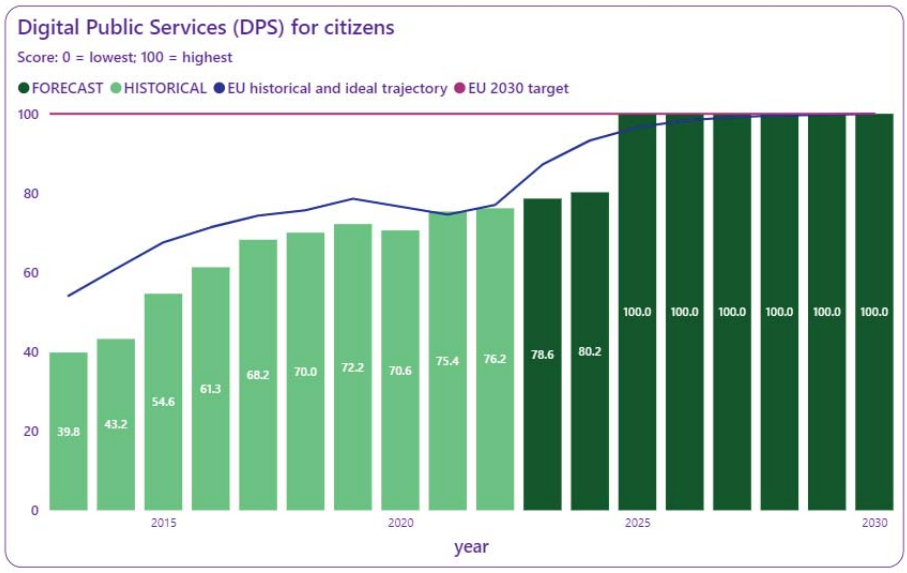
3.1.2 Key digital public services and solutions – trusted, user-friendly, and accessible to all

3.1.2.a e-ID

Electronic identification is widely used in Czechia, with 10 banking institutions providing electronic identity services for online authentication and digital transactions on both government and non-government websites. In 2021, for example Bank ID solutions were introduced, and by 2023, 4 million users were using them. Banking identity (although the most widely used identity means) belongs to the so-called Citizen electronic identity, which includes government and non-government identity means.

In January 2024, the DIA launched a mobile application called *e-Doklady* for e-ID, which has since been used by more than 400 000 users. Czechia had to update its Act on the Right to Digital Services to launch it. This app allows Czech citizens to download their electronic ID to their smartphones, offering a convenient and secure alternative to traditional plastic cards. The app *eDoklady* is primarily used for identity verification, however it the app can also store different identity-related documents; it allows users to easily copy and paste their identity data when filling out online forms and serves as an encrypted proof of identity.

3.1.2.b Digitalisation of public services for citizens and businesses



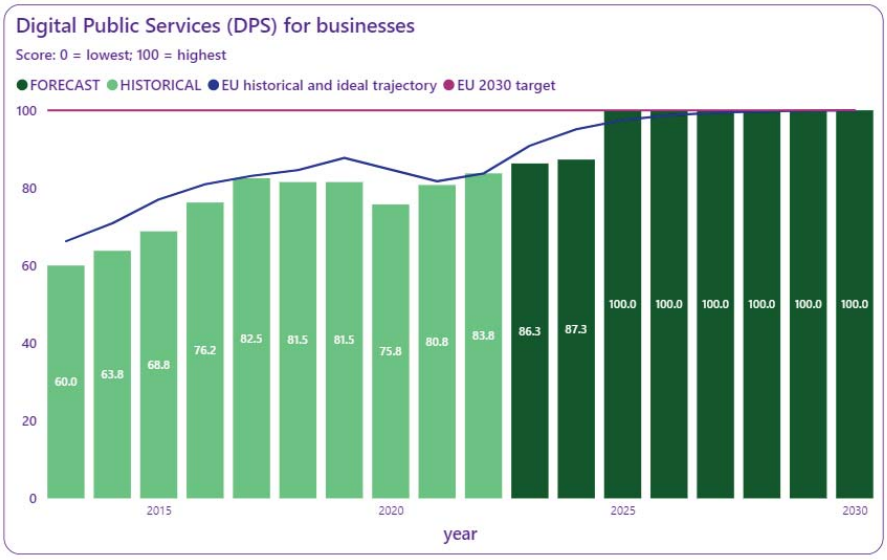
2023 state of play and recent progress

	Country level	EU level
FORECAST	78.6	87.2
DESI 2024	76.3	79.4
AVERAGE ANNUAL GROWTH %	0.2	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



2023 state of play and recent progress

	Country level	EU level
FORECAST	86.3	90.9
DESI 2024	83.8	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

Czechia has untapped potential to contribute to the EU's digital decade target for the digitalisation of public services for both its citizens and businesses. Compared to other countries, Czechia shows a positive dynamic comparing 2021 to 2023 data when it comes to the services for businesses but a limited one when it comes to services for citizen. Both scores lag behind the EU average.

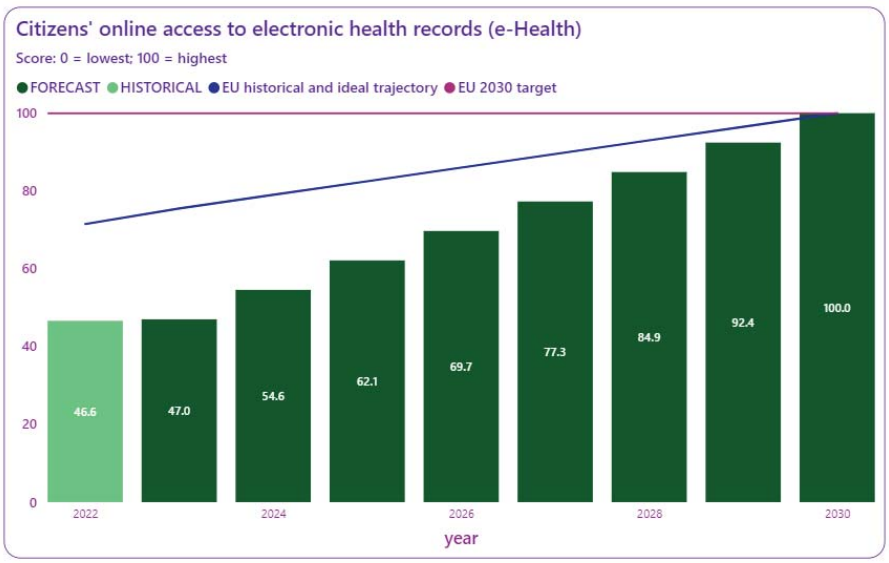
In 2023, the creation of the Digital Information Agency (DIA), a centralised body supporting key digital projects in public administrations, gave an impetus to digitalising public services. In particular, the DIA monitored implementation of the Act on the Right to Digital Services[16], ensuring the right of 'natural and legal persons to the provision of digital services by public authorities in the exercise of their competences'. A dedicated team in the agency provides guidance and technical assistance to public administrations in their

[16] Act no. 12/2020 Coll.

digitalisation work. Certain administrations and service providers have made a catalogue of public services available to users.

According to the OECD, **Czechia is one of the top performing countries in managing and using open government data**. However, compared to other OECD countries, Czechia lags behind in using these tools and data for policy development and process transformation. The gradual and recent use of AI by Czech ministries in policymaking will help improve this area. However, this also indicates that the DIA's role is very diverse, covering the digitalisation of services for the population and the digitalisation of administrations from a management perspective and strategic perspective. To meet these demands, a strong team might be needed.

3.1.2.c e-Health



2023 state of play and recent progress

	Country level	EU level
FORECAST	47.0	75.5
DESI 2024	51.1	79.1
AVERAGE ANNUAL GROWTH %	9.5	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

Czechia has an overall eHealth maturity score of 51 in 2023, an improvement of 4 points since 2022, still the score is below the EU average of 79. The country's lowest-scoring sub-indicator in this area is for the maturity of electronic results and reports, with a score of 0 out of 100. Furthermore, only 1 out of 11 applicable healthcare provider categories currently contribute data.

Czechia's e-health system is a hybrid model, with some data being provided nationally and others provided regionally or by healthcare providers. Data on e-prescription and e-dispensation are mature and made available nationally; as pharmacies supply data through the central e-prescription system. Furthermore, one region provides medical data to people through its own regional patient portal, and some healthcare providers do the same through their patient portals. Despite these developments, only a limited percentage of the population has access to their e-health records.

A centralised nationwide service to access e-health records does technically exist in Czechia. However, less than 19% of the population is able to access the online e-health record service through native mobile application(s) and online portal(s), which requires two-factor authentication using e-ID.

Czechia's efforts to make e-health services accessible to people with vulnerabilities scores 50 compared to the EU average of 77; the services do not comply with the Web Content Accessibility Guidelines. Furthermore, there are laws that grant the right to legal guardians and authorised persons to access e-health records on behalf of others, but this functionality has not yet been implemented in the online service.

According to Eurostat, in 2023, 64% of the Czech population sought health information online, slightly more than the EU average of 56%. This trend has been growing since 2015, showing the increased interest of Czechs in e-health services.

In 2023, a new app was launched to serve as a vaccination card. During the COVID-19 crisis, a mobile application was developed to store the EU's COVID-19 certificate. Although it is no longer in use, it remains installed on 6 million mobile phones. Therefore, the government decided to upgrade the app to include all vaccination certificates. This new service, EZKarta, will be an expanded gateway for healthcare digitalisation and a new communication channel between the Ministry of Health and the Czech public.

The delivery of e-health services has improved thanks to the implementation between 2018 and 2020 of a national e-health framework under the Structural Reform Support Programme. Before that, the development of e-health solutions by the public and private sectors was often ineffective and unsustainable.

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

As set out in the European Digital Rights and Principles, children and young people should be empowered to make safe and informed choices and express their creativity online.

According to a Eurobarometer survey, only 33% of the Czech population thinks that this right is upheld, which is below the EU average of 39%. The Czech police have seen a significant rise in cybercrime in recent years, with children increasingly falling victim to bullying and online predators. In 2022, Czech police investigators recorded nearly 8 500 cybercrimes, five times more than a decade ago.

In response to these challenges, in 2022, **Czechia's police launched an educational prevention initiative called 'Your Journey Online.'** The first part focuses on educating children and young individuals on how to present themselves on social media and underlines the importance of securing their devices and personal accounts. The second part of the programme concentrates on navigating online information, stressing the need for fact-checking, especially amid widespread misinformation, and being aware of common cyber fraud tactics. Additionally, the programme provides recommendations on trustworthy sources and identifies key risk indicators for safe online communication. In 2023, the police conducted 4 132 digital security events, reaching an audience of 192 020 individuals. This project will continue in 2024.

Private sector initiatives are also supporting child-friendly content and trying to involve children and young people in developing digital policies that concern them. For example, one of the biggest non-profit organisations in Central Europe, People in Need, launched the JSNS.cz portal. Since 2001, this platform has been providing educational material on societal challenges in Czechia and the world to raise critical thinking among children. The portal is primarily designed for primary and secondary school teachers to improve their teaching through film, discussions and learning activities, such as a documentary on digital platforms' data collection and usage policies.

As part of the 2023 revision of the country's recovery and resilience plan (RRP), Czechia decided to renew funding the activities of EDMO, the European Digital Media Observatory. The non-partisan centre aims to identify sources of disinformation and develop a series of short and long-term strategies and recommendations to help civil society, public institutions and the private sector to respond to the declining trust in key institutions and resist the effect of rising exposure to misinformation. The EDMO consortium, led by the Charles University in Prague, is composed of a diverse team of people from technical and humanities backgrounds, including scientists, journalists and fact-checking professionals.

4 Leveraging digital transformation for a smart greening

Czechia is an industrial country and one of the most energy-intensive economies in the OECD. However, since 2008-2010, thanks to the gradual introduction of renewable energies in the energy mix and the shift to less energy-intensive industries, Czechia has managed to decouple energy-related CO_2 emissions from economic growth. This was highlighted by a sharp decline in emissions in 2020 caused by the impact of the COVID-19 crisis. According to the Berlin Declaration Monitoring 2022 report, Czechia still has room to improve implementation of its resilience and sustainability policies, especially when it comes to assessing the energy consumption of digital tools and infrastructure and being transparent with the results.

Czechia's population and businesses have made notable efforts towards sustainability. According to Eurostat, 54.7% of Czech enterprises of 10 employees or more consider the environmental impact of ICT solutions and devices when choosing them and take measures to reduce ICT devices' paper and energy consumption, compared to the EU average of 48.7%. Moreover, Czech people recycle more than the EU average, with 15.5% recycling their mobile phones, 18% recycling desktop computers and 10.8% recycling tablets (versus the EU averages of 10.3%, 12.8% and 9.7% respectively).

The Czech roadmap does not set out any fully fledged measures contributing to twinning the green and digital transitions. The political ambition is not aligned with the mindset of the population as, according to the Eurobarometer survey, 61% of the population think that digital technologies will help fight climate change, and 75% think that it is important that public authorities ensure that digital technologies serve the green transition. These results are still below the EU average of 74% and 81% respectively, showing that public awareness on how digital technologies can improve the green transition is still low.

On 26 September 2023, the Commission endorsed the modified recovery and resilience plan (RRP), which includes a REPowerEU chapter to end the EU's reliance on Russian fossil fuels following Russia's invasion of Ukraine. These REPowerEU reforms will help the green and digital transitions as they aim to accelerate the Renovation Wave, the European Green Deal's key initiative to improve energy efficiency by renovating buildings. The reforms also aim to further boost the transition to renewable energy by streamlining permitting procedures, strengthening the domestic electricity grid and facilitating the production of clean energy by using solar and wind power. For example, Czechia aims to modernise and digitalise the electricity grid and facilitate permitting procedures by digitalising it. Additionally, the plan includes new reforms to bolster administrative capacity and improve the R&D ecosystem.

Within the **Operational Programme Environment (2021-2027)**, the twin transitions are supported by three measures: (i) improving energy efficiency in public buildings and infrastructure using control and measuring software, easing energy management; (ii) preventing and managing anthropogenic risks using equipment to measure the quality of environmental components; and (iii) modernising waste collection systems using chips/sensors in containers.

Annex I – National roadmap analysis

Czechia National Digital Decade strategic roadmap

The National Strategic Roadmap of Czechia was submitted on 15 November 2023. The roadmap has been **consulted** through a series of workshops with stakeholders, is approved by the Government Council for the Information Society, the Committee for the EU, and the Government. The document is published in both Czech and English.

The Czech roadmap is mostly complete and presents 13 targets and 12 trajectories until 2030 (out of 14 expected). The FTTP trajectory is assumed to be similar to the presented VHCN one. The edge nodes trajectory is missing. Among the national target values provided, most of them are below the EU targets, except for e-Government targets and basic digital skills. The adoption of technologies by enterprises (cloud, AI, data analytics), taken separately are set below the 75% target (60%, 16%, 25%, respectively). The trajectories have been computed on the basis of the correct KPI definitions but might require rework on the temporality (see recommendations).

Digital Decade Target/objective	Budget (EUR Million)	Number of measures
Connectivity gigabit	409.3	4
Connectivity 5G	90.6	3
Semiconductors	2.3	2
Edge nodes	-	-
Quantum computing	10.5	1
SME take up	162.8	4
Cloud/AI/Big data uptake	325.6	3
Cloud only uptake	-	-
AI only uptake	5.9	2
Big data uptake	-	-
Unicorns	35.1	1
Basic digital skills	83.1	6
ICT specialists	334.9	7
eID	13.0	2
Key public services	270.6	19
e-Health	23.0	4
Objectives	-	-
Total	**1 766.9**	**58**

Czechia presents a non-exhaustive selected set of the main policies and measures contributing to the achievement of each of the Digital Decade targets. However, there is only a short description of measures covering several types of objectives such as technological leadership, sovereignty, competitiveness, cybersecurity, fundamental rights, and the green transition.

In total, the measures presented amount to EUR 1.77 billion. The allocation of the budget towards connectivity and take-up of technologies by enterprises is coherent with the improvements needed to reach the Digital Decade targets.

The interplay between the digital and green transitions is not enough developed. The source of funding (especially EU funding) could be more precise in the present document. New tailored measures to answer

challenges identified in the previous State of the Digital Decade report 2023 (e.g., shortage of ICT specialists) would have been welcome.

The roadmap is overall coherent with efforts in all the dimensions of digitalisation. However, some aspects might require more effort. For example, the skills elements could benefit from a split between advanced and basic skills. Moreover, the timespan of most measures coincides with the timeframe of structural funds and RRF programme implementation, and most of the budget set out in the roadmap comes from those sources of funding. Hence, most measures don't last after 2027.

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

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

MCP and EDICs

Czechia participates in multi-country projects related to cutting-edge technologies. Czechia is part of the European High-Performance Computing Joint Undertaking (EuroHPC JU) as host of the first European quantum computers and Czechia is also a participant in the IPCEI on Microelectronics and Communication Technologies.

Czechia is also a member of Networked Local Digital Twins Towards CitiVERSE-EDIC (already set up). These digital twins are virtual replicas of a city's physical assets, processes, and systems, using data, analytics, and AI to create real-time simulation models. The CitiVERSE is focused on advancing generative AI applications in smart cities, including simulations that address the impact of changing traffic conditions on air quality, decarbonisation, and congestion. This helps the cities assessing their carbon print and learn from what the other cities are doing.

Moreover, Czechia is a member of the Alliance for Language Technologies (ALT-EDIC, already set up), is developing the Statute and other relevant documents of the possible future Genome EDIC, within an informal Working Group and is engaging in discussions on the setup of the possible future Digital Commons EDIC, also within an informal Working Group.

EU funding for digital policies in Czechia

EU funds support the digitalisation efforts in Czechia. The Czech Recovery and Resilience plan devotes EUR 1.94 billion (22.8% of the total) to digital transformation. According to the Joint Research Centre's 'Mapping EU level funding instruments to Digital Decade targets' study[17], EUR 1.81 billion of the Czech Recovery and Resilience Plan directly contribute achieving Digital Decade targets. Out of the Cohesion Policy funds received by Czechia, EUR 1.34 billion contribute directly to Digital Decade targets according to the same mapping study.

The main investments focus on boosting digital skills and supporting the digitisation of key public services (EUR 315 million) and the digitalisation of SMEs (EUR 251 million).

On 26 September 2023, the Commissions endorsed the modified recovery and resilience plan, which includes a REPowerEU chapter. The digital target went up from 21.7% to 22.8%. New measures focus on the digitalisation of public services lead by the digital information agency (DIA) with the creation of a contact centre and a data centre, the creation of a fund for early-stage startups and new investment for the IPCEI microelectronics.

On 19 February 2024, the Commission has endorsed a positive preliminary assessment of Czechia's second payment request for EUR 702 million under the Recovery and Resilience Facility. In 2023, the RRP funded 10 completed measures in digital, especially in the digitisation of public administration (open data sources from public entities were published, operation systems were upgraded, competence centres for digital projects in the administration were opened) and in connectivity, with the creation of the tool to map networks.

[17] 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

Denmark

1 Executive summary

Denmark 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, Denmark made notable progress in digitalising public services for businesses and in increasing the number of ICT specialists. However, **challenges persist** in the digitalisation of SMEs and, more generally, in enterprises' take-up of advanced technologies, such as artificial intelligence (AI).

With a focus on solving societal challenges through digital means, Denmark presented a national roadmap that demonstrates plans to strengthen **the competitiveness of enterprises, improve public services and advance the green transition**. The updated Digitalisation Strategy 2024 – 2027, launched in November 2023, marks the allocation of approximately EUR 100 million for initiatives that focus on providing technology knowledge in primary schools, increasing the uptake of digital technologies such as AI and robotics, using data for the green transition, among other things. Relevant strategies also include the Joint Government Digital Strategy 2022-2025, the national Broadband Strategy, Denmark's National Strategy for Quantum Technology and the Strategy for Cyber and Information Security.

According to the **Special Eurobarometer 'Digital Decade 2024'**[18] survey, 83% of the Danish population consider that the digitalisation of daily public and private services is making their lives easier, well above the EU average of 73%.

Denmark is a member of the **Alliance for Language Technologies European Digital Infrastructure Consortium (ALT-EDIC),** which addresses the scarcity of European language data needed for AI solutions**.** It is also developing the Statute and other relevant documents of the possible future **Genome EDIC** and engaging in discussions on the set-up of the **Digital Commons EDIC,** both within informal Working Groups. Denmark is also finalising membership negotiations with the **Local Digital Twins towards the CitiVERSE – EDIC.** Finally, the country has set up **five European Digital Innovation Hubs (EDIHs)** to build up the digital capacity of companies and public sector organisations[19].

[18] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351
[19] Information last updated on 31 May 2024.

Digital Decade KPI [1]	Denmark			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	DK	EU
Fixed Very High Capacity Network (VHCN) coverage	96.3%	97.2%	0.9%	78.8%	7.4%	x	100%
Fibre to the Premises (FTTP) coverage	77.9%	84.0%	7.9%	64.0%	13.5%	x	-
Overall 5G coverage	97.8%	100.0%	2.2%	89.3%	9.8%	x	100%
Semiconductors		NA					
Edge Nodes		22		1 186		x	10 000
SMEs with at least a basic level of digital intensity	79.4%	75.3%	-2.6%	57.7%	2.6%	95%	90%
Cloud	62.2%	66.2%	3.2%	38.9%	7.0%	78%	75%
Artificial Intelligence	23.9%	15.2%	-20.3%[2]	8.0%	2.6%	76.6%	75%
Data analytics	NA	49.5%	NA	33.2%	NA	72.7%	75%
AI or Cloud or Data analytics	NA	77.4%	NA	54.6%	NA	75%	75%
Unicorns		8		263		x	500
At least basic digital skills	68.7%	69.6%	0.7%	55.6%	1.5%	80%	80%
ICT specialists	5.7%	5.9%	3.5%	4.8%	4.3%	7.7%	~10%
eID scheme notification		Yes					
Digital public services for citizens	84.1	84.2	0.2%	79.4	3.1%	100	100
Digital public services for businesses	88.7	88.7	0.0%	85.4	2.0%	100	100
Access to e-Health records	95.8	97.9	2.2%	79.1	10.6%	100	100

[1] See the methodological note for the description of the indicators and other descriptive metrics
[2] The decrease recently observed on the AI value is likely linked to a heightened awareness among enterprises regarding both the utilisation of specific AI technologies, like for example Robotic Process Automation (RPA) based on AI.

Denmark's Recovery and Resilience plan (RRP) devotes 27% of the total budget to the country's digital transformation (approximately EUR 382 million)[20]. Priority is given to implementing the new digital strategy, extending high-speed rural broadband coverage, improving cybersecurity readiness and the use of AI, further digitalising SMEs and the public administration, with a particular attention to developing digital solutions for the healthcare sector, and boosting R&D. Under Cohesion Policy, an additional EUR 1.9 billion (9% of the country's total cohesion policy funding) is allocated to the country's digital transformation[21].

National Digital Decade strategic roadmap

With respect to Denmark'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.

The Danish roadmap is **coherent**, including on objectives, but only partly reflects the efforts needed to achieve the Digital Decade targets. **It includes 2030 national targets for 10** of the 15 key performance indicators (KPIs) but lacks formalised targets and trajectories for **Fibre-to-the-premises (FTTP) coverage, edge**

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

[21] 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.

nodes and unicorns. The Fixed Very High-Capacity Networks (VHCN) coverage target is set for 2025, while the 5G target is assumed not to feature because the country has already reached full coverage. In total, 9 of the national targets presented are aligned with the EU's 2030 targets, while **ICT specialists** is below. The roadmap covers all objectives, namely digital citizenship, fostering leadership and competitiveness, and digital for green**.** With **55 measures** presented, the total reported budget in the roadmap at the time of writing is **estimated at EUR 145.4 million** (less than 0.11% of GDP), with priorities set on quantum, the uptake of key technologies by enterprises and the digitalisation of public services. Some aspects might require more effort, especially for digital skills, boosting the number of edge nodes and the uptake of digital technologies by smaller enterprises.

Recommendations for the roadmap

Denmark 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 targets and trajectories for **FTTP, edge nodes** and **unicorns,** and formalise the trajectory for **VHCN up to 2030**. (ii) Consider aligning the level of ambition of targets for the **number of ICT specialists** to the corresponding EU targets. (iii) **Recalculate some of the trajectories using the correct starting year** for the following KPIs (basic digital skills, cloud, data analytics and SMEs with at least a basic level of digital intensity), as in SDDR2023.
- **MEASURES:** (i) Strengthen the measures contributing to targets where Denmark has the potential to do more, including on **digital skills, edge nodes** and the **uptake of digital technologies by smaller enterprises**; (ii) Review the budget description for all measures, highlighting EU sources of funding such as the 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:** Provide additional detail on the stakeholder consultation of the roadmap.

Digital rights and principles

The Digital Decade Eurobarometer sheds light on Danish perceptions of digital rights. While 60% of Danes believe the EU protects their digital rights effectively, a 4-point decrease from last year, it remains above the EU average of 45%. Concerns have escalated, particularly with 67% worried about children's online safety, a significant 25-point increase, and 47% about control over personal data, up 6 points. Positively, 74% value the freedom of assembly online, and 72% appreciate access to free public services, both well above 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[22].

A competitive, sovereign and resilient EU based on technological leadership

To underpin its technological leadership and competitiveness, Denmark is equipped with strong infrastructure and a high-quality research community, particularly in the fields of robotics and deep-tech centres for the fabrication of nano technologies like quantum technologies, sensors and chips. However, **more can still be done to transfer R&D into market innovation and to boost the use of new technologies**, in

[22] 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.

particular AI and cloud, by smaller younger companies, and help them to keep pace with larger companies when it comes to the level of digitalisation.

On infrastructure, Denmark is on track to reach 100% coverage for VHCN and 5G by 2025, 5 years earlier than the EU's 2030 target. The country boasts one of the highest percentages of fixed broadband subscriptions with speeds above 1 Gbps in the EU (29.3%). 5G in the 3.4-3.8 GHz band, which is essential for enabling advanced applications requiring large spectrum bandwidth, covered 85.0% of Danish households in 2023, significantly above the EU average of 50.6%. Denmark continues to focus on technological leadership and sovereignty, with plans to invest more in semiconductors and the commercialisation of quantum technologies, where Denmark is already contributing significantly.

Although all indicators on businesses digitalisation exceed the EU average (for example, 75.3% of SMEs have at least a basic level of digital intensity), their limited or at times very limited dynamic suggests there can still be some room for improvement. Through automation initiatives like SME:Digital and SME:Robot, Denmark aims to streamline digital processes in SMEs. However, more could be done to promote a wide range of digital solutions designed to meet the needs and resources of all types of SMEs, particularly smaller enterprises. The recent allocation of a EUR 4.2 million research fund under the Danish Innovation Fund will already contribute to reinforcing strategic research in key technologies, particularly big data, AI, as well as cyber, information security and semiconductors. More could be envisaged when it comes to Danish enterprises taking advantage of European co-funding to have a real impact on the country's competitiveness and productivity. Denmark's start-up scene thrives in robotics, automation, quantum, and drone technologies, but still faces challenges in accessing venture capital and competing for talent. On cybersecurity, the National Strategy for Cyber and Information Security is being implemented to protect critical government ICT systems and improve the cyber skills of people, businesses, and authorities.

Recommendations – Denmark should:

- **DIGITALISATION OF ENTERPRISES:** Focus on supporting and raising smaller enterprises' awareness of digital solutions to improve their businesses and learn how to better use them.
- **AI/CLOUD/DATA ANALYTICS:** (i) Review the mix of measures to support the adoption of advanced digital technologies by businesses, particularly those targeting the adoption of AI by enterprises. (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 to implement the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.
- **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.
- **EDGE NODES:** Consider integrating the deployment of more edge nodes at national level, as well as investment programmes, factoring in the innovation that edge nodes will bring in the areas of AI, the Internet of Things (IoT) and networks rollout.

Protecting and empowering EU people and society

Denmark is delivering a digital transformation that aims to boost digital inclusion and a skilled workforce. In 2023, 69.6% of the population had at least a basic level of digital skills, above the EU average of 55.6%. However, there is still scope for improvement to bridge the urban-rural divide and the gender gap, especially to avoid the risk of digital exclusion in a country where the digital transformation is steadily advancing. ICT

specialists as a percentage of the Danish population in employment is 5.9%, which is also above the EU average of 4.8%, yet still showing important gender differences (only 22.6% of employed ICT specialists are women). Moreover, the share of companies that had hard-to-fill ICT vacancies looking for ICT specialists in 2022 (10.7%) was generally higher than in the EU (6%), showing there is still an issue in the ICT labour market. Looking ahead, more can be done to improve young people's interest in the ICT field, especially among women. Denmark also aims to step up existing efforts in upskilling and reskilling the labour force and to retain more international ICT students in the Danish labour market. These efforts could help increase enrolment rates in ICT courses and the number of graduates in the country (currently representing 5.5% of graduates in the country) as, although ICT-focused degree programmes have enough places available, they often go unfilled. On the digitalisation of the administration (public services for citizens and businesses, e-ID and access to e-health records), Denmark is on track and performing above the EU average, with a notable e-Health maturity score of 97.9 out of 100 and with health data supplied across all the categories of healthcare providers. The country's new single secure e-ID solution, MitID, was notified under the e-IDAS regulation with a substantial and high level of assurance. Data shows that 83.9% of Danish citizens made use of the e-ID to access public services in the last 12 months, which is much higher than the EU average (36.1%). With a high level of digitalised public services, Denmark pays particular attention to ensuring inclusiveness and accessibility giving, whenever necessary, the possibility to those with impairments to opt out.

Recommendations – Denmark should:

- **BASIC DIGITAL SKILLS:** Focus on integrating basic digital skills in primary and lower-secondary education at national level, to ensure there is an equal level of basic digital skills among the Danish population, paying particular attention to the existing urban-rural divide and gender gap.
- **ICT SKILLS:** Follow up on the plans set out in the new digitalisation strategy to upskill and reskill ICT specialists. Design schemes to improve young people's interest in ICT, including among women, and retain international students in ICT-related degree programmes to increase enrolment rates.
- **E-HEALTH:** Make the data type of medical images available to citizens through the online access service.

Leveraging digital transformation for a smart greening

Denmark is actively improving the standardisation, digitalisation, and automation of data to support businesses, public authorities and the population in accessing their climate and environmental footprints and make smarter, more informed choices. In line with this, the Danish government wants to create a circular data bank that collects and shares data on waste and materials.

Recommendations – Denmark should:

- Continue developing a coherent approach to twinning the digital and green transitions, including by supporting relevant pilots. First, continue to promote 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.
- Build on existing measures to 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. Where possible, take the lead in this area by promoting national tools and methodologies at EU level.

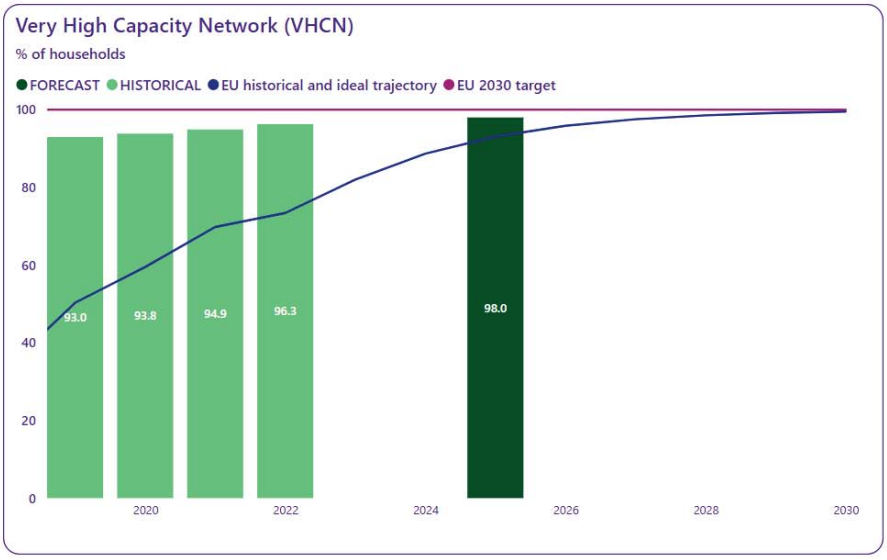
2 A competitive, sovereign and resilient EU based on technological leadership

Denmark benefits from a strong connectivity infrastructure and a high-quality research community. The country aims to focus its attention on investing more in new technologies, especially AI, and the digital growth of its SMEs. This aligns with the results of the 2024 Digital Decade Eurobarometer survey, where 94% of Danish respondents believed it is crucial that public authorities increase Research and Innovation (R&I) to have more secure and stronger digital technologies. Denmark also wants to focus on exploring the potential of new technologies in detecting cyberattacks, ultimately strengthening its sovereignty and resilience.

2.1 Building technological leadership: digital infrastructure and technologies

Denmark's digital infrastructure is in a very good state, with both cable and fibre technologies contributing to reaching 100% VHCN coverage soon and 5G coverage having already reached the EU target. Still, some regional coverage disparities remain.

2.1.a Connectivity infrastructure (gigabit)[23]



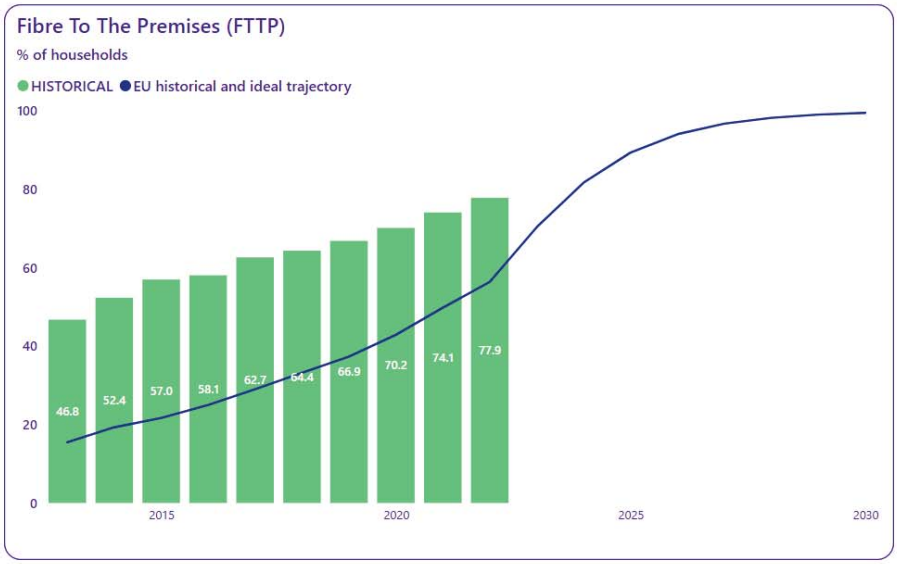
2023 state of play and recent progress

	Country level	EU level
FORECAST		82.0
DESI 2024	97.2	78.8
AVERAGE ANNUAL GROWTH %	0.9	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

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



2023 state of play and recent progress

	Country level	EU level
FORECAST		70.3
DESI 2024	84.0	64.0
AVERAGE ANNUAL GROWTH %	7.9	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

Denmark brings a very strong contribution to the EU's VHCN target. With networks using both cable and fibre technologies, the country's 97.2% VHCN coverage is above the EU average of 78.8% and slowly approaching 100% coverage. The country also scores well above the average performance in FTTP coverage, which stands at 84.0% compared to the EU average of 64.0%, showing an annual growth rate of 7.9% (below the EU average of 13.5%). Denmark also has among one of the EU's highest shares of fixed broadband subscriptions of speeds faster than 1Gbps (29.3%, against an EU average of 18.5%).

For many years, Denmark has been prioritising the commercial rollout of broadband infrastructure by streamlining administrative processes and supporting telecoms operators' access to fibre networks, excavation work and data. Investment levels remained high and the take-up of fibre continued to rise in 2023, reaching 1.2 million subscriptions (up from 1.1 million in 2022). The share of fixed broadband subscriptions of speeds of at least 100Mbps (73% in 2022) and at least 1Gbps (19.8% in 2022) rose by about 9 percentage points and 10 percentage points respectively from 2022 to 2023. National information campaigns are likely to have played a role in stimulating demand for high-speed internet access.

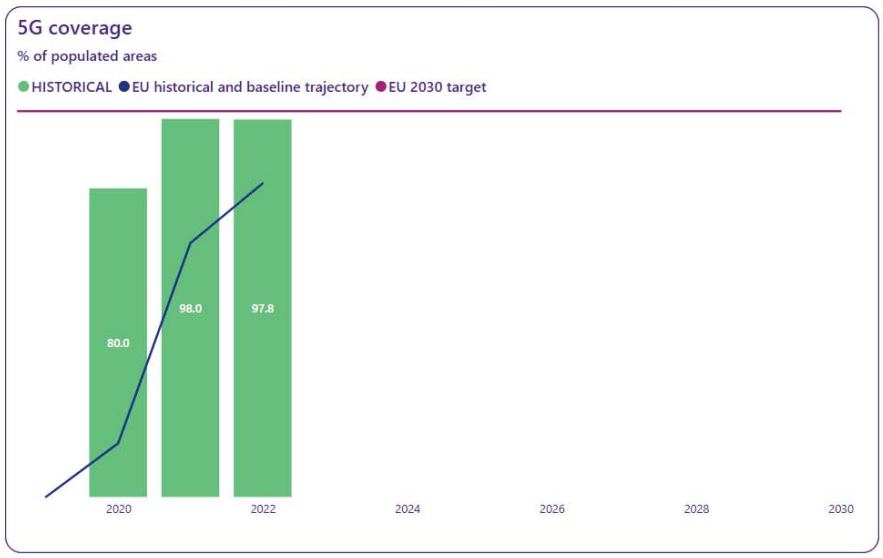
In addition to the market-based broadband roll-out, Denmark introduced the National Broadband Fund in 2016, supported by the RRF in 2021, primarily to improve fast broadband access in remote areas. In 2023, EUR 13 million was allocated, with around EUR 11 million used to fund 145 local projects targeting approximately 2 000 households. The unspent funds have been transferred to support new applications in local broadband projects to be spent in 2024-2027.

As highlighted in its roadmap and in the national broadband strategy, **Denmark aims to achieve 98% coverage of all households and businesses by VHCN by 2025, 5 years ahead of the EU's 2030 target.** However, it does not formally commit to a 2030 target in the scope of the Digital Decade. **Considering the current high level of broadband penetration** and planned investments in fibre roll-out, **the country's contribution to the EU's Digital Decade target is expected to be very significant.** However, achieving full coverage for all remaining addresses will be a difficult and costly task.

Looking to the future, Denmark will continue to push for deploying VHCN via commercial roll-out and, where necessary, using public funds to reach some of the most remote areas. The Municipal State Aid Scheme is expected to enter into force mid-2024 and holds the potential to help municipalities address uncovered areas within their remit. **Municipalities will play a crucial role, particularly in coordinating and promoting the roll-out in cooperation with telecoms operators**. The interactive mapping tool, Tjekditnet.dk,

managed by the Danish Agency for Data Supply and Infrastructure, allows Danes to monitor broadband development with aggregated data covering both fixed access and mobile network coverage at national, municipal and regional level. With consumer interests in mind, the government has also agreed to launch a website where people living or working in underserved areas can register their interest in high-speed broadband and contact providers who can then look into possibilities for commercial uptake.

2.1.b Connectivity infrastructure (5G)



2023 state of play and recent progress

	Country level	EU level
FORECAST		
DESI 2024	100.0	89.3
AVERAGE ANNUAL GROWTH %	2.2	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

Denmark brings a very positive contribution to the EU's Digital Decade target, with 5G coverage already reaching 100% of populated areas and 99.2% of the 5G pioneer bands assigned, against 89.3% and 73.4% respectively at the EU level. 5G in the 3.4-3.8GHz band, an essential band for enabling advanced applications requiring large spectrum bandwidth, covered 85.0% of Danish households in 2023, significantly above the EU average of 50.6%.

Mobile broadband take-up is also high, with 97.6% of individuals reporting that they have used the internet on a mobile device, above the EU average of 89.9%. Additionally, 81.7% of the population had a 5G SIM card in 2023, well above the EU average of 24.6%. In the summer of 2023, two mobile operators switched on the country's first 5G standalone network, providing a good basis for advanced 5G services, including network slicing and edge computing. Finally, Denmark has been prioritising focus on the take-up of different types of use cases by facilitating workshops with various stakeholders to create new partnerships and circulating newsletters to raise awareness.

With 5G coverage at 100%, Denmark's target for 2030 is fully aligned with the EU's and is significantly contributing to it. Looking ahead, after taking stock of progress in 2023, the Danish government approved a model to include mobile broadband to complement fixed broadband in mapping broadband coverage. This is to ensure that the country can reach 100Mbps download and 30Mbps upload speeds by 2025. The country will also focus more on satellite broadband's potential to cover some of the most remote addresses.

2.1.c Semiconductors

Denmark has an active research community in the field of semiconductors, with several companies playing an important part in the EU semiconductor supply chain. In 2023, the country moved forward with expanding existing facilities, boosting the EU's possibility to produce its own microchips. One confirmed project, proposed by the Technical University of Denmark (DTU), focuses on doubling its cleanroom capacity (i.e., advanced laboratory facility) for microchip production at the National Centre for Nano Fabrication and

Characterisation (DTU Nanolab). The laboratory was last expanded in 2003 and, with the current 1 350 m² space, will grow to approximately 5 600 m² with an additional basement area. The cleanroom will be designed to host researchers developing and fabricating not only nanochips and microchips, but also quantum sensors, quantum encryption units and quantum computers among other things. With a budget of EUR 46 million, the goal is to complete the project by mid-2026. At the end of 2023, the Danish government also agreed to allocate EUR 4.2 million to support the country's participation in European R&D initiatives, including on semiconductors, microchips and nanochips.

At EU level, Denmark participates in the Joint Education for Advanced Chip Design in Europe project (Edu4Chip), which designs and implements university study programmes to train a new generation of chip design experts. The aim is to train more than 150 EU and 100 non-EU students every year until mid-2027.

Overall, with its major facilities and plans to invest more in public research and education, **Denmark has the potential to continue contributing to the EU's sovereignty in the semiconductor sector.**

2.1.d Edge nodes

Latest estimates show there are 22 edge nodes deployed in Denmark, slightly less than 2% of the 1 186 edge nodes estimated in total in the EU, according to the Edge Deployment Data Report. **The country does not set out any national target or measures in its 2023 national roadmap for edge node development**. Focusing more on edge node investments and deployment will be crucial in the future, especially as edge computing will continue to play a critical role in enabling AI, the roll-out of future networks and the Internet of Things.

2.1.e Quantum technologies

Denmark has been actively investing in R&D in quantum technology, making the country a key player in the EU's quantum ecosystem. The University of Copenhagen and Aarhus University both have strong research groups working on various aspects of quantum physics and technology, including quantum computing, quantum communication and quantum sensing. The Danish government has also invested in the field, through initiatives such as the Danish Quantum Technology Hub, which brings together researchers from academia and industry to work on developing new quantum technologies. Additionally, several Danish companies are working on commercialising quantum technologies, such as Universal Quantum, a start-up that develops quantum computing software. As a result of the work done by the Ministry of Industry, Economic and Business Affairs, universities, research institutes and companies to develop a National Quantum Plan, in the coming years, the country aims to pursue its national quantum technology strategy to focus on commercialisation, applications, security and international partnerships.

In the first part of the strategy, the goal is to allocate EUR 134 million up until 2027 to **make Denmark a world-leader in quantum technology research**. The funds will be used to strengthen the research infrastructure, ensuring better access to quantum computers and supporting a nation-wide effort to build skills in, for example, quantum technology applications. The second part of the strategy includes: (i) creating a national test centre for quantum technology, which will serve as meeting point for research institutions, start-ups and other companies working in the field; (ii) setting up a national forum to facilitate dialogue; (iii) creating a European quantum fund in partnership with Denmark's Export and Investment Fund (EIFO); (iv) developing new use cases and projects to showcase the potential of quantum technologies; (v) securing more funding for higher education institutions to provide courses and training on quantum science; (vi) increasing security and tackling potential threats from the use of quantum technologies; and (vii) increasing Denmark's involvement in European and international quantum initiatives.

On the application side, the Niels Bohr Institute in Copenhagen hosts a new NATO Centre for Quantum Technologies. This centre will include an accelerator site, an incubator where companies can mature their

new technological solutions before introducing them to the market, and test centres and laboratories where quantum technology can be developed and tested. This is part of the DIANA initiative, a network of 23 accelerator sites and 182 test centres in 28 countries providing companies with the resources and guidance to develop deep technologies to solve critical transatlantic defence and security challenges. Moreover, the University of Copenhagen partnered with the Novo Nordisk Foundation to work on a quantum programme with the aim of building quantum hardware and algorithms to develop Denmark's first quantum computer by 2034, with the support of EUR 201 million. Finally, in February 2024, the same foundation awarded a grant to establish the Copenhagen Center for Biomedical Quantum sensing, under which an international research community will work together to develop new quantum sensing principles and techniques for early detection of diseases.

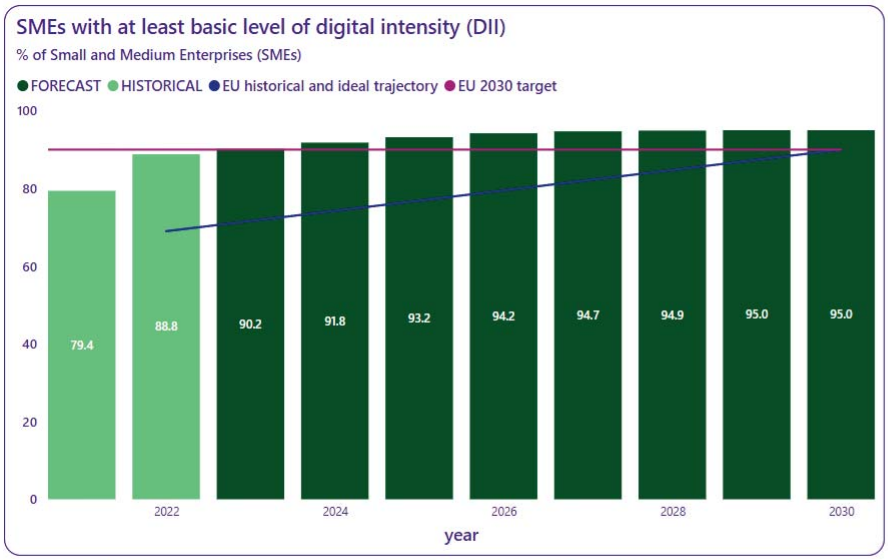
At EU level, Denmark participates in the LUMI-Q consortium, a collaboration between eight Danish universities and the Danish Agency for Research and Education, and in **the pan-European infrastructure EuroQCI,** with the Danish Quantum Communication Infrastructure. The goal of the LUMI-Q consortium is to offer a European quantum computer environment integrated into supercomputers. The new quantum computer will initially be connected to the EuroHPC supercomputer Karolina in Czechia, with plans to connect to other supercomputers, such as Europe's most powerful computer, LUMI, in Finland. The Danish Quantum Communication Infrastructure is a project under the EuroQCI initiative, funded by the Danish government and the Digital Europe programme. It aims to set up a quantum-secure metropolitan network between five Danish public authorities and two associated data centres in the Copenhagen area and construct a 200 km-connection linking three participating university partners via the metropolitan network.

With its expertise, solid research community and future plans, Denmark is making a strong contribution to the EU's goals in advancing quantum technologies.

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

One of the key priorities outlined in Denmark's digitalisation strategy is the need to increase the growth and level of SMEs' digitalisation and tackle the late adoption of key advanced technologies, particularly by smaller enterprises. Although Danish SMEs are generally advanced, they lag behind larger companies on digitalisation and the uptake of key technologies. To address digitalisation, the government has committed to equipping SMEs with the right skills and help them with administrative procedures. To make Danish SMEs more competitive at a global scale, the government also plans to prepare a globalisation strategy, identifying strengths and weaknesses and providing specific recommendations that can address potential dependencies, including those in the digital sector.

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



2023 state of play and recent progress

	Country level	EU level
FORECAST	90.2	71.6
DESI 2024	75.3	57.7
AVERAGE ANNUAL GROWTH %	-2.6	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

With 75.3% of SMEs having at least a basic level of digital intensity, Denmark brings a very strong contribution to the EU's Digital Decade target but shows a very limited dynamic. According to 2023 data, 13.2% of Danish enterprises with 10 or more employees are recognised for their very high level of digital intensity index. Around 35.7% of SMEs in the country reported selling online, more than 16 percentage points higher than the EU average, and the highest in the EU. E-commerce turnover has remained stable, with 18.6% of SMEs engaging in it in 2023, still higher than the EU average of 11.9%. **Although Danish SMEs generally lead in several EU metrics related to the digitalisation of businesses, some are still lagging behind large companies.** Moreover, the 2023 value represents a very limited annual growth 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).

The Danish national programme, SME:Digital, has been the main support to SMEs to leverage digital tools and solutions since 2018, together with the five European Digital Innovation Hubs (EDIHs). SME:Digital supports small SMEs through grants for consultancy on digital solutions and their implementation, investment support, skills and management development, and guidance on digital technologies. Up to 2022, the initiative had supported almost 6 000 digital projects in SMEs and plans to support approximately 1 700 companies with grants from 2023 to 2025. The findings of a recent impact report (November 2023) show that the support has resulted in higher turnover and employment for SMEs. In just 2 years, participants in the programme have had increases in turnover that are 8 percentage points higher than other SMEs. Funding mostly comes from the Recovery and Resilience Plan (RRP), with a total of EUR 13.8 million allocated for 2023-2025, of which EUR 11.3 million is for grants and EUR 2.4 million for managing the programme. In addition, during this period, the EU's Regional Fund and the Danish Business Promotion Board is providing a further EUR 934 million to the programme. Since its launch in May 2023, the Danish Export and Investment Fund (EIFO), with a budget of EUR 42.7 million, is also facilitating access to finance for smaller Danish companies working on digitalisation. On the regulatory side, the Danish Business Authority has been supporting Danish SMEs to run their businesses smoothly. Denmark also set up a one-stop-shop where businesses can ask questions about regulations regarding the use of new technologies and new business models.

The Danish roadmap highlights the country's ambition to exceed the EU target (90%) and reach 95% of SMEs having at least a basic level of digital intensity by 2030. Despite its good baseline value, the country's

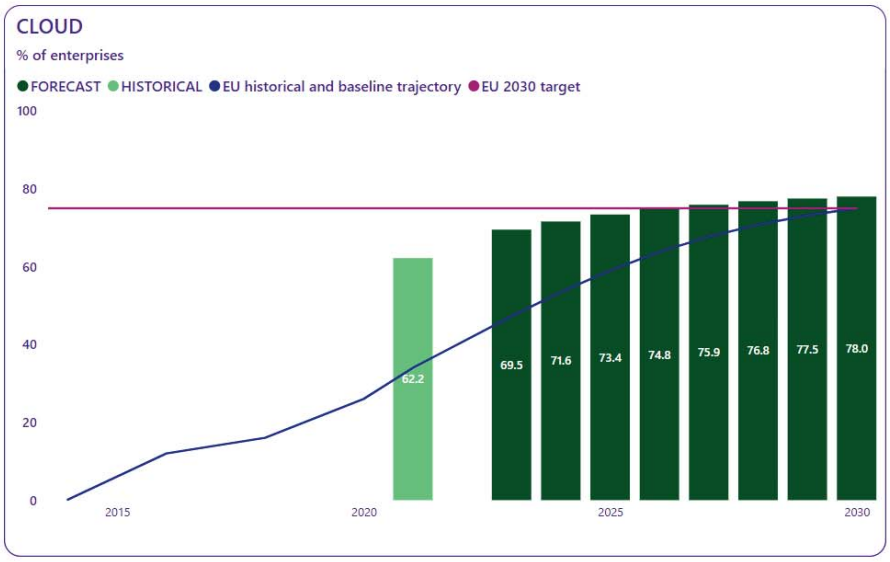
trajectory set out in the roadmap assumes there will be a positive dynamic in the coming years. However, Denmark has shown a very limited annual growth over two years, suggesting further efforts may be needed to ensure the target is reached before 2030. The 2023 State of the Digital Decade report already recommended that Denmark continues implementing its policies in business digitalisation, in particular by boosting incentives.

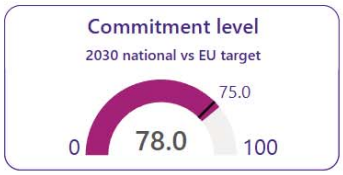
In response to this recommendation, Denmark recently updated its digitalisation strategy. It highlights that the focus of the coming years will be supporting SMEs' uptake of robotics and helping companies manage and report on their administrative obligations with public authorities. In particular, the SME:Robot initiative will allow SMEs to trial robot solutions to boost automation and give them advice on how to implement such solutions in their businesses. With the provisions on digital reporting in the Bookkeeping Act expected to come into force this year, Danish enterprises will be required to take on the first steps in automating their digital accounting by using a certified book-keeping system, thereby creating a good digital business foundation. As part of the Danish digitalisation strategy, around EUR 1 million will also be allocated to help businesses manage their public sector interactions and obligations in the next 2 years.

Overall, Denmark is working to encourage SMEs' digitalisation through financial and knowledge support via SME:Digital and SME:Robot, helping with the implementation of certain digital solutions, mainly robot solutions, and simplifying digital reporting. Integrating initiatives to promote a wide range of digital solutions, other than robots, could be helpful in addressing SMEs' diverse needs and resources.

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

- **Cloud**





2023 state of play and recent progress

	Country level	EU level
FORECAST	69.5	47.3
DESI 2024	66.2	38.9
AVERAGE ANNUAL GROWTH %	3.2	7.0

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

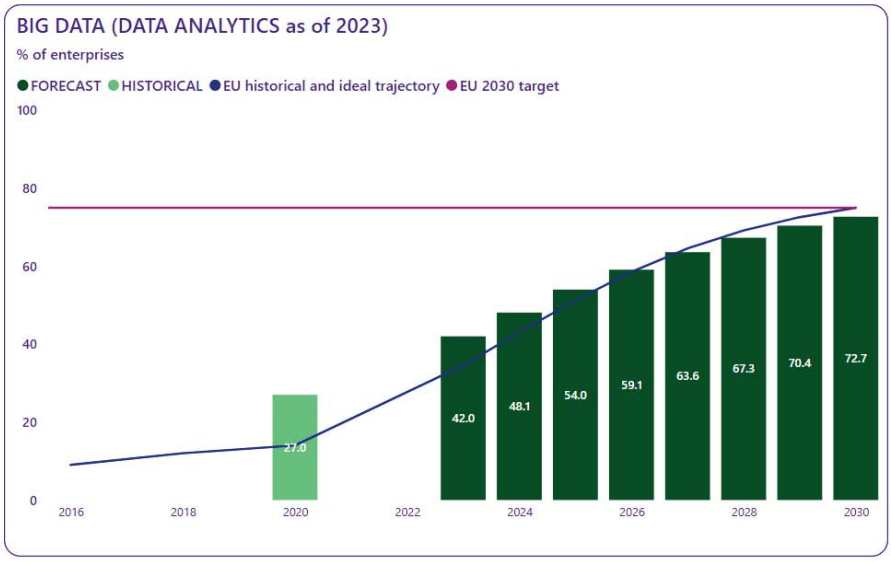
Note: The source of national forecast values is the 2023 country roadmap

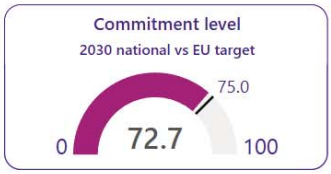
Denmark brings a very strong contribution to the EU's Digital Decade target, while demonstrating a limited dynamic. The take-up of cloud solutions by Danish enterprises with 10 or more employees (at 66.2% in 2023) is well above the EU average (38.9%). For companies with 250 employees or more, take-up is even higher (93.7%). This indicates an overall strong trend in Danish enterprises, particularly the larger ones, using cloud services to improve the efficiency, cost-effectiveness, scalability and security of their operations. However, the average annual growth rate of cloud uptake (+3.2%), shows a limited dynamic in relation to the EU's +7% average growth per year on average, which may be linked to the fact that the country's starting point is already comparatively high.

The level of ambition for cloud adoption in Denmark's roadmap (78%) goes beyond the EU's 75% target. The national trajectory is linked to a good starting point and seems realistic overall, despite it departing from a baseline value (67% in 2022 and 69.5% in 2023) that does not fully correspond to the last observed DESI measurements (62.2% in 2021 and 66.2% in 2023). The country is on track to significantly contribute to the EU's 2030 target; however, more could be done to envisage measures aimed specifically at increasing cloud adoption among smaller companies.

The roadmap's main measures for business take-up of cloud services are related to EU initiatives. In particular, Denmark is part of the DOME project, which aims to create a distributed open marketplace or ecosystem bringing together European stakeholders in edge and cloud services. The EU contribution on behalf of Denmark is of approximately EUR 0.22 million through to 2025. Another measure at EU level is CloudCamp4SMEs, a project co-funded with the EU to provide SMEs with tailored and accessible training in cloud technologies. One of the pilot projects will be carried out in Denmark, as well as in other countries, with an EU contribution of about EUR 13 000 through to 2025. There are no other national measures in the roadmap that contribute to smaller enterprises' adoption of cloud services.

- **Data analytics (Big Data)[24]**





2023 state of play and recent progress

	Country level	EU level
FORECAST	42.0	34.6
DESI 2024	49.5	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

On the use of data analytics by enterprises, Denmark brings a very strong contribution to the EU's Digital Decade target, with 49.5% of them having adopted data analytics.

In its roadmap, Denmark's level of ambition for enterprises adopting big data/data analytics (72.7%) for 2030 is below the EU target of 75%. The growth rate cannot be calculated since it is the first year of measurement for this indicator, but the trajectory seems realistic overall, particularly given the country is already above the EU average of 33.2%.

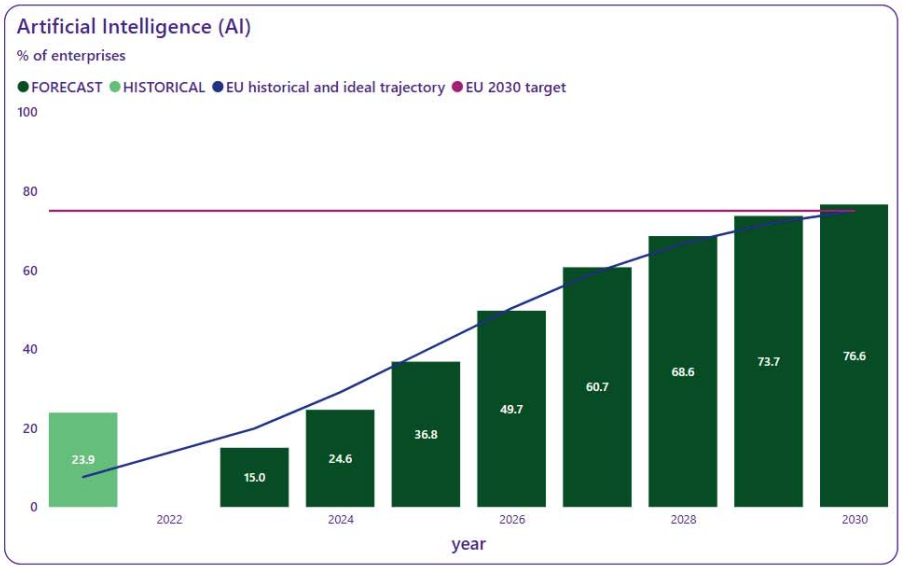
In 2023, Denmark has been developing some measures set out in its roadmap to foster the adoption of big data/data analytics. After the official launch of Datavejviser.dk, the Danish data portal designed to help users locate data across different Danish public sector sources, the country made new improvements in the IT solution and further enhanced dissemination efforts. The portal essentially summarises available public data to help companies identify and reuse it to develop new data-driven solutions. Up until 2025, Denmark plans

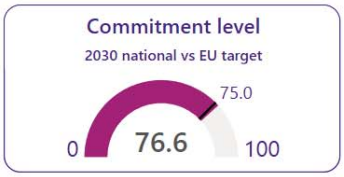
[24] As of 2023, Big Data was changed by ESTAT, in agreement with all the EU National Statistical Institutes, into Data Analytics and covers a broader range of technologies including Big Data. For this reason, no comparison is possible with previous years.

to provide more funding also to the OpenDataDK platform, a collaboration between Danish municipalities, regions and public entities to provide free access to public sector data. Other privately led platforms exist for sharing data in Denmark, including Energinet's DataHub. Since 2013, this platform has gathered data and business processes that can be accessed online by those involved in the electricity market.

At EU level, Denmark reports it will take part in coordinating the pilot project 'SME Financing – Acceleration of innovative SMEs' from 2023 to 2025, which aims to promote SMEs' ability to manage how they handle, store and share their credentials with financial institutions. Lastly, the country will continue to be part of the Nordic Smart Government and Business (NSG&B) until at least 2027. The NSG&B is a collaboration programme between 14 Nordic organisations, which aims to streamline the use and sharing of data between businesses and from businesses to authorities, in a similar fashion to European dataspaces.

- **Artificial Intelligence**





2023 state of play and recent progress

	Country level	EU level
FORECAST	15.0	19.9
DESI 2024	15.2	8.0
AVERAGE ANNUAL GROWTH %	-20.3	2.6

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

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

Denmark is bringing a very strong contribution to the EU's Digital Decade AI target but demonstrates a very limited dynamic in recent years. Although 15.2% of Danish businesses adopted AI solutions in 2023, almost twice the EU average of 8.0%, this is less than the 23.9% reported in 2022. This significant decrease, shared and analysed by the Danish statistical institute, may be due to a clearer understanding among enterprises about what AI entails. In particular, the main explaining factor was the detailed specifications for robotic process automation based on AI.

The Danish digitalisation strategy for 2024-2027 focuses strongly on AI in terms of research, adoption by businesses and protection of people's rights. In addition to what reported in previous sections, Denmark is involved in two major European Testing and Experimentation Facilities (TEFs): the Smart Cities and Communities project (CitCom.ai) and the manufacturing project (AI-MATTERS). In July 2023, EUR 40 million was officially earmarked for the first TEF and EUR 60 million for the second, with good a part of the funding coming from the Digital Europe programme. The goal is to accelerate the development and adoption of AI solutions up until 2027. Moreover, the AI Denmark initiative, already described in the 2023 State of the Digital Decade report, supported 120 SMEs from 2020 to 2023 in using and developing AI to improve their businesses (for instance, by increasing automation). This included AI pilot projects, workshops, sharing best practices and EUR 4.6 million in funding from the Danish Industry Foundation. In 2019, the Danish government set out

a strategy to make the country a frontrunner in the use and development of AI, with a strong commitment to ethical and human-centred practices.

Denmark's roadmap sets an AI adoption target of 76.6% for 2030, slightly above the EU's 2030 target (75%). The last two available measurements of AI uptake suggest that reaching the 2030 EU target on time may prove difficult in absence of more efforts targeted specifically at AI adoption by enterprises. Nonetheless, the potential for AI in the country is substantial.

Looking ahead, Denmark is planning to embark on a government-led strategic initiative to support AI development in the country, as reported in its new digitalisation strategy. Although this initiative is not focused on SMEs' adoption of AI, it aims to gather input and experiences from the business and research communities and the public sector to develop AI language models and other AI-enabled resources. A total of about EUR 8 million was allocated to the initiative for the next 3 years. It remains to be seen and monitored how this will concretely impact SMES' adoption of AI. Overall, Denmark's future plans focus mostly on developing the AI ecosystem from an R&D perspective and less on fostering the adoption of AI by enterprises, in line with the Digital Decade target.

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

Combining the adoption of these three technologies (cloud or data analytics or AI), Denmark's take-up rate is 77.4%, above the EU average of 54.6%. With more investment expected through the updated digitalisation strategy up until 2027, the country is expected to focus more on the growth and digitalisation of SMEs, with particular attention to creating a strong foundation to use AI. At the legislative level, the regulation promoting the use of new technologies in businesses, first launched in 2018, is expected to continue guiding companies in navigating the existing rules and standards until at least 2025 and remove additional legislative barriers.

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

Denmark has a dynamic start-up ecosystem, with venture capital investments for seed and start-up companies amounting to 0.06% of GDP in 2022. ICT investment intensity is at 36%, which is above the average of OECD countries (34.1%). With eight unicorns reported in 2023, Denmark's performance in fostering a vibrant start-up ecosystem that is relatively strong compared to many other EU countries. However, start-ups and scale-ups still face **challenges in accessing venture capital and competing for talent**, and there are still a **limited number of examples of Danish success stories.**

In 2023, the country analysed the Danish entrepreneurship ecosystem, **outlining the key framework conditions needed for Danish businesses to develop and grow**, setting the scene for a future strategy. The structural points mentioned include the need for effective regulation, good access to capital, a skilled workforce, high-value creation and exports. From an investment perspective, the analysis highlights that the Danish entrepreneurial environment is generally attractive to private, national and foreign investment. Positive developments in private investment include venture investment in Danish companies and Danish venture capital funds, which have increased in recent years. On top of the private capital market available, direct investments from the Danish Export and Investment Fund (EIFO) have also been crucial for Danish start-ups. In 2023, more financing from the EIFO was secured to support the growth of companies with unicorn potential and help retain high-growth companies. These appear to be the two biggest challenges for start-ups in Denmark. According to data from the OECD, there are relatively few active companies in the country on significant growth paths. Moreover, Danish start-ups show an overall high establishment rate, which appears to be at odds with a lower survival rate**. Improving access to capital and increasing available funds,** as EIFO has done, could help address these two major structural issues in the years to come. Additionally, in May 2023, EIFO signed an agreement with the European Investment Fund (EIF) that will see about an additional EUR 42 million provided by EIFO to support Danish companies, backed by a loss guarantee from the EIF.

Looking forward, Denmark also intends to **increase support to Danish digital companies to expand their services and commercial collaboration abroad**, in at least three different markets, with a budget of EUR 5.8 million through to 2027. It does not, however, commit to any national target or present a national trajectory in its roadmap.

2.3 Strengthening cybersecurity & resilience

In Denmark, as in other EU countries, **cybersecurity is crucial not only to protect sensitive data and critical infrastructure with the aim of promoting leadership and sovereignty,** but also **to ensure the trust and confidence of businesses, people and public bodies in digital matters.**

Overall, Denmark shows a good awareness and use of ICT security measures, but the risk of exposure to cybersecurity incidents remains high. As of 2022, 98.2% reported taking ICT security measure (against the EU average of 91.8%). Nonetheless, in 2021, more than one in four (26.4%) Danish enterprises registered ICT security incidents that led to the unavailability of ICT services, destruction or corruption of data or disclosure of confidential data – this is one of the highest percentages in the EU. In 2022, 57% of Danes were exposed to fraud attempts through calls, email or text messages, according to the 2022 Danish Information Security report. This suggests that more still might need to be done.

In 2023, Denmark received a positive preliminary assessment of its second RRF payment, covering major steps and flagships measures including the **new National Strategy for Cyber and Information Security for 2022-2024**. Considering the growing threat of cyberattacks, Denmark has increased investments in this area. A total of EUR 36.4 million has been allocated to introduce 34 new initiatives and technical safety requirements to boost Denmark's technological resilience, secure the protection of critical government ICT systems and improve the knowledge and skills of people, businesses and authorities. A major development in 2023 was the launch of a new National Coordination Centre for Cyber Security (NCC), which will help ensure a more cohesive, national approach to cybersecurity. Working alongside the Danish Agency for Digitalisation and the Danish Business Authority, the NCC's main goals are to set up a network of those involved in cyber-security and to allocate EUR 2.3 million in grants for innovative cybersecurity projects in 2024 and 2025. The first round of grants opened in February 2024 to support companies in specific industries to strengthen their cybersecurity. The NCC is part of a wider network (Network of National Coordination Centres) of 27 centres, one from each Member State, working together to improve cybersecurity cooperation and competitiveness at EU level under the European Cybersecurity Competence Centre.

On improving general awareness on cybersecurity, the Danish Agency for Digitisation and the Centre for Cyber Security has continued to contribute content to sikkerdigital.dk, a website with useful information for public authorities, businesses and the public. In January 2024, a new leaflet was published on the website with advice on defending against and responding to fake calls, emails, text messages and online shops. In addition, as a result of the public-private collaboration Cybersecurity Pact, an alert service was launched on the sikkerdigital.dk website in 2024. Danish SMEs can sign up for free to receive information about the latest and biggest cybersecurity threats, giving companies a better opportunity to tackle threats and potential vulnerabilities in their digital solutions. On skills, Denmark participates in the Collaborative, Multi-modal and Agile Professional Cybersecurity Training Program for a Skilled Workforce (CyberSecPro), where EU Member States are working together to create education and training material as a basis for future courses on EU cybersecurity.

3 Protecting and empowering EU people and society

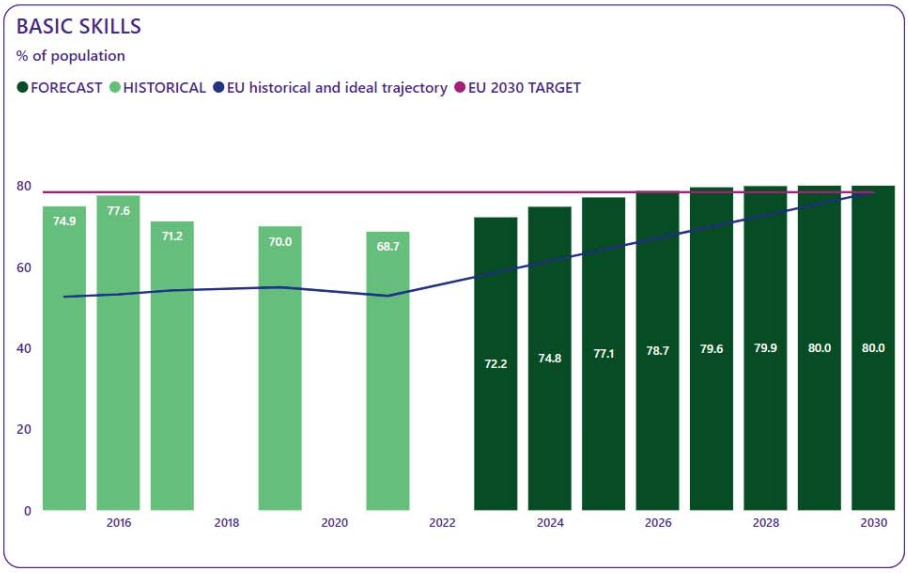
3.1 Empowering people and bringing the digital transformation closer to their needs

Denmark's digitalisation strategy puts a strong emphasis on people, particularly on issues like digital inclusion, empowerment and transparency. Overall, the country's economy and society have a high level of digitalisation, with 97.5% of the population reported having used the internet in 2023. This is generally in line with what reported in the Digital Decade Eurobarometer survey in 2024, which revealed that 83% of the Danish population considers that the digitalisation of daily public and private services has made their lives easier, one of the highest scores in the EU and well above the EU average (73%). Furthermore, 72% of Danes think that, by 2030, digital technologies will play a crucial role in accessing public services.

Given this high level of digitalisation, Denmark is committed to ensuring no one is left behind, in line with the EU's Declaration of Digital Rights and Principles. In terms of digital skills, the country is involved in initiatives to equip the population, particularly children, with the skills needed to navigate the online world and to provide ICT training that better meets employers' needs. On digital public services, Denmark is prioritising more transparency and freedom of choice. To this end, a digital infrastructure for managing digital consent has been implemented across the public sector to give people the possibility to manage how authorities access and use their personal data. This has positively influenced people's perception of public digital solutions, with 78% of Danes reported trusting them and 83% having had a good experience in 2023.

3.1.1 Equipping people with digital skills

3.1.1.a Basic digital skills



2023 state of play and recent progress

	Country level	EU level
FORECAST	72.2	59.8
DESI 2024	69.6	55.6
AVERAGE ANNUAL GROWTH %	0.7	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

Denmark brings a very strong contribution to the EU's Digital Decade target on basic digital skills but shows a limited dynamic. In 2023, 69.6% of the population had at least a basic level of digital skills, well above the EU average of 55.6%. This reaches 76.6% for people living in cities and 64.1% for people living in rural areas. In terms of gender, 71.2% of men have at least a basic level of digital skills, compared to 68.1% of women. These results show there is an urban-rural divide and still some work to do to close the gender gap.

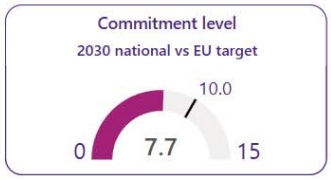
In 2023, existing initiatives were strengthened to equip the Danish population, especially children and young people, with the necessary skills to navigate the digital world. One of the most visible initiatives is

the funding pool, which was set up by the Ministry of Children and Education in 2022. Educational institutions and similar bodies can apply for funding to support digital skills and competencies programmes. National funding amounted to EUR 1.9 million in 2022 and EUR 1.4 million in 2023, with a plan to grant EUR 1.6 million in 2024 and EUR 1.7 million in 2025, totalling EUR 6.5 million. This measure aims to not only boost digital skills but also equip children and young Danish people with the tools needed to be digitally independent and navigate the online world safely. Similarly, Denmark continues to be involved in the Safer Internet Centre, a collaboration between the Media Council for Children and Young People, Save the Children and the Centre for Digital Pedagogy. The centre promotes the safe and responsible use of digital technologies and social media among younger people and those looking after them (e.g., parents and authorities). A particular focus goes on strengthening digital media skills, promoting creative and educational online content and setting limits on the use of digital screens at a very young age. The centre is part of a European network under the Digital Europe programme, which works to implement the EU Better Internet for Kids initiative. This effort is essential for Denmark to improve digital skills and empower people, particularly in light of recent reports that show the harm of excessive screen use on the younger generation. In February 2024, the Danish Agency for Education and Quality made recommendations on the use of screens and digital devices in primary and lower-secondary schools, giving school managers more responsibility in setting policies for screen use at school and balancing digital teaching methods with analogue ones.

With 69.6% of the population possessing at least a basic level of digital skills (above the EU average of 55.6%), Denmark is well-positioned to reach its national target of 80% by 2030, fully in line with the EU target. However, it is essential that basic digital skills are integrated into primary and secondary education nationwide, to ensure equal opportunities regardless of socio-economic status and gender.

In its roadmap, Denmark specifically highlights a willingness to implement more initiatives targeted at students in primary and lower-secondary schools, with a focus on understanding technology. In February 2024, EUR 21.4 million was allocated for this purpose, but the implementation details are yet to be decided. Denmark also plans to focus more on improving teachers and educators' expertise in basic digital skills, with a budget of EUR 1.3 million until 2025. Improving the skills of people with a low level of basic digital skills will also be a Danish priority, although the roadmap lacks precise measures for this goal.

3.1.1.b ICT specialists



2023 state of play and recent progress

	Country level	EU level
FORECAST	6.2	5.4
DESI 2024	5.9	4.8
AVERAGE ANNUAL GROWTH %	3.5	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

Denmark brings a very positive contribution to the EU's Digital Decade target for ICT specialists and shows a positive dynamic. In Denmark, ICT specialists as a percentage of the population in employment is 5.9%, above the EU average of 4.8%, and up 3.5% from 2022. In absolute numbers, Denmark hosts 176 800 ICT specialists, which is 5 900 more than 2022. Women made up only 22.6% of ICT specialists in 2023, nonetheless showing some progress since 2022 (22.0%) and above the EU average (19.4%).

Overall, Denmark has improved ICT training in the country. Eurostat reports that every third enterprise in Denmark provides ICT training for its employees, against an EU average of about 22.4%. With a stronger emphasis on data science specialists, the Danish Data Science Academy continues to be active in training and attracting talent (the Academy has been funded since 2022 by the Novo Nordisk Foundation and the VILLUM FONDEN with a budget of EUR 24.7 million up until 2026). The Academy offers mentoring programmes for data scientists, scholarships for PhD and postdoctoral fellowships and travel grants to foster networking and knowledge sharing. After supporting the first 10 PhD fellows in their research projects in 2022, the Data Science Academy granted an additional EUR 3.4 million to support 16 new PhD and postdoctoral fellowships. The goal is to fund courses and activities that develop improved teaching within the realm of data science.

At EU level, Denmark is also involved in several initiatives at EU level, including: (i) the project DigiQ (Digitally Enhanced Quantum Technology Master), offering short courses on quantum technology; (ii) the Cybersecurity Training Programme for a Skilled workforce, aiming to fill the gap between education, work and marketable cybersecurity skills; (iii) the Leading European Advanced Digital Skills (LeADS) programme and the Quantum Technologies courses for Industry (QTIndu), with training programmes designed by both academic and industry stakeholders. All these initiatives run from 2022 to 2026 and are supported by EU funding.

Danish higher education institutions are working to encourage women to follow science, engineering, technology and mathematics (STEM) studies. For instance, the IT University of Copenhagen is making targeted efforts, which have resulted in women making up about 40% (36% at the Bachelor's level and 42% for both Bachelor's and Master's levels combined) of the intake in ICT courses in 2023.

Denmark's national target is to have ICT specialists make up 7.7% of the working population by 2030, which is below the EU target of 10%. Denmark reports that reaching the national target would require an increase of 50 000 ICT specialists, which seems realistic given the positive average annual growth rate. Nonetheless, as acknowledged in the national roadmap, it remains to be seen how the new initiatives and measures presented in the digitalisation strategy will be implemented to support this goal.

Looking ahead, Denmark plans several measures to further support reaching the target for ICT specialists. Similar to efforts to increase the level of basic digital skills, the digitalisation strategy focuses on the need to upskill, reskill and retain ICT specialists in the country and provide them with more training on topics such as cybersecurity, AI and IT for healthcare. The strategy also plans to strengthen vocational education and training initiatives in IT education, with the additional goal of retaining international students in the Danish job market. This could contribute to increasing the rates of ICT enrolment and graduates in the country: **although ICT-focused degree programmes appear to have enough capacity, places often go unfilled.** Looking forward, the goal is also to further develop the IT and digital skills of higher education educators.

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

Denmark shows a high degree of digitalisation in its public services. People and businesses in Denmark are generally encouraged to interact with public authorities through digital tools and are expected to continue to do so in the future. This is line with the Digital Decade Eurobarometer survey results, which shows that 72% of Danish respondents think that the principle of getting access to all key public services online in the EU is applied well in their country. **Given the overall high level of digitalisation, the country pays close attention to the accessibility and inclusion of its online services.**

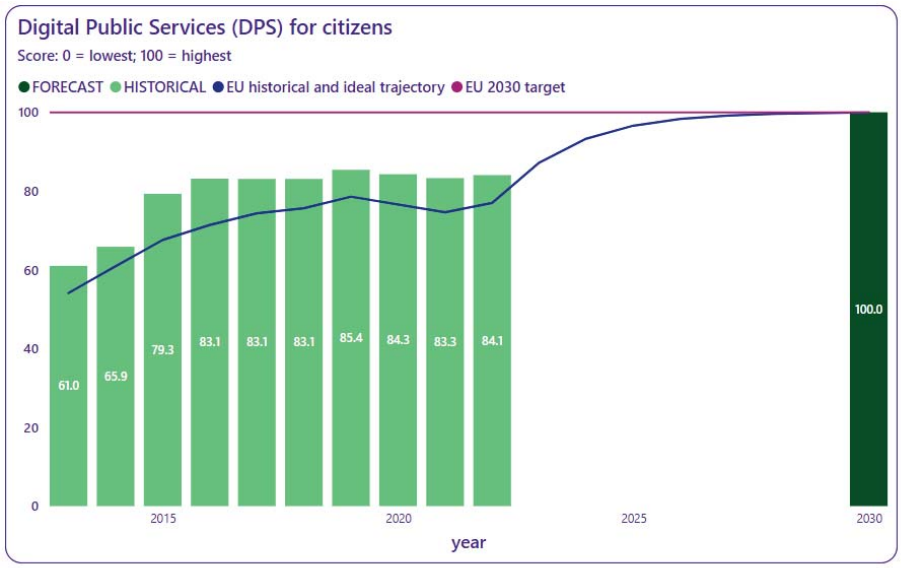
3.1.2.a e-ID

Digital identity is very important for Denmark and plays a key role in facilitating secure and efficient online interactions between people, businesses and the government.

According to the latest available data**, 98% of Danish people who can obtain the Danish e-ID** (meaning they must be 15 years old or older) **have used it to access online services for private purposes in the last 12 months.** Similarly, 83.9% of Danes have used their e-ID to access online services provided by public authorities or public services in the same time frame, which is much higher than the EU average (36.1%). This corresponds to more or less what Denmark reports in its roadmap, with about 5.2 million people currently using MitID. Replacing the old NemiID, MitID is the country's single secure e-ID solution notified under the e-IDAS regulation with a substantial and high level of assurance. Of these 5.2 million users, about 4.9 million live in Denmark. Overall, this shows that the vast majority of Danish people are using digital identity services. The country is also working on improving cooperation with Nordic and Baltic countries participating in the Nordic-Baltic e-ID project (NOBID), which also involves Italy and Germany. NOBID monitors and facilitates the regional implementation of the e-IDAS interoperability network, enabling people to access e-ID recognised across the EU, in line with the Digital Decade's Rights and Principles. In the pilot projects carried out between 2023 and 2024 on the e-IDAS 2.0 Digital Identity Wallet, Denmark and other countries participated in the NOBID consortium, focusing on authorising payments for products and services.

In 2023, Denmark worked on improving MitID security and the mobile app. In October 2023, an update was released that allows users who suspect their digital identity is being misused to block their e-ID using the mobile app. Previous updates in 2023 allowed users with a foreign passport or ID to create their MitID directly in the app. **Overall, Denmark is advancing well with its e-ID implementation and is actively involved in EU digital identity projects.** The country has allocated a total budget of EUR 99.6 million up to 2030 for MitID, including associated developments.

3.1.2.b Digitalisation of public services for citizens and businesses



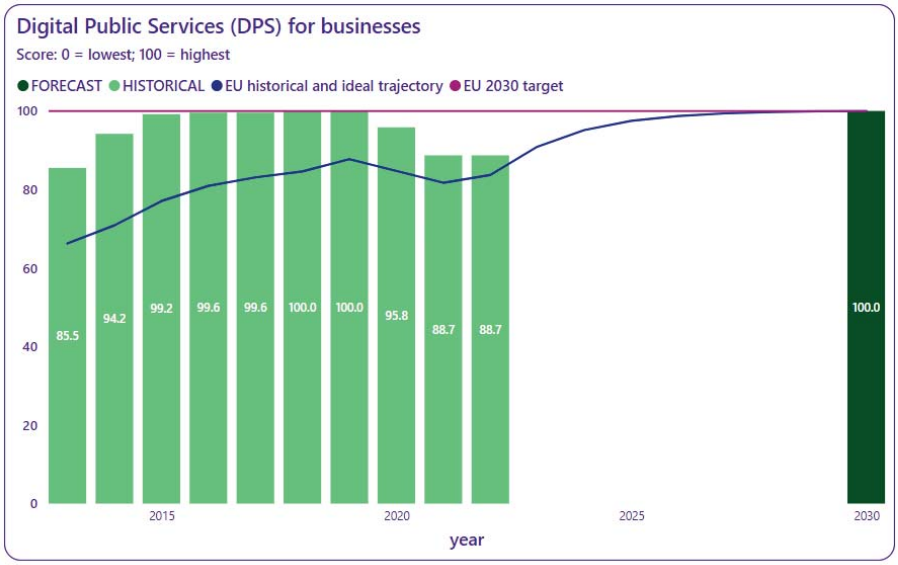
2023 state of play and recent progress

	Country level	EU level
FORECAST		87.2
DESI 2024	84.2	79.4
AVERAGE ANNUAL GROWTH %	0.2	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



2023 state of play and recent progress

	Country level	EU level
FORECAST		90.9
DESI 2024	88.7	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

Denmark is bringing a positive contribution to the EU's Digital Decade targets, with a score of 84.2 out of 100 for digital public services for citizens, and 88.7 for digital public services for businesses. Despite these scores being above the EU averages (79.4 and 85.4 respectively), the recent annual growth shows signs of stagnation. The digitalisation of public services for citizens shows a limited dynamic, with an annual growth rate of 0.2%, and the score for the digitalisation of public services for businesses was the same as in 2022.

Denmark provides several solutions for citizens and businesses to access digital public services, public-available data and information. The Digital Post is one of the main channels for communication with public authorities. It can be accessed via the main national citizen portal, Borger.dk, where Danish people can find information about the public sector and access different digital services. The portal was launched in 2007, but in 2023 the government worked to improve one of the pages, My Overview (*Mit Overblik*). This page gives people a comprehensive and personalised overview of the most important information about themselves and relevant services, including taxes, pensions, health, student grants and housing. In 2023, Denmark gathered new data and studied ways to update the page's features. In 2024 and 2025, Denmark will work to connect new data to the page's services. This project has a budget of EUR 7 million.

Although not a service provider, Datavejviser.dk guides Danish people and businesses who want to access public data online. It directs them to free accessible gateways, such as Datafordeler.dk, which stores Danish authorities' basic public data. The Datafordeler.dk portal is reported to be accessed approximately 1.5 billion times every month and provides information across systems and sectors about individuals, properties, addresses, companies and geography. Looking ahead, Denmark has allocated EUR 1.6 million to maintain and improve the data on Datafordeler.dk portal up until 2027. Alongside developing the IT solution, the country also wants to boost dissemination efforts to promote the portal's use, particularly by companies. Denmark is planning to develop MyTender to make it easier for companies to bid for public contracts online, ultimately reducing companies' transaction costs and barriers to bidding.

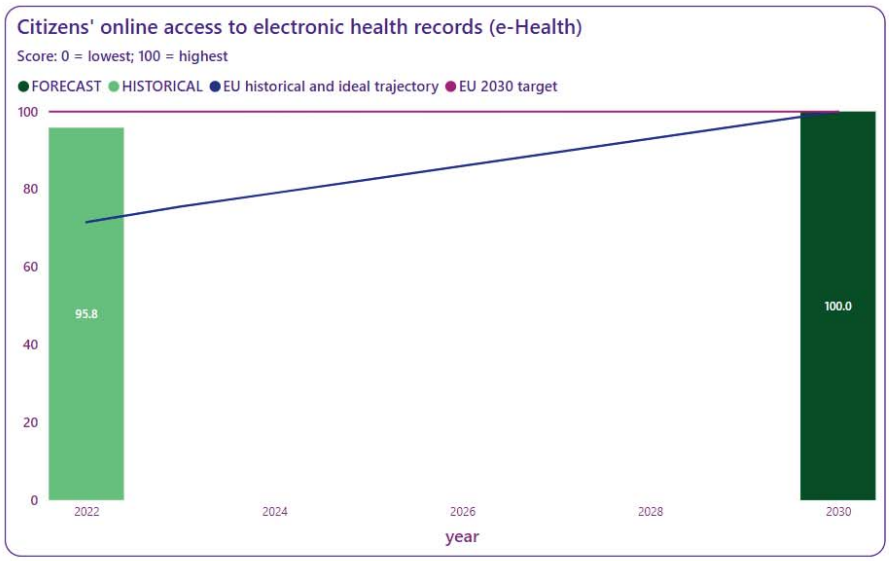
At EU level, Denmark participates in several projects and initiatives to improve the interoperability and accessibility of digital services for both citizens and businesses. One of these is the Cross Border Digital Services Programme, which focuses on making digital services more accessible in the Nordic Baltic region.

Denmark does not explicitly present any trajectory for digitalising public services in its roadmap despite aligning with the EU target of having 100% of key public services online by 2030. Based on the country's current performance, **Denmark is expected to contribute to the EU's Digital Decade target.**

The Danish roadmap sets out a significant number of measures to digitalise key public services, including some on improving transparency and inclusiveness. One of the new initiatives centres on setting up a digital infrastructure to manage digital consent across the public sector, giving people control over how authorities use their personal data. In August 2023, the implementation phase of the initiative was launched, and the aim is to introduce a digital consent solution by the end of 2024, with a planned budget of EUR 12 million. Furthermore, the Danish Parliament passed a new law in May 2023, simplifying the rules for digital exemption and giving people an alternative to digital services provided by the Digital Post. Before the law was passed, citizens were obliged to use digital solutions to, for instance, notify the government about moving houses or to apply for housing benefits. Those having difficulties using digital services will now have the possibility to use alternatives. In the future, Denmark plans to put in place more initiatives that bring people at the centre of digitalisation and leave no one behind.

Overall, Denmark is committed to digitalising its public services. The 2023 State of the Digital Decade report recommended that the country continue implementing its policies to reach its targets, in particular by supporting the sharing of public data. **The current measures seem to go in the right direction, but ongoing monitoring of their implementation is essential.**

3.1.2.c e-Health



2023 state of play and recent progress

	Country level	EU level
FORECAST		75.5
DESI 2024	97.9	79.1
AVERAGE ANNUAL GROWTH %	2.2	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 97.9, compared to an EU average of 79, Denmark brings a very strong contribution to the EU's Digital Decade target concerning the access to e-health records. A centralised service with nationwide access is available in Denmark, with 80-100% of the population being technically able to access online access services for e-health records through native mobile application(s) and online portal(s), logging in using an e-ID compliant with the e-IDAS Regulation. Similarly, regarding access opportunities, Denmark scores 100 out of 100 compared to a European average of 77 out of 100 and correctly follows the guidelines on web accessibility. This is particularly important considering the high number of Danish people reported seeking health information online, approximately 73.8% of them in 2023, which is much above the EU average of 56%. The only data category missing is that of medical images, otherwise health data are supplied across the categories of healthcare providers. Overall, Denmark scores 92 for

categories of health data available, compared to an EU average of 74, with 11 out of 11 applicable healthcare provider categories currently applying relevant data.

Digitalising the health system is important for Denmark, not only to make data for patients and doctors more accessible but also to deliver more patient-centred care, which can ease pressure on hospitals. In its roadmap, the country aligns with the EU target and lists two main measures: one to help improve access to health data for both people and health professionals (with the main Danish digital gateway to healthcare, sundhed.dk portal as one means to achieve citizen access), and another to strengthen developing a digital solution that gives a comprehensive overview of patient data. On the first measure, latest developments show that sundhed.dk was visited 43 million times in 2023, with about 3.6 million visitors each month and 120 000 visits a day. The most visited pages include the Medical and Patient Handbook and pages where users can view their own health data. According to a 2023 study, users are generally very satisfied with the services provided by sundhed.dk, and people have generally reported positive experiences and attitudes to digitalising healthcare data and services. Looking ahead, Denmark plans to develop health records further, to include more data from municipalities and general practices. These plans are supported by the Joint Public Sector Digitalisation Strategy, with a budget of EUR 3.4 million between 2022 and 2025.

Denmark's roadmap highlights the intention to further develop a solution to give a comprehensive overview of patient data by creating greater cohesion and collaboration across regional and local healthcare systems. The government, the Local Government Denmark and the Danish regions have agreed to share more patient information so that people with certain illnesses can be digitally monitored, contacted online and have access to video consultations, which could halve the number of physical visits they have to make to hospital centres. This focus is particularly important given the country's recent shortages in healthcare professionals.

At EU level, the country continues to participate in the Genomic Data Infrastructure project, funded by the Digital Europe programme, the 1+ Million Genomes Initiative, the joint action 'Towards the European Health Data Space' and the pilot project for the European Health Data Space, as well as the eHDSI@Denmark project providing access to e-prescription and patient summary cross-border.

In the future, Denmark intends to modernise the digital communication features of its online healthcare tools, providing, for instance, better support during pregnancy. The country also wants to continue the development of the national online healthcare infrastructure and set up a board to recommend health apps, providing the public and healthcare professionals with better guidance on which tools better fit their needs.

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

Denmark is very committed to the objective of building a safe and human-centric digital environment, particularly protecting children online and promoting responsible AI systems. According to the Digital Decade Eurobarometer survey 2024, 88% of Danish respondents think shaping the development of AI and other digital technologies to ensure they respect our rights and values is an important consideration for public authorities. 69% of Danes believe digital rights and principles are upheld in their country to ensure access to safe and privacy-friendly digital technologies. However, only 29% think digital rights and principles are upheld to ensure safe digital environments and content for children and young people, which is one of the lowest percentages in the EU.

In June 2023, the Danish government gathered recommendations **from the government's expert group on big tech to ensure democratic accountability of big tech business models.** One of the 13 recommendations is to make big tech more responsible on preventing children and young people from accessing age-inappropriate content. In response, Denmark pushes for a European standard for age verification to ensure that there is an effective solution for age verification issues involving minors. The government also plans to

launch an awareness campaign to educate children and parents about using online services safely and responsibly. In February 2024, the expert group on big tech published their second report on big tech's development and use of AI. The Danish government is now trying to pursue these recommendations in the EU, including a call for more measures against harmful and misleading information, the need to protect children and younger people from chatbots, the importance of having more control over copyright laws and drawing up guidelines for the use and procurement of generative AI in the public sector. The generative AI guidelines were published by the Danish Agency for Digital Government and adopted in January 2024. They contain guidance on what to consider when deciding what types of generative AI tools are suitable for an organisation, how to develop guidelines for an organisation's use of AI, and how to support a responsible use through an organisational framework. The guidelines also give insights into the risks associated with bias and information security. Denmark plans to continuously update these guidelines in line with generative AI developments. The Danish data protection authority (Datatilsynet) and the Danish Agency for Digital Government recently announced a regulatory sandbox to give practical guidance on AI rules and regulation at EU level for companies and public authorities, strengthening the objective of ensuring the ethical and responsible uses of AI. All this with an approximate budget of EUR 2 million up until 2027.

Best practice: Commission for the well-being of children and young people

In August 2023, the Danish government set up a Commission for the well-being of children and young people aged 0-25 years. The Commission's task will be to examine four key themes. One theme focuses on how digital life and social media use affect young people's well-being. The theme looks at how to better safeguard children's online experiences to ensure they are protected, can participate and are empowered. The Commission will provide ongoing reports until the end of 2024, after which it will present its final recommendations.

4 Leveraging digital transformation for a smart greening

Accelerating the green transition with the support of emerging digital technologies, solutions and data is one of the key visions outlined in Denmark's digitalisation strategy. The recognition of the link between the digital and the green transitions is also reflected in the Digital Decade Eurobarometer survey results: 83% of Danish people believe that, by 2030, digital technologies will be crucial in helping fight climate change. This is one of the highest scores in the EU, and significantly above the EU average (74%). Overall, Denmark's intention is to find a balance between using data and new technologies to stimulate innovation, growth, competitiveness, efficiency and promoting sustainability and environmental consciousness, in line with the EU's Declaration on Digital Rights and Principles.

Danish people and enterprises are both generally aware of the digital sector's green transition. 46.8% of Danish enterprises considered the environmental impact of ICT services or ICT equipment before selecting them. 67.5% applied some measures to reduce the paper or energy consumption of ICT equipment, which is close to the EU average. Moreover, more Danish people tend to recycle their ICT devices: among those who used the internet in the last three months, 14.1% of them recycled mobiles or smartphones, 17.5% recycled laptops and tablets and 20.3% recycled their desktops, against an EU average of 11.5%, 10.8% and 14.2% respectively.

Denmark has been particularly active in improving monitoring techniques through the better use and sharing of data, for instance data on waste and materials as well as on climate-related issues like water consumption. By increasing the standardisation, digitalisation and automation of data, the ultimate goal is to support businesses, public authorities and the public in better assessing their climate and environmental footprints, so they can make smarter and more informed choices. In 2023, Denmark also set up a national subgroup, consisting of the Agency for Data Supply and Infrastructure and certain telecoms businesses, focused on gathering data on energy consumption and greenhouse gas emissions from the telecom sector. The data are expected to be collected and published in 2025 or 2026. The Center Denmark, co-funded by the EU, has also been running a digital platform gathering data on energy consumption to show consumer behaviour in the water, heat and electricity sectors. Finally, the Danish Business Authority and the Danish Energy are supporting the development of a digital Climate Compass, which can be used by Danish businesses to automatically calculate their climate footprint and adjust their targets accordingly.

Looking ahead, Denmark will continue focusing on using digital tools to report, develop and compute data to support the green transition. A digital guidance platform will be created to help companies determine and document environmental, social and governance data and work more generally on a sustainable transition, including due diligence and responsible business conduct. With a greater focus on documenting sustainability and compiling standardised data on environmental, social and corporate governance issues, companies can showcase their work and performance on sustainability, with the potential to contribute to the digital and sustainable transformation of SMEs. The measure is financed with EUR 4.1 million from the EU's Recovery and Resilience Facility. The first version of the digital guidance platform was launched in April 2023 but will be continuously expanded and updated.

Annex I – National roadmap analysis

Denmark's national Digital Decade strategic roadmap

Denmark submitted its national strategic roadmap in October 2023 (link to the official roadmap in Danish). It is partly complete and contains **10 national targets** with corresponding trajectories until 2030 (out of the 15 expected). There is no clear trajectory for VHCN coverage and the target is only set for 2025. The absence of a 5G target and trajectory is presumably due to the fact that Denmark already reached full coverage. No targets or trajectories are presented for **FTTP coverage, edge nodes and unicorns**. Eight of the set national targets match the 2030 EU targets, with the notable commitment to have 95% of SMEs achieve at least a basic with at least a basic level of digital intensity, above the 90% Digital Decade target. Denmark also aims for 78% cloud uptake and 77% AI uptake, slightly above the EU's 75% for both. However, the national target for ICT specialists is below the EU's 2030 target. Finally, the trajectories provided in the roadmap do not always use the baseline published in the 2023 State of the Digital Decade report.

The table below is a best-effort attempt at categorising the measures and budget presented in the Danish roadmap.

Digital Decade Target/objective	Budget (EUR Million)	Number of measures
Connectivity Gigabit	4.3	2
Connectivity 5G	-	-
Semiconductors	6.1	2
Edge nodes	-	-
Quantum computing	58.4	9
SME take up	14.3	7
Cloud/AI/Big Data uptake	31.8	7
Cloud only uptake	-	-
AI only uptake	-	-
Big data uptake	-	-
Unicorns	-	-
Basic Digital Skills	1.0	2
ICT Specialists	5.5	2
e-ID	13.2	4
Key Public Services	8.9	11
e-Health	1.9	6
Objectives	0.1	3
Total	**145.4**	**55**

Denmark's roadmap describes a non-exhaustive selection of the main policies and measures contributing to most of the Digital Decade targets. Although the roadmap refers to all objectives, the measures only cover competitiveness and resilience and digital policies for the green transition. In total, the measures presented amount to EUR 145.4 million. Overall, **the vision set out in the roadmap is comprehensive,** with a substantial share of the budget (40%) presented planned to support the development of quantum technology. Moreover, almost 22% of the budget will be allocated to the uptake of cloud, AI and data

analytics by SMEs and other businesses. In terms of measures per target, Denmark has a relatively high number of measures (11 out of the 55) for digitalising key public services.

The roadmap is **coherent** overall; however, some aspects might require more detailed action. For example, it could sharpen the focus on raising digital skills (where the country mentions that additional measures will be needed but have not yet agreed at political level), increasing the number of edge nodes and the uptake of digital technologies by smaller enterprises.

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

MCPs and EDICs

Denmark 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 is also developing the Statute and other relevant documents of the possible future **Genome EDIC** and engaging in discussions on the setup of the possible future **Digital Commons EDIC,** both within informal Working Groups. Denmark is finalising membership negotiations with the **Local Digital Twins towards the CitiVERSE – EDIC** (already set up), which will contribute, among other things, to the European common data infrastructure and services. Finally, the country has set up **five European Digital Innovation Hubs (EDIHs)** to build up the digital capacity of companies and public sector organisations[25].

Denmark is also an active in a number of multi-country projects and initiatives. These include the Joint Education for Advanced Chip Design in Europe (Edu4Chip), the LUMI-Q consortium, the National Competence Centres in the framework of EuroHPC Phase 2, the European networks of testing and experimentation facilities for AI.

EU funding for digital policies in Denmark

Denmark's Recovery and Resilience plan (RRP) allocates approximately EUR 382 million (27% of the total) to the digital transformation[26]. According to a Joint Research Centre's study[27], EUR 284.5 million of the Danish Recovery and Resilience Plan directly contribute to achieving Digital Decade targets. Out of the Cohesion Policy funds received by Denmark, EUR 37.2 million contribute directly to Digital Decade targets according to the same mapping study. Key digital measures include supporting the development of the new digitalisation strategy (EUR 67 million), such as further digitalising the public administration and preparing the country for future challenges in areas like cybersecurity and AI; improving incentives to boost R&D in companies (EUR 59 million); extending rural broadband coverage through the National Broadband Fund (about EUR 13 million); and fostering the digitalisation of SMEs (about EUR 9 million).

[25] Information updated on 31 May 2024.

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

[27] 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

Estonia

1 Executive summary

Estonia 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, Estonia made notable progress in digitalisation of public services, and in digital skills including ICT specialists as well as cybersecurity initiatives. However, important **challenges** persist in reaching full gigabit coverage and the digitalisation of SMEs.

Digitalisation is a priority in Estonia, as demonstrated by its national Digital Agenda for 2030, adopted in 2021. The Digital Strategy focuses on three areas: the digital state, cyber security, and connectivity. Estonia's digitalisation policies are very comprehensive, however, there are no strategies on semiconductors, edge nodes and quantum policies. Furthermore, Estonia could improve its connectivity infrastructure, in particularly its coverage and speed. The digitalisation of key public services is a top priority in Estonia.

Estonia is putting people at the centre of digitalisation, focusing on inclusion and participation: it has implemented accessible key public services for people and enterprises, enabling activities such as engaging in the democratic process. Estonia's focus on cybersecurity also shows its commitment to ensuring a safe and secure digital environment.

According to the **Special Eurobarometer 'Digital Decade 2024'**[28] (Digital Decade Eurobarometer), 81% of Estonians consider that the digitalisation of daily public and private services is making their lives easier, considerably above the EU average of 73%. Additionally, 73% of Estonians are aware that rights that apply offline should also be respected online.

Estonia is a member of the Networked Local Digital Twins towards CitiVERSE European Digital Infrastructure Consortium (EDIC), and an observer in the Alliance for Language Technologies EDIC which addresses the scarcity of European language data needed for AI solutions (both EDICs have already been set up). Estonia is also in the working groups aiming to set up the Genome and the Digital Commons EDICs[29].

Estonia's Recovery and Resilience Plan (RRP) allocates 24.1% of its budget to digital policies (EUR 208 million), with priorities on digitalising enterprises and public administrations, and increasing connectivity[30]. Under Cohesion Policy, an additional EUR 0.4 billion (11% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[31].

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

[29] Information last updated on 31 May 2024.

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

[31] 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]	Estonia			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	EE	EU
Fixed Very High Capacity Network (VHCN) coverage	76.3%	76.9%	0.8%	78.8%	7.4%	x	100%
Fibre to the Premises (FTTP) coverage	76.3%	76.9%	0.8%	64.0%	13.5%	x	-
Overall 5G coverage	43.3%	87.5%	102.0%	89.3%	9.8%	x	100%
Semiconductors		NA					
Edge Nodes		3		1 186		x	10 000
SMEs with at least a basic level of digital intensity	54.0%	55.9%	1.7%	57.7%	2.6%	x	90%
Cloud	50.5%	52.6%	2.1%	38.9%	7.0%	x	75%
Artificial Intelligence	2.8%	5.2%	36.3%	8.0%	2.6%	x	75%
Data analytics	NA	25.6%	NA	33.2%	NA	x	75%
AI or Cloud or Data analytics	NA	60.6%	NA	54.6%	NA		75%
Unicorns		2		263		x	500
At least basic digital skills	56.4%	62.6%	5.4%	55.6%	1.5%	60%	80%
ICT specialists	6.6%	6.7%	1.5%	4.8%	4.3%	x	~10%
eID scheme notification		Yes					
Digital public services for citizens	94.0	95.8	1.9%	79.4	3.1%	x	100
Digital public services for businesses	98.8	98.8	0.0%	85.4	2.0%	x	100
Access to e-Health records	89.2	97.5	9.3%	79.1	10.6%	x	100

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

National Digital Decade strategic roadmap

With respect to **Estonia's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating a **low ambition** and, based on this document, intends to allocate **limited effort** to achieve the Digital Decade objectives and targets, although the **formal adoption of the roadmap at the national level** which is crucial for the country to fully commit towards these ambitions, **is still pending.**

The roadmap presents one national target out of 15, zero **trajectories** out of 13 possible and three measures. The roadmap does not present targets nor trajectories on very high-capacity networks (VHCN), Fibre-to-the-premises (FTTP) coverage, overall 5G coverage, edge nodes, SMEs with at least a basic level of digital intensity, cloud, artificial intelligence, data analytics**,** unicorns, ICT specialists, digital public services for citizens, and businesses, nor access to e-health records.

The national target included in the roadmap and the three measures briefly referred to in the roadmap refer to basic digital skills. The national target being 60% is not in line with the **EU's level of ambition,** which is 80% by 2030. Moreover, with 62.6% of its population having already at least a basic level of digital skills, Estonia has in fact already reached its national target.

Furthermore, the roadmap does not detail the amount of funds dedicated to the Digital Decade. In addition, Estonia did not consult stakeholders on the roadmap. Given Estonia's digital steps forward, it is important that the roadmap reflects these. The roadmap requires more effort in all areas.

Recommendations for the roadmap

Estonia should, when submitting adjustments to its national roadmap in accordance with Article 8(3) of the DDPP Decision:

- **TARGETS:** (i) Establish a national target and trajectory on VHCN coverage, FTTP coverage, 5G coverage, edge nodes, SMEs with at least a basic level of digital intensity, cloud, AI, data analytics, unicorns, ICT specialists, digital public services for citizens, digital public services for business, and access to health records. (ii) Align the level of ambition of the national target and propose a trajectory for at least basic digital skills.
- **MEASURES:** (i) Clearly present measures dedicated to VHCN coverage, FTTP coverage, 5G coverage, edge nodes, SMEs with at least a basic level of digital intensity, cloud, AI, data analytics, unicorns, ICT specialists, at least basic digital skills, digital public services for citizens, digital public services for business, and access to health records considering the Digital decade objectives. When presenting the measures in the roadmap provide a description of the measures, describe its intended effects and results, state the budget of the measure differentiating from public, EU and private funding. (ii) Provide **more information on the implementation of digital rights and principles** (and Digital Decade general objectives), including what national measures contribute to it.
- **CONSULTATION:** (i) Consult stakeholders in the drafting of the roadmap. (ii) Report on the consideration of stakeholders' feedback in the roadmap.

Digital rights and principles

The Digital Decade Eurobarometer reveals Estonian perceptions of digital rights. While 42% of Estonians believe the EU protects their digital rights effectively, a decrease of 6 points from last year brings it below the EU average of 47%. Concerns have intensified, particularly with 55% worried about children's online safety, a 10-point increase, and 46% about control over personal data, up 11 points. On the positive side, 66% appreciate the level of digital skills and education, and another 68% access to online public services, both well above 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[32].

A competitive, sovereign and resilient EU based on technological leadership

Estonia is committed to improving digital infrastructures and technologies. The country is working on infrastructure improvements, such as the Access to Networks Support Scheme 1.0 and 2.0. There has been significant annual growth in 5G coverage thanks to the radio spectrum auctions of the 700 MHz and 3.4-3.8 GHz bands in 2022. There is an important urban rural divide, and the government aims to tackle this and ensure full coverage for all through the Access to Networks Support Scheme 4.0. However, there is a greater need for public and private investment to reach more households and cover the white areas (areas with low connectivity). Additionally, Estonia does not have measures on edge nodes or semiconductors. The percentage of SMEs with at least a basic level of digital intensity is falling behind the EU average. Estonia's progress on data analytics and AI take-up is slow. Creating a safe and secure digital environment is of importance to Estonia at every level. Measures include strengthening the country's infrastructure and improving the population's cybersecurity skills.

[32] 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 – Estonia should:

- **CONNECTIVTY INFRASTRUCTURE:** (i) Continue the ongoing efforts to support VHCN, FTTP and 5G rollout, including by fostering private investment and by stimulating take-up. (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.
- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.
- **SEMICONDUCTORS/QUANTUM COMPUTERS:** Develop strategies and measures for semiconductors, and quantum computing.
- **EDGE NODES:** As edge computing is an important component of AI, future network deployment, and the Internet of Things, consider edge node deployment when creating investment programmes and strategies in these areas.
- **DIGITALISATION OF ENTERPRISES AND AI/CLOUD/DATA ANALYTICS:** (i) Continue work on digitalising SMEs especially for data analytics and AI. (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.

Protecting and empowering EU people and society

Estonia is heavily committed to improving peoples' digital skills and putting them at the centre of digital transformation. Estonia is actively creating a human-centred, inclusive, and transparent digital environment in line with the overarching EU objectives for digitally empowering people. The country performs above the EU average in improving the public's digital skills and ICT specialists already make up a high percentage of the in employment (6.7%). Estonia also has the second highest percentage of female ICT specialists in the EU (26.8%). Estonia has introduced educational measures aiming to educate both educators and people in different parts of life, by focusing on lifelong learning.

Estonia is a front runner in providing key public services for people and businesses, striving to make digital services available for every major life event. In 2023, the government introduced new online applications to streamline administrative processes such as marriage, childbirth, military service, migration and death of a loved one. The application Digigate is set to reduce the administrative burden on entrepreneurs by letting them provide all relevant information in one place online, streamlining communication with the authorities.

Almost 80% of the Estonian population has at least one e-ID. Additionally, Estonia's high e-health maturity places it in the trendsetter cluster. All data categories investigated in this framework are made available to citizens in a timely manner. Moreover, all the categories of healthcare providers investigated in the eHealth survey supply relevant data to the online access service for electronic health records. Citizens can access these data through an online portal, although a mobile application is not available. Furthermore, all applicable categories of healthcare providers supply relevant data. Regarding access opportunities for certain categories of people, Estonia scores 100/100 compared to a European average of 77/100 and does follow the Web Content Accessibility Guidelines accessibility guidelines. Overall, Estonia is working to further streamline public service applications to make data accessible in a single, user-friendly platform.

Recommendations – Estonia should:

- **BASIC DIGITAL SKILLS:** Continue implementing initiatives to improve digital skills and ensure that no one is left behind.
- **ICT SPECIALISTS:** Continue measures aiming at increasing the number of more senior ICT specialists (higher level of experience) and continue improving gender balance.
- **E-HEALTH:** Offer a mobile application for citizens to access their electronic health records.

Leveraging digital transformation for a smart greening

Estonia shows great ambition to bringing the green and digital transitions together with the government aiming at becoming "the greenest digital government in the world", in its Digital Agenda 2030. Estonia needs to continue capitalising on opportunities presented by the green transition by integrating related initiatives into a wider framework. Through its study carried out in 2023, 'Analysis of the Current State and Opportunities for environmental friendliness in the digital state environment', the country aims to identify key digital and green challenges. The findings will be presented in 2024, which will pave the way for an action plan. Although Estonia has already introduced green requirements into public procurement procedures, the country could develop a more extensive strategy that combines green and digital measures for the private sector. Private enterprises, particularly the start-ups, are taking steps to create synergies between green and digital steps.

Recommendations – Estonia 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.
- Encourage private investments and initiatives in responsible green tech.

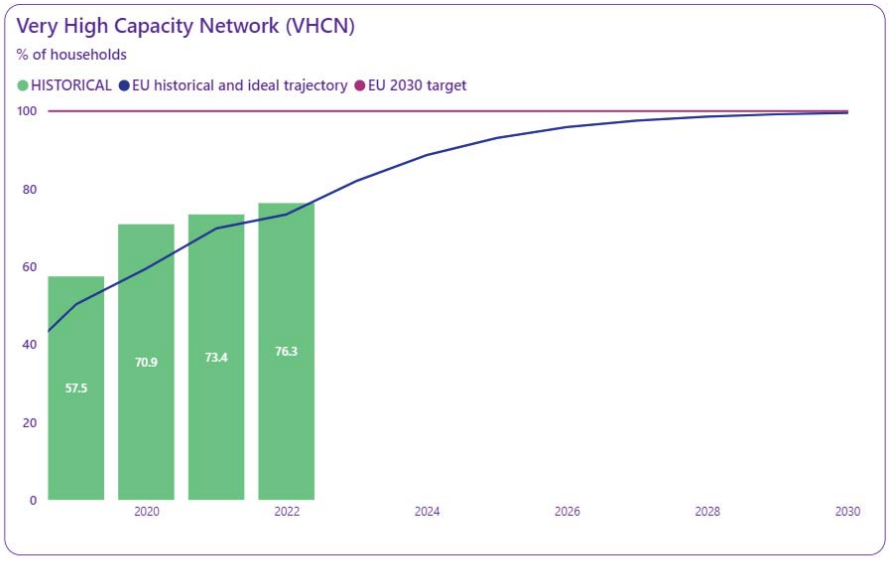
2 A competitive, sovereign and resilient EU based on technological leadership

2.1 Building technological leadership: digital infrastructure and technologies

Estonia is committed to improving digital infrastructures and technologies: but still has a long way to go to reach its digital goals. The country is implementing measures to increase its gigabit connectivity coverage, and operators are expanding 5G coverage. The country is working on infrastructure improvements such as the Access to Networks Support Scheme 1.0 and 2.0. There has been significant annual growth in 5G coverage due to the radio spectrum auctions of 700 MHz and 3.4-3.8 GHz bands. It is important to reach full coverage to ensure everyone is connected. There is a greater need for public and private investment in VHCN and FTTP to reach more households, and white areas (areas with low connectivity).

Estonia has made few investments in quantum computing and none in semiconductors, and edge nodes. Thus, suggesting a strong need for more targeted action in those areas. The percentage of SMEs with a least basic level of digital intensity is falling behind the EU average. Even though the overall take-up on cloud is above average, Estonia is falling behind on data analytics and AI. This is relevant also in the context of the Digital Decade Eurobarometer 2023, which reports that 85% of Estonians believe it should be important for public authorities to build efficient and secure digital infrastructures including connectivity and data processing facilities: 89% believed that the public authorities should increase R&D to ensure more secure and stronger digital technologies.

2.1.a Connectivity infrastructure (gigabit)

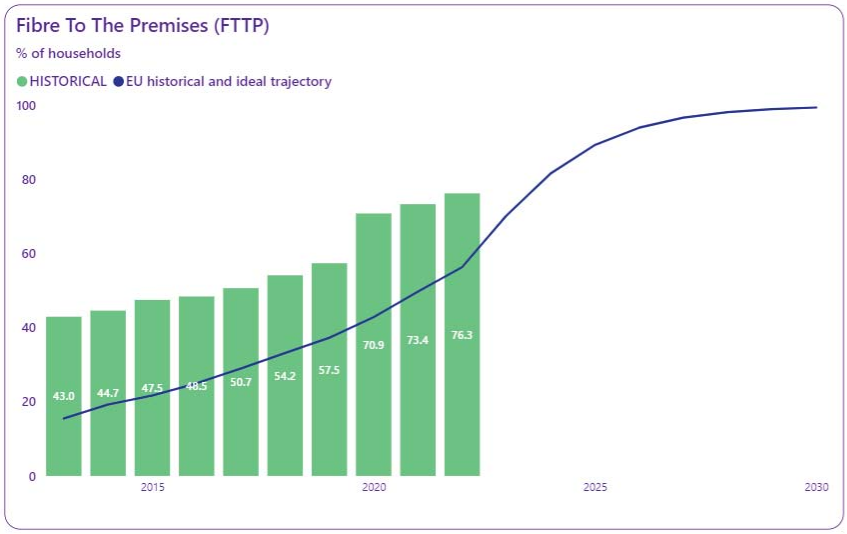


2023 state of play and recent progress

	Country level	EU level
FORECAST		82.0
DESI 2024	76.9	78.8
AVERAGE ANNUAL GROWTH %	0.8	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



2023 state of play and recent progress

	Country level	EU level
FORECAST		70.3
DESI 2024	76.9	64.0
AVERAGE ANNUAL GROWTH %	0.8	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

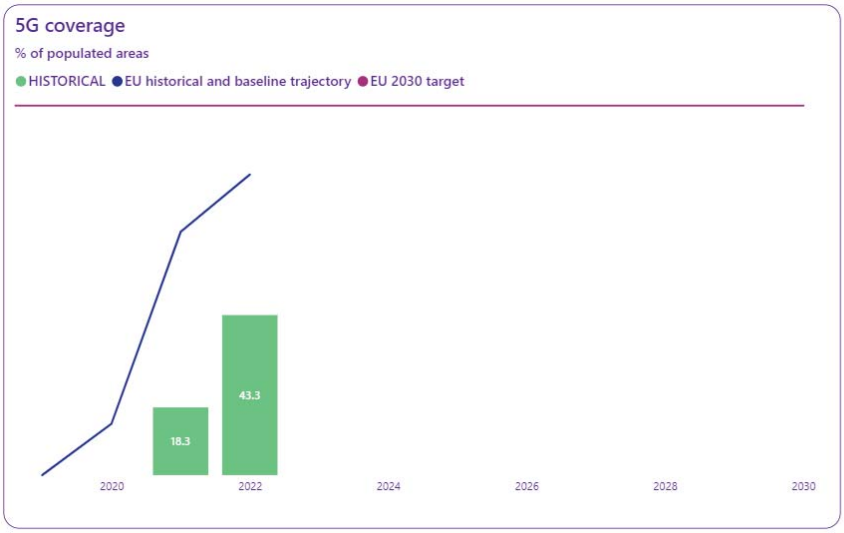
Estonia brings a positive contribution to the EU's Digital Decade target on Fibre-to-the-premises (FTTP) while showing a limited dynamic. The country has untapped potential to contribute to the EU's Digital Decade target on very-high-capacity networks (VHCN), and showing a limited dynamic. The VHCN and FTTP coverage of 76.9% is close to the EU average. Furthermore, the country's recent annual VHCN and FTTP growth rates of 0.8 % falls significantly below the EU averages of 13.5% (FTTP), and 7.4% (VHCN). Merely 0.17% of its fixed broadband subscriptions have a connection speed of at least 1 Gbps/s, significantly below the EU average (18.52%). **Estonia's roadmap has no targets or trajectories for VHCN or FTTP.**

Estonia is working to increase its gigabit coverage. The Access Networks Support Scheme 1.0, which is Estonia's first large-scale support measure ran, from 2018 to 2023. The scheme successfully extended VHCN to 40 016 addresses with VHCN 17 000 out of those in 2023. Estonia's third support scheme, Access Networks Scheme 2.0, runs from 2022 to 2025. It is funded with EUR 24.29 million from the RRF, with two calls for tenders already launched in 2022 and 2023. This scheme will extend coverage to more than 11 000 addresses by 2025**.**

State aid programmes are important to further expand gigabit coverage as private investments cannot lead to a positive business plan. In general, internet speed is lower in rural areas due to the condition of the copper network (old copper and long lines). There are no definite plans yet regarding the total closure of the copper network (copper switch-off-CSO). Copper is still essential since 50% of all retail customers rely on it. Therefore, the switch-off will happen gradually with a step-by-step approach in the coming years.

Estonia is making progress in focusing on last-mile efforts by launching the pilot initiative Access Network Support Scheme 4.0, running from 2023 until 2024. By enabling communities to apply for this support, Estonia is attempting to reach households that proactively strive to connect to a public electronic communication access network. The scheme's budget is EUR 800 000, and the maximum amount of state aid allowed is EUR 20 000 per project and EUR 10 000 per address. In 2023, the scheme supported five communities in connecting 100 addresses with VHCN by 2025. The importance of last-mile efforts is further demonstrated by results in the Digital Decade Eurobarometer survey, 80% of Estonians consider the availability and affordability of high-speed internet is crucial for their daily use of digital technologies.

2.1.b Connectivity infrastructure (5G)



2023 state of play and recent progress

	Country level	EU level
FORECAST		
DESI 2024	87.5	89.3
AVERAGE ANNUAL GROWTH %	102.0	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

Estonia has untapped potential to contribute to the EU's Digital Decade 5G target, while showing a positive dynamic. 5G coverage in Estonia (87.5%) is slightly below the EU average (89.3%). In contrast, the country estimates to have 99% population coverage, and 87.5% territory coverage. The substantial growth rate in 5G coverage at 102%, is significantly higher than the EU average of around 10%. 5G in the 3.4-3.8 GHz band, which is essential for advanced applications requiring large spectrum bandwidth, covered 43.7% of Estonian households in 2023, slightly below EU average (50.6%). In the 2023 State of the Digital Decade report, one of the recommendations for Estonia was to foster 5G development. The Estonian Consumer Protection and Technical Authority (ECPTRA, the country's national regulatory authority), and telecom operators largely contributed to the increase of 5G coverage through 2023, with radio spectrum auctions of 700 MHz and 3.4-3.8 GHz bands completed in 2022. **Estonia's roadmap has no target or trajectory on 5G coverage.**

In 2023, the 26 GHz band was auctioned. Each of the main three mobile operators took two licences (400 MHz bandwidth each licence). The operators announced that they were still in the testing phase and had not yet fully used these bands.

To boost the country's resilience, Estonia is introducing national roaming. This will ensure basic connectivity for people in times of crises or network failures or collapses, include data connection, SMS, and voice calling. Negotiations are ongoing with ministries, and operators and the initiative will be incorporated into the national legal framework.

There are three main active telecom operators in the country. The ECPTRA reports that the telecom market is competitive; however, it can be difficult for newcomers to break into the market mostly due to an already saturated market and low retail prices. The ECPTRA also reports that the mobile market is affordable for consumers. Two of the three operators announced that they are in the process of shutting down their 3G networks.

2.1.c Semiconductors

Estonia has started discussions on setting up an Estonian competence centre that would collaborate with universities and science parks in the European Digital Innovation Hubs (EDIH) network. The country reports of no developments regarding semiconductors.

2.1.d Edge nodes

The Edge Deployment Data Report estimates 3 edge nodes for Estonia. This number represents less than the 0.3% of the total estimated in the EU (1186).

Estonia's roadmap has **no target or trajectory on edge nodes**. The country reports of no developments regarding edge nodes.

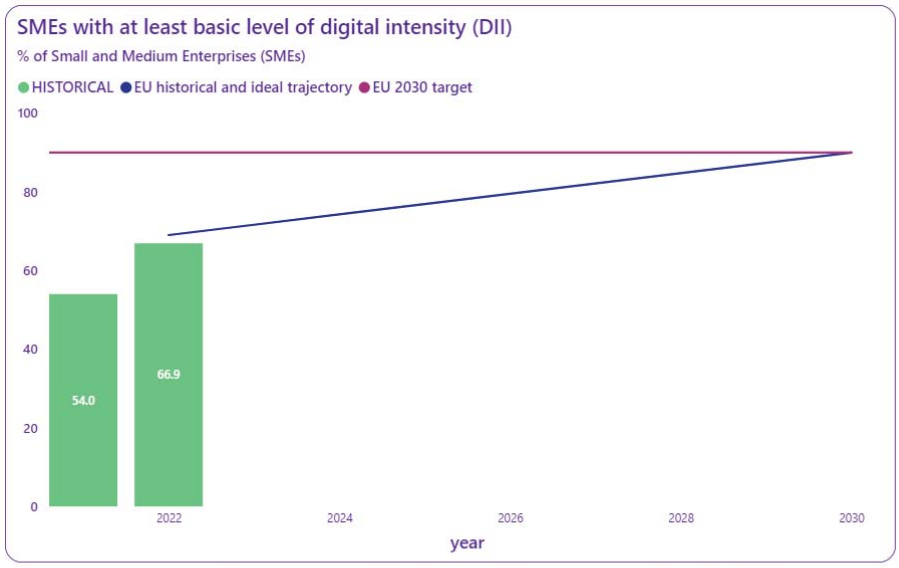
2.1.e Quantum technologies

The country is still in the early stage of quantum technology development. Estonia's main contribution to this target is the Estonian Scientific Computing Infrastructure (ETAIS). The project aims to increase the competitiveness of Estonia's computing and data-intensive research disciplines by providing access to a new modern scientific computing infrastructure. The project is a collaboration between the University of Tartu, Tallinn University of Technology, the National Institute of Chemical Physics and Biophysics, and the Education and Youth Board (HARNO). Furthermore, Estonia is taking part in two multi-country projects: the EuroQCI and NordIQuEst. These projects will build a pan-European infrastructure and create a Nordic ecosystem that combines high-performance computing and quantum computing with the aim to develop the LUMI supercomputer.

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

Estonia has a thriving and dynamic start-up environment, but falls behind in the digitalisation of SMEs. The country is making progress in the take-up of cloud services, but is lagging behind in AI and data analytics. Many of the country's measures aimed at increasing the digitalisation of SMEs can contribute to establishing an interconnected digital ecosystem and competitiveness. However, it is difficult to assess the impact of these measures because they only started in 2023, with implementation to continue in 2024. According to the Digital Decade Eurobarometer, 76% of Estonians believe it should be important that public authorities ensure that European companies can grow and become European Champions able to compete globally.

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



2023 state of play and recent progress

	Country level	EU level
FORECAST		71.6
DESI 2024	55.9	57.7
AVERAGE ANNUAL GROWTH %	1.7	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

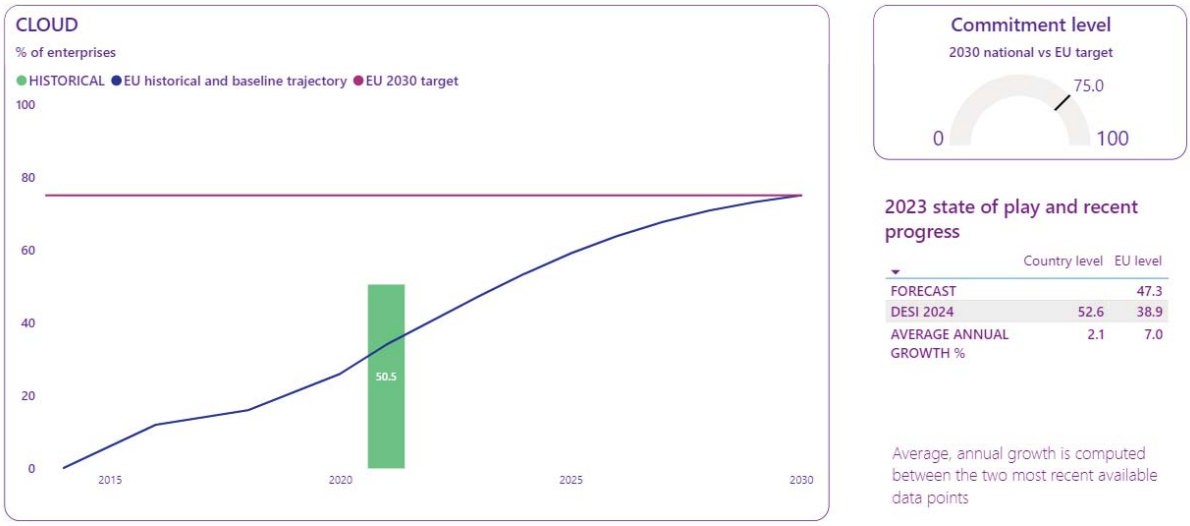
Estonia has untapped potential to contribute to the EU's Digital Decade target on the digitalisation of SMEs, while demonstrating a limited dynamic. With 55.9% of its SMEs having at least basic level of digital intensity, Estonia performs lower than the EU average of 57.7%. The annual growth rate for this indicator is 1.7%, which

is lower than the EU average of 2.6%. However, Estonia is one of the EU's front runners in the use of e-Invoices (58,7% against the EU average of 38%). Estonia's roadmap has **no target or trajectory on the digitalisation of SMEs.**

To increase the number of SMEs with at a least basic level of digital intensity, Estonia has adopted focused educational and support measures. Several of these measures were launched in 2023 and will end in 2024. They often aim to achieve sector-specific improvements in digitalisation for enterprises (such as in tourism, manufacturing, and mining, transport and logistics sector). Support includes drawing up a digital roadmap and educating key staff in digitalisation practices. These measures typically provide mentorships opportunities, classes, and certification, at no or little cost to participants.

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

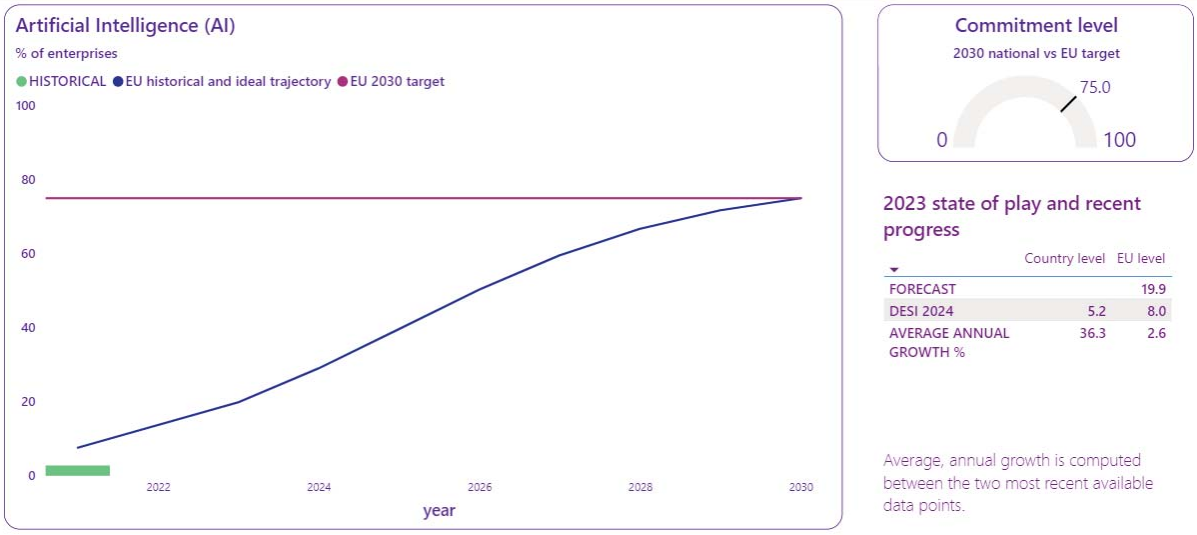
- **Cloud**



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

Estonia brings a positive contribution to the EU's Digital Decade target for cloud, while demonstrating a limited dynamic. 52.6% of Estonia's enterprises have adopted cloud services, s above the EU average of 38.9%. However, the Estonian annual growth rate of 2.1% is below the EU average of 7.0%. Estonia's roadmap has **no target or trajectory on cloud**.

- **Artificial Intelligence**

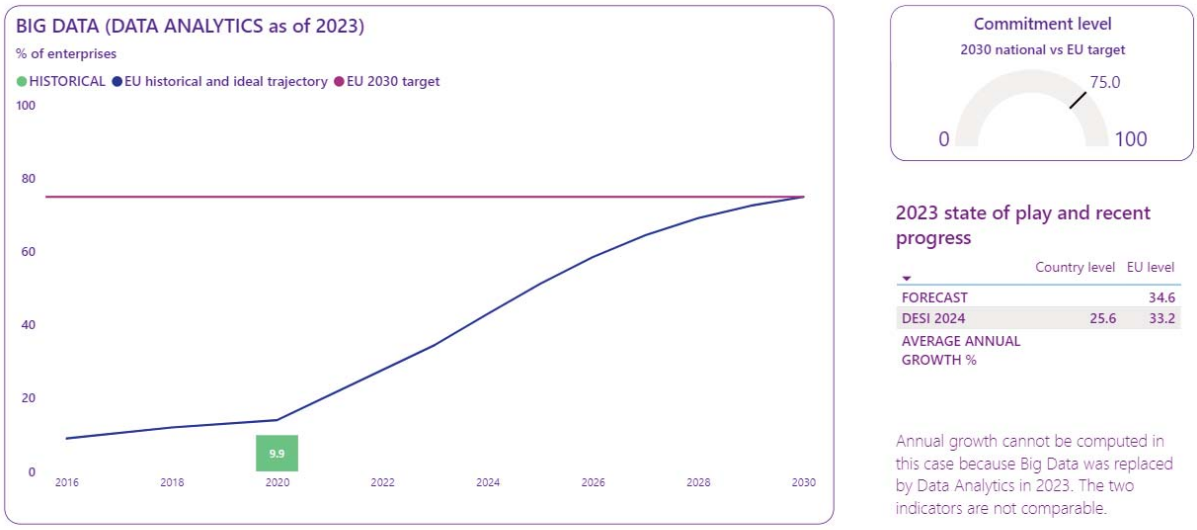


Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

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

Estonia has untapped potential to contribute to the EU's Digital Decade target for AI adoption, while showing a very strong dynamic. Few Estonian enterprises have adopted AI solutions (5.2%, behind the EU average of 8.0%). However, there is a remarkable annual growth rate of 36.3%, significantly above the EU average of 0.6%. Estonia's roadmap has **no target or trajectory on AI.**

- **Data Analytics (Big Data)[33]**



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

Estonia has untapped potential to contribute to the EU's digital decade target for use of data analytics by SMEs. At 25.6%, the country's performance is below the EU average of 33.2%. Progress cannot be assessed since the indicator's definition has changed. Estonia's roadmap has **no target or trajectory on data analytics**.

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

Estonia brings a positive contribution to the EU's Digital Decade target for SMEs uptake of AI/Cloud/ data analytics. 60.6% of all Estonian enterprises with 10 persons or more has adopted at least one of these

[33] 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.

technologies, which is above the EU average of 54.6%. The country performs above the EU average for cloud adoption while falling below the EU average for data analytics and AI. Estonia's roadmap has no target on take-up by enterprises of AI or cloud or data analytics.

As the areas of cloud services, data analytics and AI can be interconnected, many of the Estonian's strategies aim to address these together. One example is the Estonian European Digital Innovation Hub (EDIH), AI & Robotics Estonia (AIRE), which supports enterprises' in their digitalisation efforts. This includes assistance with testing and validating innovative robotics, AI technologies and algorithms, setting up cooperation networks, and assessing enterprises digital maturity to provide tailored recommendations. This service is free for enterprises, funded by the Estonian government and an EDIH, and has supported 146 enterprises working primarily in manufacturing (90%) and health technologies (10%). **Estonia's Ministry of Economic Affairs and Communications encourages Estonian enterprises to develop and use AI through the AI Development Programme which will also** deal with **cloud services and data analytics.** The programme is set to support companies with a budget of EUR 2 million over two years. funding at least 8-12 RDIE projects with up to EUR 75 000. It also aims to provide at least 10 smart solutions for start-ups, spin-off enterprises and university research teams that will be allowed to develop their products in an AI accelerator.

Promoting responsible and human-centric AI system is of great importance for Estonia as demonstrated by its National AI strategy. Estonia launched a first AI strategy for 2019-2021, followed by a second strategy for 2022-2023 and is now developing a third National AI strategy for 2024-2026. These AI strategies have been and will continue to focus on the principles of human-centred and trustworthy AI and cover how AI is used in the public and private sectors, education, research and legislative amendments. It is publicly funded with a budget of EUR 20 million. One result of the strategy was the AI Support Toolbox, which includes the Data Sandbox and Data Panel services. These services provide legal, technical and other types of support to institutions implementing AI-related or other data-driven projects.

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

The Estonian start-up system is very dynamic, and continues to be a high priority for the country. Estonia has two unicorns, which is a respectable number given its GDP. Estonia's roadmap has **no target or trajectory on unicorns.**

Since 2019, Estonia has allocated at least 1% of its GDP to its start-ups(estimated 2.2% in 2023). This has contributed to cementing its position as an EU front runner. Estonia also attracts the highest venture capital investments for seed and start-ups in the EU, amounting to 28% in 2022, and is home to one of the EU's largest ICT sectors (making up 5.8% of GVA in 2020). However, investments in start-ups fell in 2023 due to a downturn in the venture capital market and in the start-up sector as a whole. In 2023, the country recorded approximately 70 start-up deals, i.e., totalling around EUR 400 million.

Guiding the Estonian start-up sector is the **R&D, Innovation and Development Plan 2021-2035.** The plan implements a knowledge transfer programme in R&D and an entrepreneurship scheme with key actions. These actions include improving R&D&I knowledge and intensity transfers between enterprises and nurturing science and technology intensive start-ups. Another notable initiative is **Startup Estonia (2022-2029)**, run by the Estonian Business and Innovation Agency and funded with EUR 10 million from the European Regional Development Fund. Startup Estonia aims to develop the start-up ecosystem and attract talent, and capital via accelerators. The programme includes four focus areas: the start-up environment, global talent, regional development and deep tech. Estonia has a specialised focus on deep tech start-ups as shown by the launch of the **Action Plan for the Development of the Deep Tech Startup Ecosystem.** This plan aims to increase the number of deep tech start-ups from approximately 150 in 2023 to 500 in 2030. This ambition is further supported by many deep tech investments from bodies such as the Creative Destruction Lab-Eesti (CDL-Eesti)

business accelerator, the NATO DIANA business accelerator, Applied Research Programme Grants (RUP), and Applied Research Centre Services (RUK).

The start-up scene is essential to the Estonian job market. According to the Estonian Tax and Customs Board, about 12484 employees worked in Estonian start-ups in 2023, a decrease of 4% from 2022, mostly due to the general economic downturn in 2023. Furthermore, Statistics Estonia, an organisation run by the Estonian Business and Innovation Agency and funded with EUR 10 million from the European Regional Development Fund, reported that in 2023, 17 403 people were part of the start-up sector for at least one day, which means every 41st working Estonian, and 12 477 individuals were employed by start-ups, which represents every 57th working Estonian. However, the country's start-up sector is facing a talent shortage. Startup Estonia estimates that nearly a third of the start-up sector's workforce comes from outside the country. Since 2017, Estonia has a 'Start-up Visa' with nearly 6 000 successful applicants since its launch. In 2023, Estonia launched the 'Scale-Up Visa' that allows scale-ups to recruit foreign talent more easily. However, Estonia's immigration cap of 0.1% (which amounted for a maximum of 1303 people in 2023) could limit this.

2.3 Strengthening cybersecurity & resilience

Estonia is a leader in ensuring secure digital infrastructures to create a safe and secure digital world. Strengthening resilience and cybersecurity is of utmost importance to Estonia especially due to the geopolitical situation. Estonia has several cybersecurity initiatives that aim to strengthen the cyber resilience of the government, the public and enterprises. **Estonia is advanced in monitoring cyberspace**. The Estonian Information System Authority (RIA) publishes daily, monthly and yearly assessments of the major cyber events and incidents in Estonia and the world**.**

Multi-country collaboration on cybersecurity is important for Estonia as demonstrated by the launch of the Tallinn Mechanism in 2023. This initiative aims to provide cyber support by identifying and matching Ukraine's cyber cybersecurity needs to increase the effectiveness of aid. The Mechanism includes ten donor states, with NATO and the EU participating as observers.

The Estonian Information System Authority leads the EU-funded EU CyberNet project. This project ensures the consistency of the EU's external cyber capacity-building projects and boosts the EU's capacity to provide technical assistance to non-EU countries in cybersecurity and cybercrime.

Cyberthreats concerns the Estonia given the rise in cyberattacks, but the country has a good level of preparedness. The RIA reported 3314 incidents with an impact in 2023, more than 50% of which were related to phishing, plus 484 denial-of-service attacks, an increase of more than 60% compared to 2022. However, despite the increase in cyberattacks Estonia well prepared and resilient, with only 139 of the attacks, less than a third, being considered to have an impact[34]. Not all **disruptions** were caused by cyberattacks, but however those that **due to an attack** was most often linked to Estonia's support for Ukraine.

In contrast, the Estonian population and its enterprises seem to take fewer cyber security precautions than the EU average. As companies' reliance on digital technologies grows, so does their risk of exposure to cybersecurity incidents and the need for preparedness. In Estonia, 85.6% of enterprises with 10 employees or more have reported taking ICT security measures in 20221, and in 2022 only 9.3% of Estonian enterprises (10 employees or more) **had insurance against ICT security incidents.** Furthermore, according to the Digital Decade Eurobarometer survey, 78% of Estonians believe that improved cybersecurity, better protection of online data and safe digital technologies would significantly facilitate their daily use of digital technologies.

[34] https://www.ria.ee/sites/default/files/documents/2024-02/Cyber-security-in-Estonia-2024.pdf.

The three telecom operators are investing in secure digital infrastructure and have precautionary measures in place for cyberattack. They also provide internal cybersecurity for staff and external trainings for B2B and enterprise customers.

Educating the public and enterprises about cybersecurity risks is a high priority for Estonia. The website Itvaatlik.ee provides cybersecurity courses and a diagnostic test. The cybersecurity educational courses are free of charge, and targeted at enterprises, individuals, parents, the public sector, and the general public. The website also runs topical campaigns in other media formats. There is an ongoing cyber hygiene campaign, broadcasted on the government's radio channel 4 (which specifically targets the Russian speaking population). Since the website's launch in 2021, 205 institutions or enterprises have signed up, and 15 160 people have passed their test. In 2023, the website averaged 6 600 visits per month, totalling 47 491 visitors, with 93.6% of the visitors coming from Estonia.

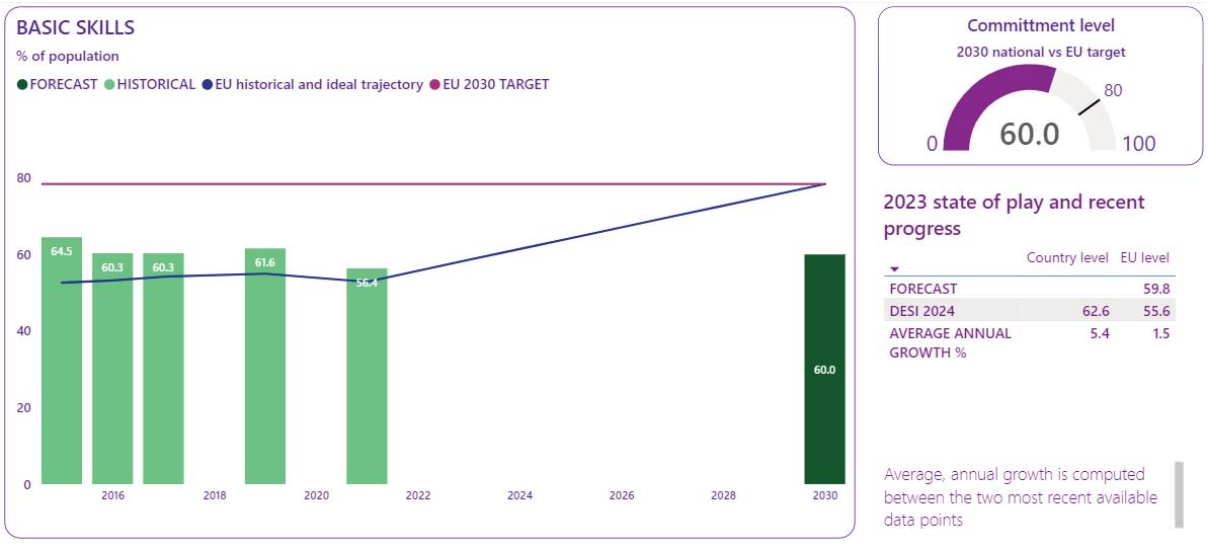
3 Protecting and empowering EU people and society

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

Estonia is heavily committed to improving the population's digital skills and putting them at the centre of the country's digital transformation. Estonia performs above the EU average in people with at least a basic level of digital skills, the proportion of ICT specialists and the percentage of female ICT specialists. Estonia has introduced educational measures aiming to educate the educators and people in different parts of life, including by focusing on lifelong learning. Digitalising the public sector has been high on the Estonian agenda for decades, and the country is already very close to reaching the 2030 Digital Decade target. As result, Estonia has focused on improving the people's digital skills to ensure that they can access such services and guarantee that no one is left behind. As Estonia identifies very different groups as being vulnerable to being left behind in the digital transformation. The country focuses on lifelong learning, creating educational measures to improve digital skills in various areas of life. In addition, Estonia focuses on educating the educators, by providing courses in teaching digital skills. Estonia looks beyond traditional educational programmes and is innovative in providing creative alternatives. For example, Estonia produces educational radio programmes, and podcasts featuring members of the government discussing the features and objectives of certain digital measures. Estonia also designs courses that tackle current digital topics. Perhaps due to Estonia's already high level of digitalisation of public services, only 69% of Estonian believe that digital technologies will be important for engaging in democratic life by 2030.

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

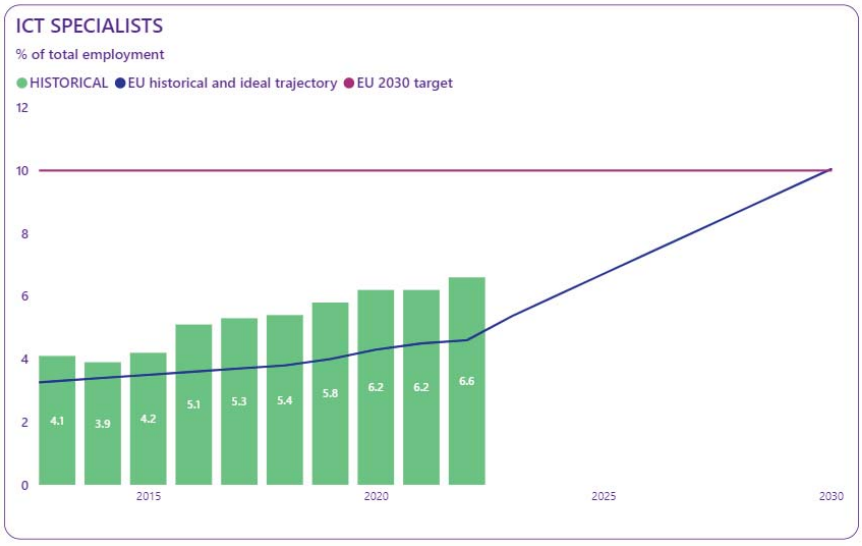
Estonia is bringing a positive contribution to the EU's Digital Decade target of basic digital skills while showing a very strong dynamic. In 2023, 62.6% of the Estonian population had at least a basic level of digital skills, which is above the EU average but behind the EU's front runners. Furthermore, Estonia is showing a strong annual growth of 5.4% against the EU average of 1.5%. On other digital skills indicators such as above basic digital skills, internet use, and at least a basic level of digital content creation skills, Estonia performs slightly above the EU average. Estonia has already reached its national target of 60% by 2030 in 2023. Therefore, given Estonia's performance above EU average and recent annual growth, a higher level of ambition for its national target could be envisaged. Estonia's roadmap has **no trajectory on basic digital skills.**

To ensure that the population is equipped with basic digital skills, Estonia implements measures to 'educate the educators.' One measure, which ran from 2022 to 2023 with EUR 175 000 in funding from the European Social Fund, aimed to increase older people's basic digital skills. The initiative involved training over 200 librarians in the principles of service design and adult learning methods (andragogy) and providing them with guidance on using digital tools and public online services. This project also created video material (which remained available after the project ended) on how to use online banking and send digital tax returns. In 2023, 829 teachers participated in training under the European Social Fund measure supporting teacher and school leaders' professional development. Furthermore, digital skills are one of eight key competences in the Estonian national curriculum, with a particular emphasis on educating teachers and school leaders.

Given that Estonia has a high percentage of youth not in employment, education or training (specifically 20-24 year-old men ((20.9%)), it is essential to engage digital skills learning. This is supported by the Digital Decade Eurobarometer survey, which indicates that only 74% of Estonians believed that more education and training to develop their skills in using digital services would significantly improve their use of digital technologies, just slightly above EU average. The project 'Digital Leap in the Field of Youth, Smart Youth Solutions' (which ran from 2022 to 2023) strived to increase digital engagement and competence of youth workers by creating prerequisites for an engaging digital leap. This resulted in the creation of courses on AI, including ChatGPT, video games, and podcasts. The project engaged 66 local government bodies, educated 207 youth workers, produced five textbooks, and created a digital competence and maturity framework for youth work and youth workers.

Estonia identifies three very different groups as vulnerable in terms of digital skills and being at risk of being left behind: older people, middle-aged people active in the job market and young people. As these groups have different needs, Estonia is adopting tailored solutions, as shown in the examples mentioned above.

3.1.1.b ICT specialists



2023 state of play and recent progress

	Country level	EU level
FORECAST		5.4
DESI 2024	6.7	4.8
AVERAGE ANNUAL GROWTH %	1.5	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

Estonia brings a very strong contribution to the EU's Digital Decade target for ICT specialists, while showing a positive dynamic. In 2023, 6.7% of the Estonian population in employment were ICT specialists, which is above the EU average but behind the EU's front runners. Furthermore, the number of ICT specialists grew by 1.5% from 2022. In absolute numbers, Estonia hosts 46 500 ICT specialists, which is 2 000 more than last year. Women made up 26.8% of ICT specialists in Estonia, up from 2022 (24.5%) and above the EU average (19.4%). Based on current progress, Estonia is in a good position to reach the EU's 2030 target. In 2023, the ICT sector accounted for 6.7% of the GDP. Estonia's roadmap has **no target or trajectory on ICT specialists.**

To increase the number of ICT specialists, Estonia is focusing on initial training and lifelong learning. The ProgeTiger Programme, implemented by the Education and Youth Board, encourages early ICT childhood education. The programme offers providing 26 courses and workshops in which 565 teachers and school leaders have participated and has carried out student activities for 3 500 students from 100 educational institutions. Furthermore, to reskill and upskill the working-age population Estonia will, through the RRF support the digital transformation of businesses, develop training programmes for information security specialists and help SMEs increase their staff's ICT skills. To date, 200 people have started information security training. In addition, the Estonian Unemployment Insurance Fund (EUIF) provided ICT education to unemployed and employed people as a part of the job market measures. However, Estonia face challenges in recruiting non-entry level ICT specialists.

At 26.8%, Estonia has the second highest number of female ICT specialists in the EU. Although Estonia is performing better than most other EU countries it still has far to go to achieve gender convergence in the ICT profession, so continued efforts may be needed. Estonia has measures aiming to include women of all ages in the ICT sector. There are many NGOs aiming to introduce young girls (aged 8-19 years) to the ICT field through targeted workshops, programmes and camps on robotics, engineering, and science, technology, engineering and mathematics (STEM). Furthermore, one of the targets of the **IT Academy programme 2023-2029**, is to increase the proportion of female students in the first-level curricula by 35% by 2029.

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

3.1.2.a e-ID

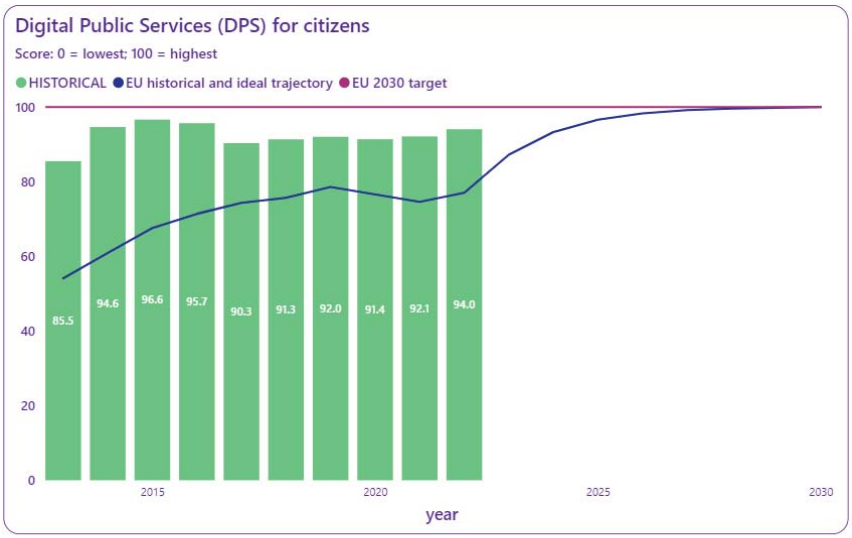
Estonia has notified 6 national e-ID scheme with a high level for cross-border use (5 smartcard-based schemes and a mobile-ID scheme) in accordance with eIDAS Regulation. The country is currently preparing implementation of the European Digital Identity Wallet under European Digital Identity Regulation.

Estonia is one of the EU's front runners in e-ID as shown by the high use of Estonian e-ID applications. At the end of 2023, 1 121 041 e-IDs had been issued which corresponds to more than 80% of the Estonian population and there were 22 351 282 authentications through the central authentication portal TARA, enabling access to public services. Additionally, in 2023, 89.43% of Estonians had used their e-ID to access online services, 82.76% to access services provided by public authorities or public services, and 77.92% to access services provided by businesses. These results are significantly higher than the respective EU averages of 41.11%, 36.14% and 16.44%. The Estonian national law, the Identity Documents Act, requires that every Estonian above the age of 15 must have an e-ID that is recognised across the EU, granting individuals complete control over their identity transactions and shared personal data they share. People can use different e-IDs supplied by the public and private sector. In 2023, to further streamline its e-ID to ensure a secure and user-friendly system, Estonia started updating its identity management and e-ID strategy for the next five years and has launched a public procurement process for the next generation e-ID cards.

Estonia participates in the pilot project 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 people living in EU, facilitate the processing administration services procedures, and 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 consortium benefits from EU funding of EUR 16 million. Estonia is also a participant in the Nordic-Baltic e-ID Cooperation Project (NOBID), to facilitate cross-border identity in the Nordic-Baltic region.

3.1.2.b Digitalisation of public services for citizens and businesses



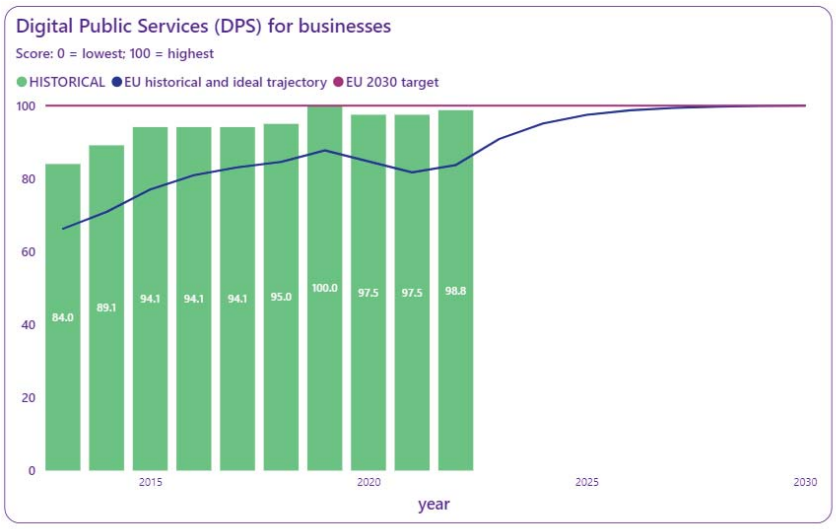
2023 state of play and recent progress

	Country level	EU level
FORECAST		87.2
DESI 2024	95.8	79.4
AVERAGE ANNUAL GROWTH %	1.9	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



2023 state of play and recent progress

	Country level	EU level
FORECAST		90.9
DESI 2024	98.8	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

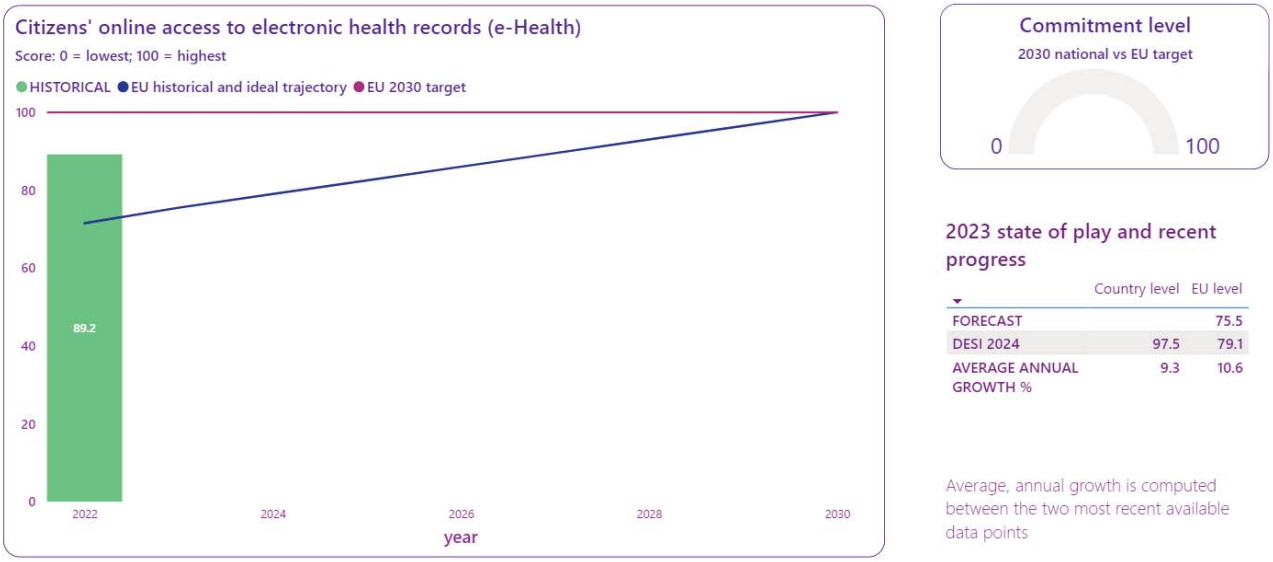
Note 2: The source of national forecast values is the 2023 country roadmap

Estonia brings a very strong contribution to the EU's Digital Decade target for digital public services for citizens and businesses while showing a positive dynamic. Estonia ranks second in the EU (95.8) and fourth for services if for businesses (98.8) significantly higher than the respective EU averages of 79.4% and 85.4%. Estonia is getting close to the EU's 2030 target, and reports that the country has reached a 'post-digital era', focusing expanding 'Personal Government' which embodies a people-centric and digital first approach. According to the Digital Decade Eurobarometer survey, 87% of Estonians believe that accessing public services online will be important by 2030. Estonia is also a front runner in internet use: 94.72% of the population have used the internet in the last 12 months – significantly above the EU average of 75.01%. Estonia's roadmap has **no targets or trajectories on digital public services for citizens and businesses.**

Estonia is working on integrating digital solutions into all important life events. In 2023, Estonia launched new online applications to register life events online, such as marriages, the birth of a child, deaths, military service, migrations to Estonia and the death of a loved one. As a result, more than 6 800 marriage applications have been submitted (about 53% of all marriage applications). Estonia is working on other applications handling retirement, divorce, the treatment journey for a child with a stable diagnosis, the digitisation of assistive device certificates and support for a reduced ability to work.

Estonia is working to improve the efficiency and quality of public services delivery to enterprises by introducing measures to reduce the administrative burden on enterprises. One key measure in place since 2021, **Digigate,** which aims to provide a single user-friendly digital gateway for the delivery of public services to entrepreneurs, while establishing a proactive delivery of information tailored to the individual enterprises. The Digigate project runs until 2025 and has received around EUR 24 million in funding from the RRF, and the country's R&D budget. In 2023, the project set up has established a national mailbox (for information sent by the state to a company). In addition, the project has made it possible to find in one place the information on suitable financing opportunities, the enterprises' obligations to the state. In addition, the project allows the enterprises to award and manage its authorisations, as well as award and manage enterprise's authorisations, which can be viewed by the public.

3.1.2.c e-Health



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

With an overall e-health maturity score of 97.5, compared to an EU average of 79.1, Estonia brings a very strong contribution to the EU Digital Decade target, while showing positive dynamic. Estonia's roadmap has no target or trajectory on **e-health**.

A centralised, nationwide access service is technically available in Estonia. 80-100% of the national population is technically able to access the online access services for eHealth records through online portal(s), logging in using an e-ID compliant with eIDAS Regulation. Estonia scores 100 on categories of health data, compared to a European average of 74. Furthermore, all applicable categories of healthcare providers supply relevant data. Regarding access opportunities for certain categories of people, Estonia scores 100/100 compared to a European average of 77/100 and does follow the Web Content Accessibility Guidelines.

Estonia is one of the EU's front runners in supplying digital technologies for healthcare. This is in line with the Digital Decade Eurobarometer survey that indicates that 78% of Estonians (on par with the EU average) believe that digital technologies will be important to access or receive healthcare services by 2030. People in

Estonia can access their e-health records using a compulsory e-ID system. In 2023, Estonia worked to further centralise most health data from public and private enterprises by requiring that e-health record solutions developed by private enterprises should submit their information through the central system and central health portal, Terviseportaal. All main health data can be viewed on the Terviseportaal regardless of whether it was recorded by a private or public healthcare provider, allowing the data to be accessed by medical professionals and individuals for secondary use. Furthermore, no mobile application is available yet, which hinders interoperability and the ease of use.

Estonia's e-health system gives individuals significant control over their health data. In their e-Health Declaration, people can suggest input to their health records, give access to a representative to review their information and opt out of allowing medical professionals and representatives access their health data (either partially or fully). This reflects how well Estonia contributes to the Digital Decade's privacy objectives.

Estonia is also working on initiatives in cross-field projects in e-health. The Estonian Research and Development, Innovation and Entrepreneurship Strategy has identified health technologies and services and digital solutions as two priorities for development and increased financial support. Therefore, roadmaps have been drawn up with business communities, researchers and government agencies.

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

Hate speech is a growing concern in Estonia. Almost 50% of the population were encountered messages online that were considered hostile or degrading in the last 3 months according to a Eurostat survey, which was the highest number reported by a Member State, and significantly higher than the EU average of 33.5%. According to the Digital Decade Eurobarometer survey, 70% of Estonians believe that shaping the development of AI and other digital technologies to ensure they respect our rights and values is important. To tackle **online crimes**, Estonia has the Web Police, which the public can contact to report bullying, harassment, online, sexual or other abuse, or impersonation online, send in a tip, or seek advice from the police. Through the Web Police, the public can contact their local police department or officers' Facebook profiles.

Digitalisation is at the heart of Estonian democracy. In the 2023 parliamentary elections, over half of the votes (313 514 out 615 009) were e-votes, outnumbering paper ballots for the first time. To e-vote, one must download a voter application to a computer and identify oneself with a valid ID-card and ID-card reader or mobile ID and a correlating pin code. The Information System Authority (RIA) reported that IT systems encountered no issues and that no cyberattack against the electoral system was detected. Currently, it is only possible to vote using a computer, but the aim is to make it possible to vote using a smartphone and tablet. It is possible to e-vote in all types of elections, from local to EU level, including the 2024 EU elections.

Best practice: Rahvaalgatus – citizen engagement

Estonia set up the Citizen Initiative Portal in 2014, Rahvaalgatus, to governance and participatory democracy. Rahvaalgatus lets any member of the public (including advocacy organisations) carry out online discussions, draft and send digitally signed collective initiatives to the Estonian Parliament and local government. Under national legislation, if an initiative has at least 1 000 signatures from individuals over the age of 16 (worth noting the voting age is 18 years old) then Parliament must process the initiative. Additionally, at local government level, at least 1% of the registered local population must support the initiative. An initiative must aim to improve Estonian society or amend existing legislation.

The website makes it possible to follow the proceeding address and see the government's course of action. This can lead to six different scenarios; the launch of a legislative act, a public sitting, the initiative is sent to another institution, the initiative is sent to the national government (for local government proposals), the initiative is rejected or the issue is by other means solved.

The website allows people to browse current initiatives, view the number of signatures and see how many days are left before the initiative becomes inactive (unless it reaches the number of signatures). To sign an initiative, the user must create an account, and the platform requires authentication by e-ID (the digital signature carries equal weight to a handwritten signature).

In 2023, 343 citizen initiatives were submitted through the platform and of these, 136 were sent to Parliament for consideration. In the end, 31 were submitted. In 2023, initiatives on the website gathered a total of 289 496 signatures.

4 Leveraging digital transformation for a smart greening

Estonia shows great ambition in combining green and digital as the government aims to be 'the greenest digital government in the world' in its Digital Agenda 2030.

The green transition continues to be a priority for Estonia as highlighted by Tallinn being named the 2023 European Green Capital. In that period, Estonia hosted Tallinn Greentech week, which included the GreenEST Summit focusing on synergies between AI and green technologies. The Greentech week had up to 500 investors, innovators and entrepreneurs in this field participating.

In 2023, Estonia's Ministry of Economic Affairs and Communication developed an action plan to reduce the environmental footprint of ICT in the Estonian public sector based on the result of the 2022 report, the Analysis of the Current State and Opportunities for environmental friendliness in the digital state environment. This analysis will guide Estonia's work in combining green and digital policies. The aim of the project was to analyse the environmental impact of digitalisation in Estonian public sector, as well as examine opportunities for measuring, reducing and improving environmental sustainability and climate-friendliness in the digital state. It looked at data centres, cloud services, workstations, digital trash and software solutions, examining 12 Estonian public sector institutions and four local governments. This identify Estonian's future and current challenges in extending the lifespan of ICT devices through rental models, and fostering a circular economy where devices are used to their full potential.

Estonia has rolled out several initiatives that provide organisations tools for calculating carbon footprints. The guidance, prepared in 2023 by Estonia's Ministry of Climate, can be used by enterprises and other types of organisations to calculate their carbon footprint of other projects, events and other activities. The calculation is in line with international greenhouse gas protocol, methodologies and standards for accounting and reporting.

Putting the green transition at the heart of public procurement is a priority in Estonia. As public sector consumption amounts to 14-16% of the country's GDP, Estonia strives to implement green requirements in public procurement. Since 2022, public sector organisations are required to consider environmental criteria when procuring IT equipment for the office.

The Estonian government's focus on sustainability does not appear to be reflected in how Estonian enterprises and people prioritise the impact of digitalisation on the environment. According to Eurostat, only 46.3% of Estonian enterprises considered the environmental impact of ICT services or ICT equipment when selecting them, which is below the EU average of 58.5%. Recycling rates are lower is less present than in other EU countries, with 6.48% of the population recycling mobile phones, 7.98% laptops and tablets and 11.6% desktop computers (versus the EU average of. 10.4%, 9.7% and 12.8% respectively). Furthermore, as the Digital Decade Eurobarometer survey shows, only 60% of Estonians believe that digital technologies will be essential in fighting climate change, and 61% believe it is important for public authorities to ensure that digital technologies support the green transition.

Annex I – National roadmap analysis

Estonia's national Digital Decade strategic roadmap

On January 15, 2024, Estonia submitted its national strategic roadmap. The roadmap provides limited information on Estonia's state of play, outlines a few strengths and challenges for some but not all indicators, which gives limited insight into Estonia's digital journey as a result. Notably, there is a lack of details on edge nodes and semiconductors and minimal information on unicorns, quantum computing, and 5G.

The roadmap names three measures on digital skills without providing any information on them. Examples of initiatives are included while describing the state of play but most of them lack details (e.g., no name of the measure, its intended effects, nor its process). The roadmap presents only one national target out of the 15 expected and zero trajectories out of 13 expected. The presented target on digital skills is below EU's level of ambition and above the country's current performance. The roadmap has not been consulted by stakeholders. Furthermore, the roadmap does not specify the amount of funds dedicated to the Digital Decade. Due to a lack of information regarding measures, targets and trajectories for KPIs, the roadmap is considered incomplete. The analysis of the roadmap is therefore limited, and it is not possible to determine if Estonia's digital vision aligns with the EU objectives.

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

MCP and EDICs

Estonia is a member of the Local Digital Twins towards CitiVERSE-EDIC and an observer of the Alliance for Language Technologies (ALT-EDIC) (both have already been set up). Estonia is developing the Statute and other relevant documents of the possible future Genome EDIC, within an informal Working Group. Estonia is engaging in discussion on the setup of possible future Digital Commons EDIC, within an informal Working Group[35].

EU funding for digital policies in Estonia

Estonia's Recovery and Resilience Plan (RRP) was updated in July 2023 to be better aligned with the national 'Estonia 2035 Strategy'. The RRP allocates EUR 208 million (24.1% of the total) to foster digital policies, all of it estimated to directly contribute to achieving the Digital Decade objectives and targets (according to the Joint Research Centre's study[36]).

The seven out of eight measures in the digital government component of the Estonian RRP, with a combined budget of EUR 97.4 million, aim at upgrading digital government services. In the implementation of these measures, Estonia draws on the latest technologies, to improve resilience, security, and efficiency, and reduce the administrative burden for both citizens and businesses. The remaining measure of the same component provides EUR 24.3 million support to improve access to VHCN for households and socio-economically important institutions such as hospitals, schools, public services and businesses.

Finally, according to the JRC study, out of the cohesion policy fundings received by Estonia, EUR 332.7 million contributes directly to the Digital Decade targets according to the JRC's mapping study.

[35] Information updated on 31 May 2024.

[36] 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)).