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COVER NOTE

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PART 6/6

COMMISSION STAFF WORKING DOCUMENT

Digital Decade country reports

State of the Digital Decade 2024

Portugal

1 Executive summary

Portugal 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, Portugal made notable progress in e-health and in rolling out 5G networks, including in the 3.4–3.8 GHz band. However, **important challenges persist** in improving basic and advanced skills across the population.

Digitalisation is a priority of the Portuguese authorities with the emphasis on reliable online public services, development of digital skills and unleashing the digital potential of enterprises. Portugal is seizing the opportunity to use EU funds to transform its economy and society and is devising its strategies on new technologies such as cybersecurity, AI, and advanced computing. Its work in this respect is facilitated by excellent digital infrastructure. However, despite the efforts, some metrics related to the general population and enterprises suggest the need for more intensive action.

According to the Special Eurobarometer 'Digital Decade 2024'[1], 74% of Portugal's population consider that the digitalisation of daily public and private services is making their lives easier (just above the EU average of 73%).

Portugal is a member of the already established Local Digital Twins towards CitiVERSE European Digital Infrastructure Consortium (LDT CitiVERSE EDIC) and of the EUROPEUM-EDIC. Portugal, together with other Member States is participating in the works for the possible future EDICs: Cybersecurity Skills Academy EDIC, the EUCAIM EDIC and the Genome EDIC[2].

The Portuguese Recovery and Resilience plan dedicates EUR 4.5 billion (21% of the total allocation)[3] to the digital transformation, with priorities given to digital qualification and skills and the digital transformation of businesses. Under Cohesion Policy, an additional EUR 2.4 billion (11% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[4].

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

[2] Information last updated on 31 May 2024.

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

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

Digital Decade KPI [1]	Portugal			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	PT	EU
Fixed Very High Capacity Network (VHCN) coverage	93.0%	94.2%	1.2%	78.8%	7.4%	x	100%
Fibre to the Premises (FTTP) coverage	90.8%	92.3%	1.7%	64.0%	13.5%	x	-
Overall 5G coverage	70.1%	98.1%	40.0%	89.3%	9.8%	x	100%
Semiconductors		NA					
Edge Nodes		19		1 186		x	10 000
SMEs with at least a basic level of digital intensity	48.6%	53.6%	5.0%	57.7%	2.6%	90%	90%
Cloud	28.1%	32.3%	7.2%	38.9%	7.0%	x	75%
Artificial Intelligence	7.2%	7.9%	4.7%	8.0%	2.6%	x	75%
Data analytics	NA	38.6%	NA	33.2%	NA	x	75%
AI or Cloud or Data analytics	NA	54.4%	NA	54.6%	NA	75%	75%
Unicorns		1		263		2	500
At least basic digital skills	55.3%	56.0%	0.6%	55.6%	1.5%	80%	80%
ICT specialists	4.3%	4.5%	4.7%	4.8%	4.3%	7%	~10%
eID scheme notification		Yes					
Digital public services for citizens	77.8	81.5	4.8%	79.4	3.1%	x	100
Digital public services for businesses	81.9	81.9	0.0%	85.4	2.0%	x	100
Access to e-Health records	62.7	86.0	37.2%	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 **Portugal's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating **some ambition** however, based on this document, intends to allocate **limited effort** to achieve the Digital Decade objectives and targets. **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.**

Portugal's roadmap partly reflects the efforts needed in all dimensions of digitalisation. The roadmap **includes only some of the expected national targets**, i.e., those related to digital skills, at least a basic level of digital intensity of SMEs, unicorns, and a joint target for the take-up of AI, cloud or data analytics, leaving space for higher ambition. The roadmap **does not include any trajectories** making it difficult to assess the pace of implementation. The national targets set for 2030 reflect EU target levels of ambition except for ICT specialists. The total budget for the measures is **EUR 854 million** (0.3 % of GDP). While the measures presented tackle some of the most pressing issues, such as the insufficient level of basic digital skills, ICT specialists, and the digitalisation of businesses, more intensive efforts are needed to reach the national targets. For the sake of the cooperation foreseen by the programme, a comprehensive roadmap perspective remains crucial also in areas where the country performs well, e.g., connectivity.

Recommendations for the roadmap

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

- **TARGETS:** (i) Propose targets and trajectories concerning VHCN, FTTP, 5G coverage, edge nodes, cloud, AI and data analytics separately, accessibility of key public services for citizens and businesses, access to e-health records and set trajectories for basic digital skills, ICT specialists, digital intensity of SMEs, unicorns using correct baseline value. (ii) Align the level of ambition of the target for ICT specialists with the EU target. (iii) Consider establishing national ambitions for technological leadership, competitiveness, and resilience to support EU-wide targets regarding semiconductors and quantum.
- **MEASURES:** (i) Supplement the roadmap with measures related to connectivity. (ii) Review the measures contributing to targets on skills and digitalisation of enterprises, consider setting up additional measures for ICT specialists and basic digital intensity of enterprises. (iii) Review the budget description of all presented measures, highlighting both national and EU sources. (iv) Provide more information on the implementation of digital rights and principles (and Digital Decade general objectives), including what national measures contribute to it. (v) Incorporate, where appropriate, measures reported through other channels in the roadmap.
- **CONSULTATION:** Consult key stakeholders, as outlined in the DDPP, before proposing the adjustment to the national roadmap.

Digital rights and principles

The Digital Decade Eurobarometer reveals that 43% of Portuguese respondents believe the EU protects their digital rights, slightly below the EU average of 45%. Confidence in digital privacy stands at 48%, also lower than the EU average. Concerns have risen significantly, with 60% worried about children's online safety, up 20 points since 2023, and 52% about control over personal data, up 15 points since 2023. Despite these concerns, 78% consider digital technologies important for accessing public services and 83% for connecting with friends and family, aligning with 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[5].

A competitive, sovereign and resilient EU based on technological leadership

To underpin its technological leadership and competitiveness, Portugal is equipped with excellent infrastructures, with a positive deployment dynamic, but it can still boost the digitalisation of its businesses. On infrastructures, Portugal is on track to reach 100% coverage for Gigabit connectivity (VHCN 94.2%, and 92.3% for FTTP) and 5G (98.1%) much earlier than 2030, the timing set for the EU target. 65.2% of Portuguese households are covered by 5G in the 3.4-3.8 GHz band, essential for enabling advanced applications requiring large spectrum bandwidth. However, the figure for fixed broadband subscriptions with download speeds of 1 Gbps or more is 9.1%, below the EU average of 18.5%. Portugal's overall good starting point is due to public initiatives, such as the recent 5G auction and the ongoing Gigabit tender, combined with the dynamism of private operators. On the other hand, the indicators on the digitalisation of enterprises (basic digital intensity of SMEs and take-up of data analytics, AI and cloud) point to a performance below or equal to the EU average. SMEs are underperforming in the adoption of digital technologies, despite ample funding support offered by the Portuguese recovery and resilience plan and other sources of EU funding, and the vision established in the COMPETE 2030 programme. However, a strong agenda is in place to foster the growth of the start-up ecosystem. Portugal aims to step up its contribution to the EU's technological resilience and sovereignty with the recent strategy on

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

semiconductors, and the revision of its strategies and actions on advanced computing and AI. A whole-of-society approach to cybersecurity skills and capabilities is also contributing to this objective.

Recommendations – Portugal should:

- **CONNECTIVITY INFRASTRUCTURE:** Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.
- **SEMICONDUCTORS:** Continue efforts in the area of semiconductors including by proposing concrete actions and exploring synergies between the national strategy and the EU-level cooperation.
- **DIGITALISATION OF SMEs and UNICORNS:** (i) Intensify the existing measures in view of the ambitious target on the basic digital intensity of enterprises and the need to ensure continuity of support until 2030; (ii) Continue reinforcing the country's start-up and scale-up ecosystem, in particular by ensuring availability and effectiveness of adopted measures.
- **AI/CLOUD/DATA ANALYTICS:** (i) Envisage specific measures for the take up of cloud, AI and data analytics, such as reinforced collaboration between public and private sector and with academia to better match the potential of these technologies with the business needs; (ii) Stimulate the adoption of next generation cloud infrastructure and services by companies of all sizes, including by liaising with the Cloud IPCEI Exploitation office and/or the coordinators and the Member States participating in the IPCEI-CIS.
- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

Protecting and empowering EU people and society

Portugal is well equipped to deliver an inclusive digital transition, but sustained efforts will be required to continuously increase the population's level of digital skills and train ICT specialists. The population's level of at least basic digital skills is just above the EU average, showing limited progress in the past few years. The proportion of ICT specialists in employment is lower than the EU average, with a decreasing share of women in the profession. Over the last few years, Portuguese authorities devised multiple initiatives to enhance the digital skills of the population, including in the workforce; these include reforms and investments in the education system and the provision of other training initiatives. The ambition of the Digital Decade and national targets will require Portugal to further intensify its efforts in this domain. The digitalisation of public services remains close to the EU average, while the level of e-health maturity improved significantly and is now above the EU average. With measures supporting digitalisation of the health system, implementing e-ID schemes and supporting the modernisation of public administration, Portugal is on track to achieve the EU-wide targets. At the same time, it could do more to raise awareness among the population about the benefits of the solutions in place.

Recommendations – Portugal should:

- **BASIC DIGITAL SKILLS:** Intensify efforts including by evaluating the take-up of the current measures and the remaining needs in order to meet the ambitious target.
- **ICT SPECIALISTS:** Adopt additional measures for ICT specialists, including cybersecurity talent and promoting ICT studies and gender balance in the field.
- **DIGITAL PUBLIC SERVICES/e-ID:** Continue developing user-friendly e-Government

solutions and intensify efforts to promote their take-up, with particular attention to the e-ID.

- **E-HEALTH:** Make the data types of medical images and hospital discharge reports available to citizens through the online access service and, building on existing legal provisions, implement technical functionality for legal guardians and authorised persons to access electronic health data on behalf of others.

Leveraging digital transformation for a smart greening

Portugal is beginning to attach importance to twining the digital and green transitions. The Portuguese authorities have shown growing commitment to a more sustainable future, putting in place digital measures, such as paperless invoicing or energy efficiency tracking, to support more resource-efficient public administration, enterprises and individual lives. On the objective of making the ICT sector more environmentally friendly, most of the players in the telecoms sector are carrying out sustainability reporting, which makes it possible to track improvements in the connectivity sector. However, a more comprehensive approach in this area may be necessary.

Recommendations – Portugal should:

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

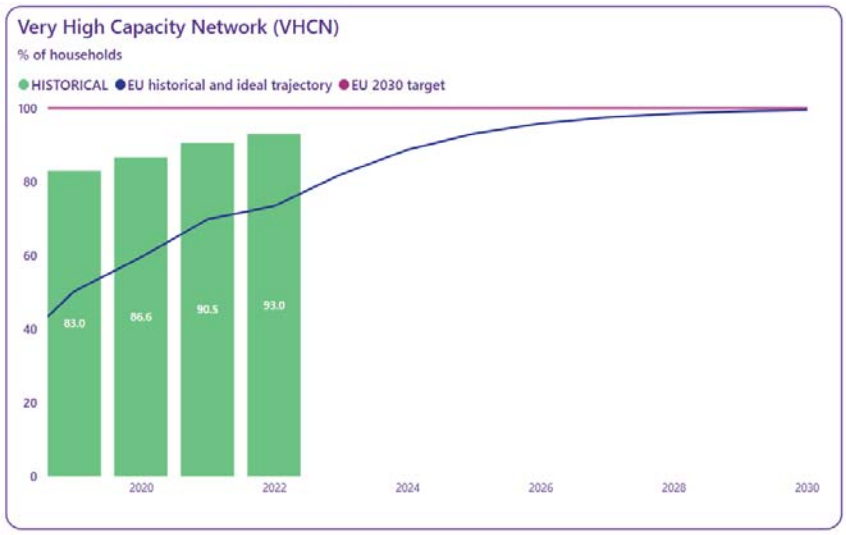
2 A competitive, sovereign and resilient EU based on technological leadership

With significant support from EU funds, Portugal is giving increasing attention to digitalisation to boost its productivity, competitiveness and resilience. Efforts are being made both to foster the growth of the digital start-ups ecosystem and to bring digital technologies to enterprises operating in other sectors of the economy. This transformation is possible thanks to an excellent gigabit infrastructure and 5G coverage that reaches almost 100% of the territory. With important investments in cybersecurity competences and tools, the government is increasingly contributing to ensuring sovereignty and resilience of both the economy and the public administration.

2.1 Building technological leadership: digital infrastructure and technologies

Portugal has been very active in deploying connectivity infrastructures, translating into a good starting point for reaching the 2030 target. Both gigabit and 5G networks should reach 100% coverage earlier than 2030, making it possible to decrease the geographical divides in a territory with sizeable rural areas. Portugal is also developing strategies to boost the potential for innovation in the most advanced technologies.

2.1.a Connectivity infrastructure (gigabit)

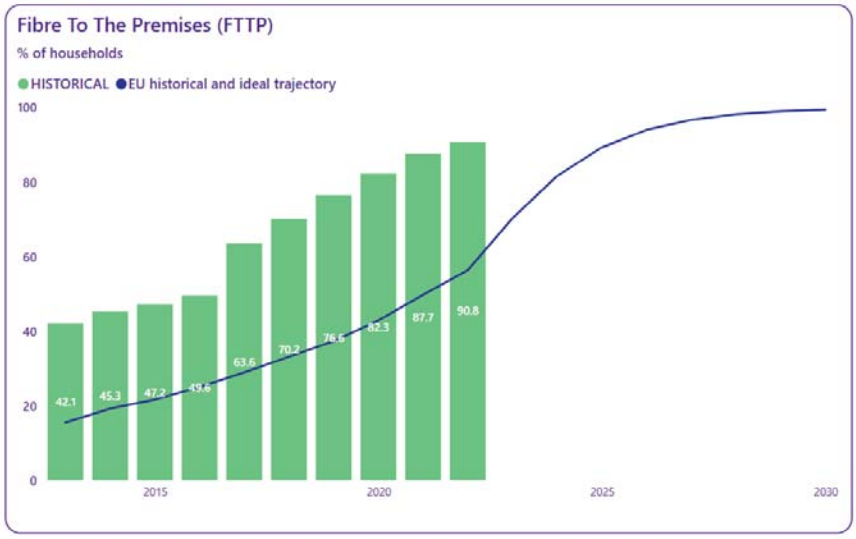


2023 state of play and recent progress

	Country level	EU level
FORECAST		82.0
DESI 2024	94.2	78.8
AVERAGE ANNUAL GROWTH %	1.2	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	92.3	64.0
AVERAGE ANNUAL GROWTH %	1.7	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

Portugal brings a very positive contribution to the EU's Digital Decade gigabit target and shows a positive dynamic for its last stretch to achieving it. The Very High-Capacity Network (VHCN) and Fibre to the Premises (FTTP) coverages are both well above the EU average. At 94.2%, VHCN coverage is very high and well above 78.8% at the EU level. At 92.3%, FTTP coverage is almost a third higher than the EU level value of 64.0%. The annual growth rate was positive, with 1.7% for FTTP deployment and 1.2% for VHCN. VHCN rural coverage (71.4%) is also higher than the EU average (55.6%), showing that efforts to close the gap between urban and less populated areas are bearing fruit. Portugal's good performance is further evidenced by the fact that 89.7% of households with fixed broadband subscriptions enjoy internet with download speeds of 100 Mbps or more. 9.1% of households have fixed broadband subscriptions with download speeds of 1 Gbps or more, lower than the EU average of 18.5%.

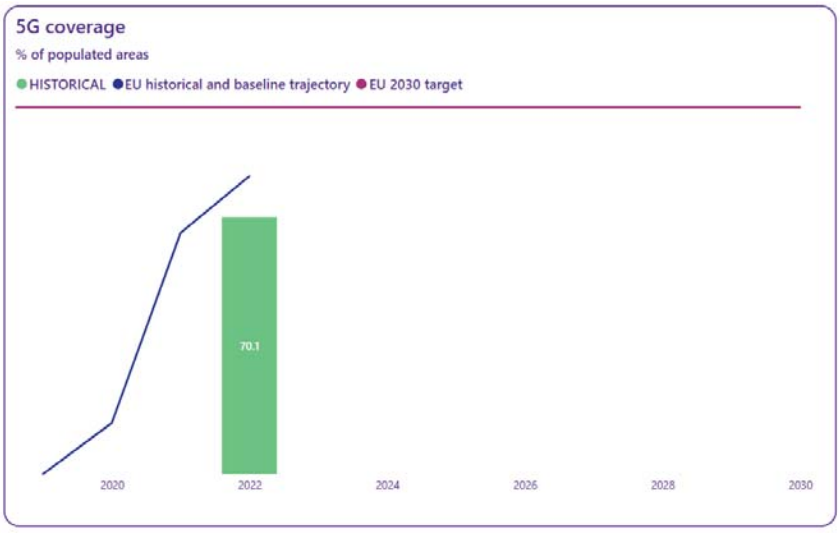
Portugal has not presented a national target to achieve gigabit connectivity for all. However, at its current performance, Portugal is already contributing significantly to reaching the EU target of 100% fibre VHCN by 2030 and can reasonably expect alignment with the EU level of ambition. Nevertheless, the inclusion of a trajectory and measures in the roadmap could not only guide the efforts on the last stretch to full coverage but also give example to the Member States which progress more slowly.

Recent developments are keeping Portugal on the right path to ensuring gigabit connectivity across its territory. At the end of 2023, Portugal launched a public tender for the installation, management and operation of VHCN providing download speeds of at least 1 Gbps and upload speeds of at least 150 Mbps in white areas. Some 417 000 residential and non-residential premises should be covered by this investment. Approximately half of the total amount of investment, EUR 172 million, has already been approved for this purpose under EU State aid rules. The identification of white areas was facilitated by GEO.ANACOM, a platform operating since October 2023 and containing geographic information on network coverage. VHCN installation will need to be completed within 3 years in line with an accumulated coverage rate of buildings for each year.

To foster effective competition and incentivise further roll-out of networks, in December 2023 ANACOM, the Portuguese electronic communications regulator adopted a number of decisions. These were: (i) a decision on the analysis of the markets for access to physical infrastructures, wholesale local access at a fixed location and wholesale central access at a fixed location; (ii) a decision on the analysis of the market for wholesale access to dedicated capacity; (iii) a decision on the analysis of electronic communications markets for leased lines' trunk segments.

With its steady development and good starting point, Portugal is in a very favourable position to achieve the gigabit (VHCN and FTTP) coverage targets within the timeframe of the Digital Decade. Setting a clear trajectory as well as embedding existing and new measures in the roadmap to achieve 100% gigabit connectivity could help support this goal.

2.1.b Connectivity infrastructure (5G)



2023 state of play and recent progress

	Country level	EU level
FORECAST		
DESI 2024	98.1	89.3
AVERAGE ANNUAL GROWTH %	40.0	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

Portugal brings a positive contribution to the EU's Digital Decade target for 5G, while demonstrating a very strong dynamic. At 98.1%, the 5G coverage in Portugal is well above the EU average of 89.3%. With 40% annual growth since last year's report, when the country scored below the EU average, 5G deployment is very intensive, even compared to the average annual growth in the EU, which is equal to 9.8%. In 2023, 5G in the 3.4-3.8 GHz band, essential for enabling advanced applications requiring large spectrum bandwidth, covered 65.2% of Portuguese households, a figure above the EU average of 50.6%.

Portugal has not presented a target value for 5G. At the same time, with the recent progress and a generous starting point, it is already very close to reaching the EU target of 100% 5G coverage. Hence, Portugal can easily meet the highest level of ambition.

Significant private investment has been made in mobile network coverage. In accordance with the obligations of the 5G auction concluded in 2021, by the end of 2024 all low-density parishes and all parishes in the autonomous regions of Madeira and Azores should have improved in their mobile network coverage. This should translate into mobile broadband provision for each of those parishes of a mobile broadband service with a speed of 100 Mbps (NOS and Vodafone) and 50 Mbps (MEO), covering at least 75% of the parish's population. By the end of 2025, the coverage of these territories is expected to be of at least 90%.

Portugal is contributing to the implementation of 5G cross-border infrastructure. In January 2023 the European Commission awarded two **5G cross-border corridor** projects between Spain and Portugal (Salamanca-Porto-Vigo and Mérida-Évora). The work will be completed by the end of 2025, paving the way for connected vehicles, more efficient emergency and logistics operations, and 5G services for drivers and passengers in rural areas. These infrastructures are seen as pivotal to boost connected and automated mobility and to strengthen the digitalisation of rail operations.

In view of its excellent performance and high probability to achieve the Digital Decade target for 5G, Portugal's inclusion of a national target, a trajectory and the relevant measures in the roadmap could not

only guide its final efforts towards full coverage but also serve as an example to Member States that are progressing more slowly.

2.1.c Semiconductors

Semiconductors are becoming a priority for Portugal. At the end of 2023 the Portuguese Strategy for Semiconductors was approved with a maximum national budget of EUR 121 million for 2024-2027. These ambitions were not included in the roadmap.

Portugal is also involved in European initiatives related to semiconductors. Two Portuguese private companies are participating in the important project of common European interest (IPCEI) on Microelectronics and Communication Technologies. In addition, the Portuguese Foundation for Science and Technology (FCT) continues to participate in the newly established **Chips Joint Undertaking**, funding national beneficiaries with winning bids in this partnership.

With its new strategy, Portugal can contribute to the EU's objective of sovereignty in the semiconductors sector. The State of the Digital Decade report 2023 encouraged Portugal to sustain its efforts on semiconductors in order to help the EU become a strong market player in that area. The national strategy is an important step towards addressing this recommendation.

2.1.d Edge nodes

Portugal has deployed an estimated 19 edge nodes out of 1186 in the EU in 2023. Despite edge computing being a critical enabler of AI, future networks roll-out, and the Internet of Things, for the time being, no national trajectory was set for edge nodes in the Portuguese roadmap to contribute to the EU target of 10 000 climate-neutral and secure edge nodes.

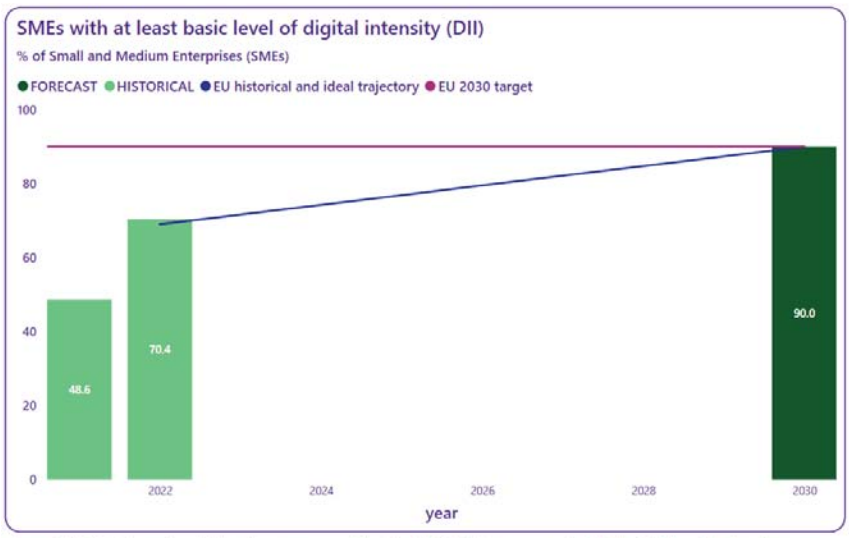
2.1.e Quantum technologies

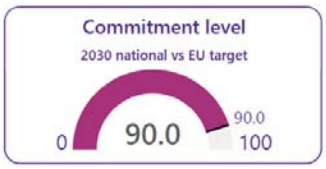
Portugal is actively participating in the European High-Performance Computing Joint Undertaking (EuroHPC), including on quantum. As part of EuroHPC, **Deucalion,** a petascale supercomputer installed at the Minho Advanced Computing Centre (in the municipality of Guimarães, Portugal) was inaugurated in 2023. In 2024, the first EU and Portuguese projects will be tested on the supercomputer, with a focus on AI and quantum. Portugal is also a partner in the **Mare Nostrum 5** pre-exascale supercomputer in Barcelona, with national researchers applying to use the shared European quantum computing resource. Supporting the operation of the two supercomputers will be possible thanks to a new investment entitled **'More Digital Science',** included in the November 2023 revision of the national recovery and resilience plan (RRP). This investment includes also establishing the National Advanced Computing Centre (CNCA) to enable more efficient work with the supercomputers, encourage research and development and pool human resources for this purpose. As part of EuroHPC, Portugal is committed to the **European Quantum Communication Infrastructure** (EuroQCI) initiative and is setting up national ultra-secure quantum communications technology infrastructure covering mainland regions, and the autonomous regions of Azores and Madeira, thereby expanding the EU network.

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

Portugal has adopted ambitious digitalisation of business targets and a range of measures to use technology to unleash the potential of its enterprises. The measures help SMEs develop basic digital intensity and adopt advanced technologies. They also aim to foster growth of start-ups.

2.2.a SME 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	53.6	57.7
AVERAGE ANNUAL GROWTH %	5.0	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

Portugal has untapped potential to contribute to the EU's Digital Decade target on digitalisation of SMEs while showing positive dynamic. With 53.6% of SMEs having at least a basic level of digital intensity, Portugal performs slightly lower than the EU average (57.7%). This represents annual growth of 5.0% over 2 years since 2021, the last comparable year that used a similar methodology to measure the digital intensity of enterprises. This progress is above the 2.6% average observed in the EU. In addition, around 16.5% of Portuguese SMEs sell online, below the EU average of 19.1%.

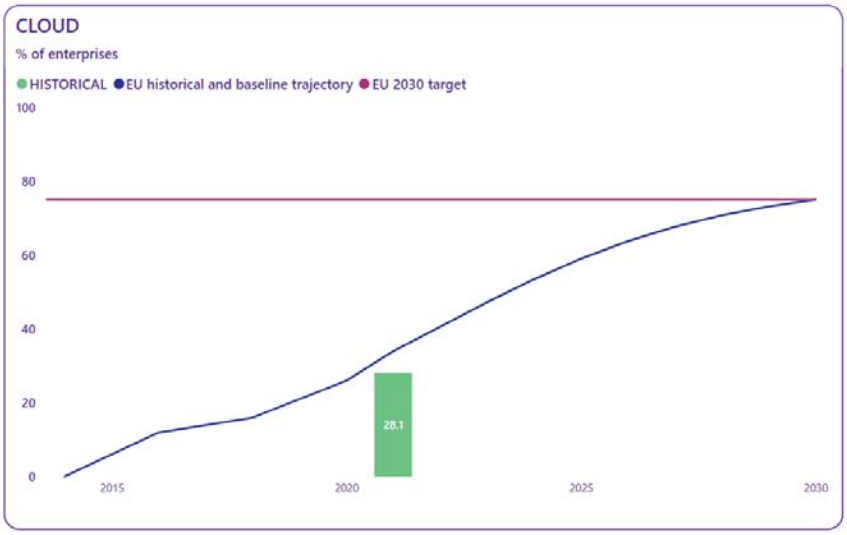
With the national target value of 90%, Portugal has demonstrated ambition equivalent to the EU target. However, no trajectory was presented. Taking into account the current rate of progress and an average starting point, reaching the target by 2030 would require a strong intensification of efforts.

Following the revision of Portugal's RRP in November 2023, the budget for several measures for enterprises was increased. The revision scales up the investment in Digital Commerce Neighbourhoods with an additional EUR 25 million. The measure supports shopping areas located in urban centres, suburban or rural areas by providing them with digital infrastructure and digital solutions. New investments benefiting enterprises in Madeira and Azores were also introduced. In addition, the RRP now aims to support 200 industrial research projects, experimental development, and organisational or process innovation. By the end of 2023, EUR 575 million from the Recovery and Resilience Facility (RRF) had already been allocated to digitally empower Portuguese enterprises.

The RRF support to businesses is also reflected in the Portuguese roadmap. The roadmap's narrative revolves around investments focusing on basic digital intensity of enterprises (through Digital Commerce Neighbourhoods and Digital Commerce Accelerators), development, testing and use of disruptive or advanced technologies (through the national test beds network and Digital Innovation Hubs (DIHs)) or related to both of the above targets (vouchers for companies). Overall, the measures complement each other well. They are also complemented by **COMPETE 2030**, a national programme to boost competitiveness of Portuguese businesses, supported by, among other things, EUR 40 million from the Digital Europe programme. The investments' duration is significantly shorter than 2030, with some measures ending already in 2025. This might be worth addressing to ensure continuous support of Portuguese enterprises and their competitiveness on the road to 2030 and beyond.

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

- **Cloud**



2023 state of play and recent progress

	Country level	EU level
FORECAST		47.3
DESI 2024	32.3	38.9
AVERAGE ANNUAL GROWTH %	7.2	7.0

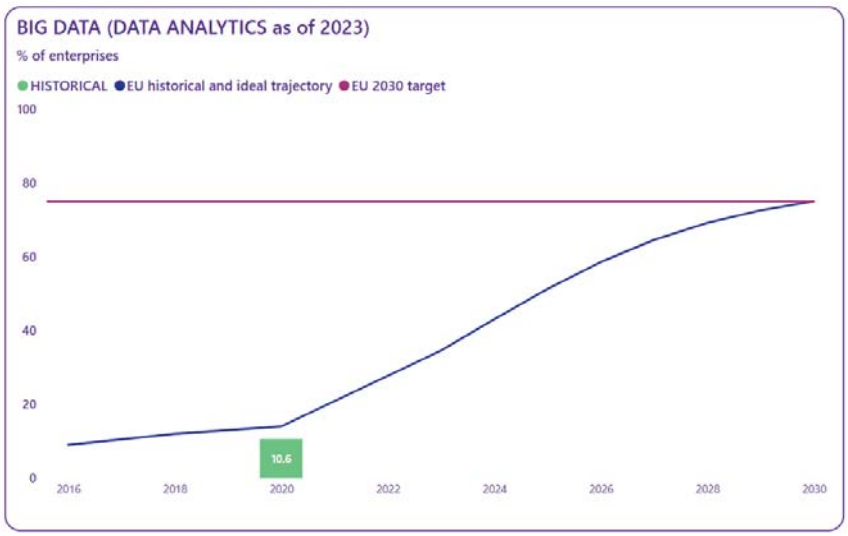
Average, annual growth is computed between the two most recent available data points

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

Portugal has untapped potential to contribute to the EU's Digital Decade target for cloud adoption and demonstrates a positive dynamic. At 32.3%, the take-up of cloud solutions by Portuguese enterprises is below the EU average (38.9%) but slightly exceeds its growth pace (7.2% in Portugal, versus 7% in the EU).

The Portuguese roadmap does not set a separate target for cloud adoption and does not present dedicated measures to foster the adoption of cloud computing by enterprises. However, Portugal could rely on existing general measures to foster cloud uptake and innovation, for example through the RRF-sponsored Digital Commerce Accelerators, entities that provide coaching, mentoring and funding support to start-ups and SMEs.

- **Data analytics (Big Data)[6]**



2023 state of play and recent progress

	Country level	EU level
FORECAST		34.6
DESI 2024	38.6	33.2
AVERAGE ANNUAL GROWTH %		

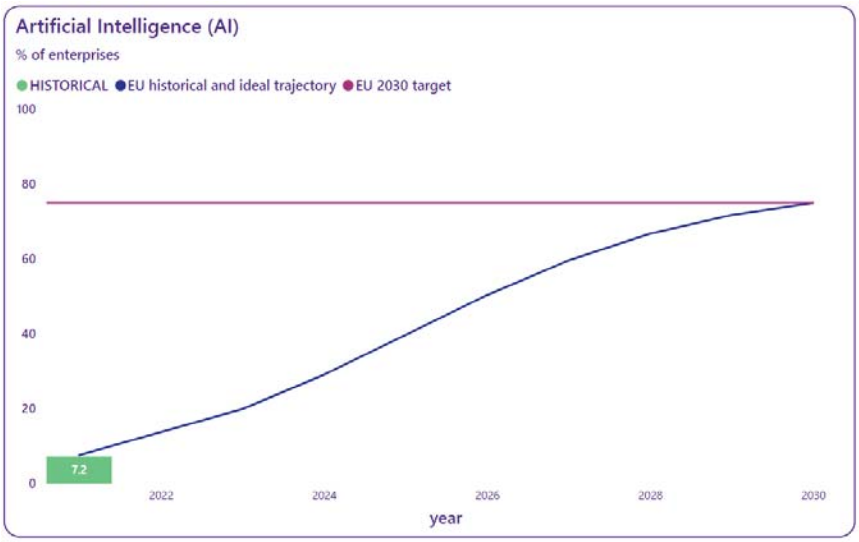
Annual growth cannot be computed in this case because Big Data was replaced by Data Analytics in 2023. The two indicators are not comparable.

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

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

On the use of data analytics by enterprises, Portugal brings a positive contribution to the EU's Digital Decade target, without assuming its own data analytics target. At 38.6%, Portuguese enterprises use data analytics tools more than their European counterparts (EU average: 33.2%). However, progress cannot be assessed since the definition of this indicator has changed.

- **Artificial Intelligence**



2023 state of play and recent progress

	Country level	EU level
FORECAST		19.9
DESI 2024	7.9	8.0
AVERAGE ANNUAL GROWTH %	4.7	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

Portugal brings a positive contribution to the EU's Digital Decade target for AI adoption and shows a positive dynamic. Few Portuguese enterprises are adopting AI solutions, posting a share of 7.9% in 2023, in line with the EU average of 8%. However, at 4.7%, Portugal's annual growth dynamic for is significantly higher than the EU average (2.6%).

The Portuguese roadmap does not set a separate AI adoption target but it presents measures that may foster the adoption of AI by enterprises. The National Digital Innovation Hubs Network, an ongoing investment funded by the RRF (until 2025) and the Digital Europe programme (until 2027) is intended to be an effective instrument for the digital transformation of companies and the public sector, providing testing, training, funding and incubation support. The technological aspects of the network focus on AI, high-performance computing and cybersecurity and, to a lesser extent, other technologies relevant to the digital transition process of SMEs and public administration. Currently 14 out of 17 DIHs provide services in AI, as it is the case also for almost all the test beds in Portugal. In addition, to a lesser extent, test beds and DIHs support the use of opportunities coming from data analytics, allowing for synergies between advanced technologies for businesses.

Additional opportunities for more comprehensive support may arise. The **National Artificial Intelligence Strategy** is currently being reviewed. This, along with an action plan in preparation, creates an opportunity to provide stronger support for safe and responsible AI uptake by enterprises.

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

Taking the three technologies together (adoption of either AI, Cloud, or Data analytics), Portugal's performance stands at 54.4%, just around the EU average of 54.6%. Overall, Portugal has untapped potential to contribute to this Digital Decade target. The level of ambition presented by Portugal in its roadmap is equal to the joint target of the EU, namely 75% of enterprises adopting one of the three: AI, cloud, or data analytics. Reaching this target by 2030 will require from Portugal sustained effort

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

Portugal has been making efforts to build a start-up friendly ecosystem. As part of the RRF investments, the country launched the start-up ecosystem mapping platform that is accessible via the Startup Portugal portal. The aim is to map 5 000 companies by 2025, thus facilitating identification of their scale-up potential as well as matching with investors, accelerators and public organisations. In addition, Startup Portugal provides information about other dedicated RRP measures, such as vouchers for start-ups and incubators and is included in the vision presented in the roadmap.

To bolster the start-up ecosystem, the 'Start-ups Law' was adopted in May 2023. The law introduces legal definitions of start-ups and scale-ups and establishes a tax incentives system aimed at promoting innovation and entrepreneurship. Its results remain to be seen in practice.

Currently Portugal counts one unicorn and has adopted the Digital Decade target of doubling the number of unicorns in its roadmap. To meet these ambitions, it plans to boost its innovative scale-up ecosystem by improving scale-ups' access to funding.

2.3 Strengthening cybersecurity & resilience

As companies rely increasingly on digital technologies, their risk of exposure to cybersecurity incidents is increasing, as is their need for preparedness in this area. In 2022 89.8% of Portuguese SMEs had some ICT security measures in place (EU average 91.8%). In the same year, a small proportion of all enterprises (11.3%) reported being insured against ICT security incidents (EU average 25%).

The **National Cyberspace Security Strategy 2019-2023** is a key policy measure for enhancing cybersecurity and resilience with a whole-of-society approach encompassing domains such as cybersecurity, cyberdiplomacy, cyberdefence and fighting cybercrime. The implementation of its action plan is monitored by the National Cybersecurity Centre (CNCS; the national cybersecurity authority and national cybersecurity certification authority). The CNCS is also responsible for multiple initiatives in the field funded under the RRP. The **C-Academy**, described in more detail in the section below on ICT specialists, is an advanced training for cybersecurity skills. The **Cybersecurity Competence Centres Network (C-Network)** aims to create a nationwide network of complementary 'one stop shops' designed to provide local guidance and services to the public administration, SMEs and other entities. The **Cybersecurity Digital Innovation Hub (C-Hub)** will foster research and development and introduce cybersecurity innovation and processes in the digital transformation of enterprises and public administration. These initiatives will come fully on stream in 2024, creating an environment conducive to cyber maturity and resilience.

Portugal is investing in raising the public's risk-awareness. With online courses offered by CNCS since 2019 on the National Platform for Mass Online Courses (the *NAU* platform), everyone can learn about secure interactions as a consumer or social media user, along with privacy considerations, thereby maintaining 'cyber hygiene'. The Portuguese authorities reported a strong interest outside Portugal, with Portuguese speakers outside the EU subscribing to the courses. The monitoring by the Cybersecurity Observatory enables public bodies, stakeholders and individuals to stay up to date with the cybersecurity landscape and align their efforts to foster cybersecurity.

Security of electronic communications infrastructure is a concern for the national administration and market players. Following an evaluation by the public authorities, telecom companies are investing significant sums in replacing equipment to comply with the security requirements set out in the EU 5G Cybersecurity Toolbox. Some of those companies work together with the CNCS also on the 'Cybersecurity Alliance' which gathers large economic operators across various sectors to promote a national culture of cybersecurity.

The Portuguese authorities consider that international collaboration is key to achieving collective resilience. Portugal participates in a consortium involving Spain, Italy, Luxembourg, Romania, The Netherlands, and Austria to implement the **ENSOC-CROSSBORDER PLATFORM**, a cross-border platform to improve the detection of cybersecurity threats and share cybersecurity data in the EU. The consortium responded to a call for expression of interests in 2023. The project, which received initial support of EUR 5 million under the Digital Europe programme, will strengthen common capacities to detect, analyse and prevent cyberthreats. The ENSOC platform, which started operations on 1 January 2024, is expected to contribute to EU leadership and strategic autonomy in the field of cybersecurity.

3 Protecting and empowering EU people and society

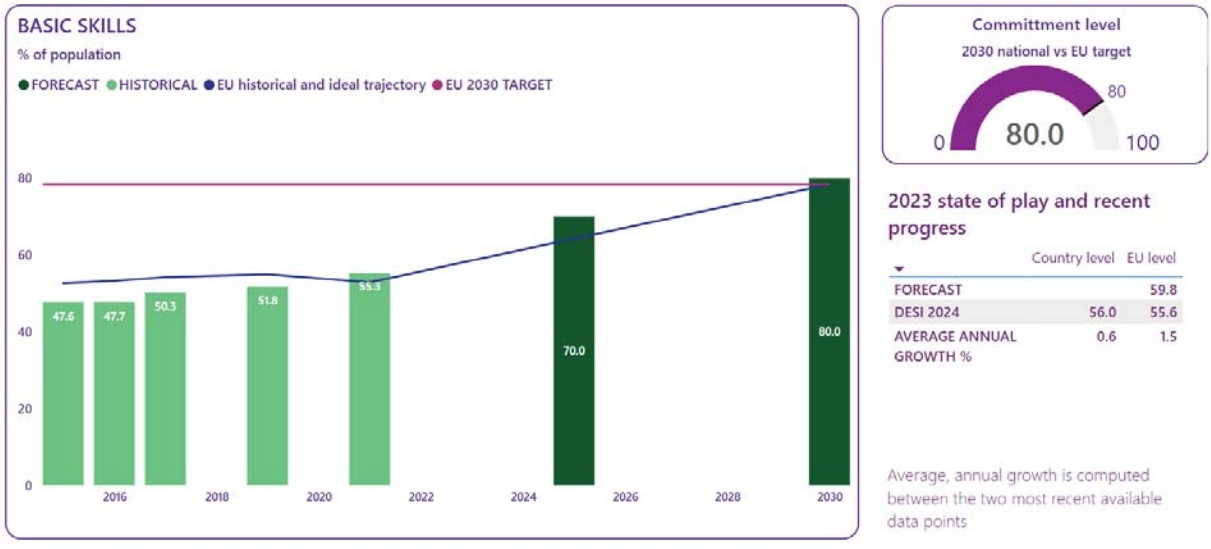
3.1 Empowering people and bringing the digital transformation closer to their needs

Digital education and digital inclusion are priorities for Portugal. The INCoDe 2030 initiative and investments under the national RRP and other EU funds focus on improving the digital skills of the Portuguese population across generations, to ensure no one is left behind in the digital transformation and to create a future-proof job market. By improving the population's skills in areas ranging from media literacy to cybersecurity knowledge, Portugal also aims to support a trusted and secure online environment. However, shortage of ICT specialists and the gender gap in this sector remain issues and require further action. In recent years, significant attention has been paid to the digitalisation of public services, including in the health sector. Many measures have already been implemented and innovative projects are ongoing, such as a generative AI virtual assistant for public services.

According to the Digital Decade Eurobarometer, 74% of the Portuguese population considers that the digitalisation of public and private services is making their daily lives easier; this figure is similar to the EU average (73%). However, the same survey found that only 62% of them think that by 2030 digital technologies will play an important role in accessing education and training opportunities, a figure below the EU average (75%). Perspectives on the importance of digital technologies for accessing or receiving healthcare services (77%) and accessing public services online (78%) remain slightly below the EU averages (79% and 83% respectively).

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

Portugal has untapped potential to contribute to the EU's Digital Decade target of 80% of the population having at least basic digital skills. With 56% of the Portuguese population having at least basic digital skills in 2023, Portugal ranks just above the EU average of 55.6%. However, there is a limited dynamic in this indicator as the growth rate of 0.6% since 2021 is slower than the EU rate (1.5%) over the same period. On the other hand, 29.9% of people in Portugal have above-basic digital skills, slightly more than the EU average value of 27.3%.

Portugal is committed to enhancing the digital skills of its population. Investments and reforms presented for this purpose in the national roadmap fall under the national recovery and resilience plan or the National Digital Skills Initiative INCoDe 2030[7], partly funded by the European Social Fund. Many out of the more than 20 measures envisaged by the roadmap target specific demographics. One example is **'I Am Digital' (*Eu Sou Digital*)**, a programme directed at promoting the digital inclusion of adults, based on a national network of young volunteers and training centres. The programme content includes, among others, the creation and management of e-mail accounts, how to search online, how to consult and use digital public services and how to access services such as home-banking or social networks. Since its launch in 2021, the programme has trained 12 975 people, calling on the support of more than 6 532 mentors registered and certified for this purpose and working at a total of 255 centres across the country. The programme's ambition was to train 200 000 adults by 2023. One example of an initiative offering skills opportunities to youth is **'Young + Digital' (*Jovem + Digital*)**, a training programme targeted at unemployed young adults aged between 18 and 35, the aim being to increase their employability through the acquisition of digital skills. Since 2020, 20 609 young people have been trained.

Portugal also puts emphasis on the digital transformation of formal education. The '**Digital School' (*Escola Digital*)** programme, funded by the RRF, was launched to guarantee universal distribution of computers with an internet connection, train teachers and provide digital educational materials. By the end of 2023, 1 050 000 laptops had been purchased for loan to teachers and students in public primary and secondary schools, 94 515 public school teachers were trained in basic or more advanced digital skills and 2 000 classrooms equipped with new projectors. Moreover, Portugal promotes initiatives targeted at the acquisition of specific digital skills from early years. The **'ubbu'** project promotes digital literacy, by teaching competences such as problem-solving and programming. It uses new learning methods, provides teacher training and teaching materials. In 2023, the project reached 49 200 young people and 1 500 teachers.

The general public in Portugal can improve its intermediate and advanced digital skills through online training courses. 13 massive open online courses (MOOCs) are freely available on the *NAU* platform to all, whether individuals, institutions, or companies. By September 2023, 25 860 people had signed up for these courses and 237 473 users were registered on the platform.

The 'Digital Spot' (*Ponto Digital*), the Portuguese part of the Digital Skills and Jobs platform, is a national repository of initiatives, actions, studies, resources, events, news, training, jobs, and financing opportunities in the field of digital skills. By the end of 2023, 92 digital training initiatives had been published on the platform, along with1 179 training actions. An advertising campaign launched at that time exponentially increased the number of visitors to the Digital Spot.

Despite extensive action in this field, given Portugal's current progress rate, it might not achieve its target by 2030. The national target is set at 80%, which is in line with the EU target for 2030. The target value is based on the indicators set out under the INCoDe 2030 programme. As a result, the presented KPI differs from the Digital Decade one in terms of baseline value. The roadmap includes an intermediate target of 70% for 2025 but does not include national trajectories. In any case, at Portugal's current rate of progress, reaching the target by 2030 would require intensified efforts towards empowering the public and equipping them with the skills necessary for a successful digital transformation.

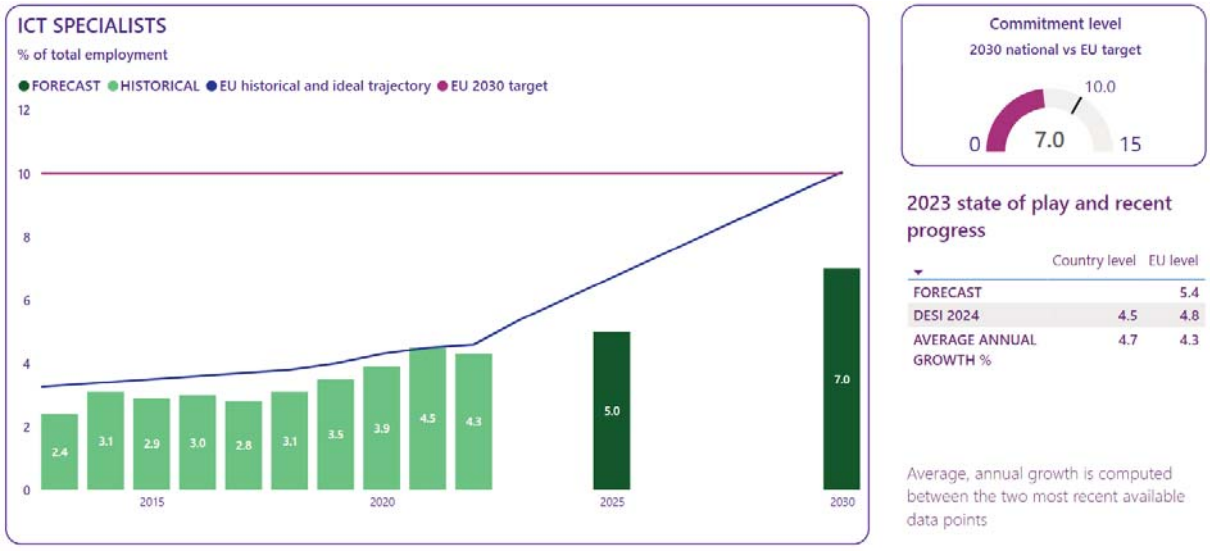
The roadmap measures supporting basic digital skills will largely contribute to the target until 2030 or until the end of RRF funding in 2026. While most of the measures are old, one new measure is the Digital

[7] Established in 2017, INCoDe 2030 as an inter-ministerial programme that encompasses boosting digital skills in formal and informal education, for businesses and public administration, responding also to general objectives of the Digital Decade and aligned with other digital national initiatives.

Skills Observatory. It monitors the INCoDe.2030 programme, using selected indicators to monitor the evolution of digital skills in Portugal. The roadmap measures are directed towards a diversified audience ranging from students and teachers to employees at various management levels, the unemployed, and employees in the public administration. The roadmap acknowledges the challenge of digital inclusion across the country's territory. The measures seem to target people across demographics in line with the 2023 State of the Digital Decade report's recommendations. However, it might be useful to evaluate why some of the measures like 'I am digital' have had a rather modest take-up compared to envisaged targets, and to adjust them accordingly.

Given Portugal's current performance and dynamic, the measures reported in its roadmap might require intensification. This could start with stronger promotion activities and implementation to meet the level of ambition of 80% of the population having at least basic digital skills.

3.1.1.b ICT specialists



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

Portugal has untapped potential to contribute to the EU's Digital Decade target for ICT specialists. The number of ICT specialists in Portugal in terms of their share of employment is 4.5%. This is slightly below the EU average of 4.8% but **shows a positive dynamic.** The figure represents a growth of 4.7% from last year, on a par with the progress observed on average across the EU (4.3%). In absolute numbers, Portugal hosts 220 200 ICT specialists, 10 100 more than last year. Women account for 20% of ICT specialists, showing a slight downward trend (DESI 2023: 20.3%; DESI 2022: 21%) but remaining above the EU average (19.4%). The number of ICT graduates in Portugal remains one of the lowest in the EU, with 2.5% students graduating from ICT studies, same percentage as last year.

Portugal continues implementing programmes aimed at the qualification of ICT specialists, as mentioned in the 2023 report. The '**UpSkill'** programme aims to convert employed or unemployed people into ICT professionals through intensive theoretical training of 6 to 9 months, followed by practical training and professional integration into a company. The 2023 edition had 485 candidates selected and 31 companies involved, slightly down compared to the previous two editions, which involved 1 232 candidates and 102 companies altogether. The '**C-Academy'** training programme funded by the RRF provides advanced skills to new cybersecurity and information security specialists from both the public administration and the private sector. Offering 44 courses in various formats, in 2023 its pilot version certified 116 people, with the ambition to train 9 800 by the first quarter of 2026.

The 2030 target established by Portugal for ICT specialists is 7%, which is lower than the 10% target value for the EU. Portugal has a 5% intermediate target for 2025 but no trajectory. The country has also an additional target of 30% of women among total ICT specialists in employment by 2030 and 20% in 2025. In accordance with the INCoDE 2030 indicators incorporated into the roadmap, Portugal also adopted an 8% target for ICT graduates.

Portugal is still developing its vision on training and attracting ICT specialists. New measures are reforms rather than investments, as they involve preparation and monitoring of national strategies and action plans. The Advanced Computing Portugal 2030 and the National Artificial Intelligence Strategy are undergoing review. Both strategies include strengthening of qualifications and retention of students, managers, and employees in the public administration or private companies, thanks to strengthening of their digital skills, especially advanced computer skills and those involving AI technologies. The strategies on data and Web 3.0 are under preparation and can be expected to refer to professionals in these areas. The roadmap measures are programmed to last mostly until 2030 (two until 2026). The Portuguese authorities are aware of the challenge involved in achieving a high and gender-equal number of ICT specialists but there are no measures designed to tackle this issue, such as a measure targeted at increasing the number of ICT graduates.

The recommendations from the 2023 State of the Digital Decade report remain valid; efforts are still needed to increase enrolments in ICT studies and incentivise future ICT specialists. This will involve targeted actions, for example providing scholarships and other funding.

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

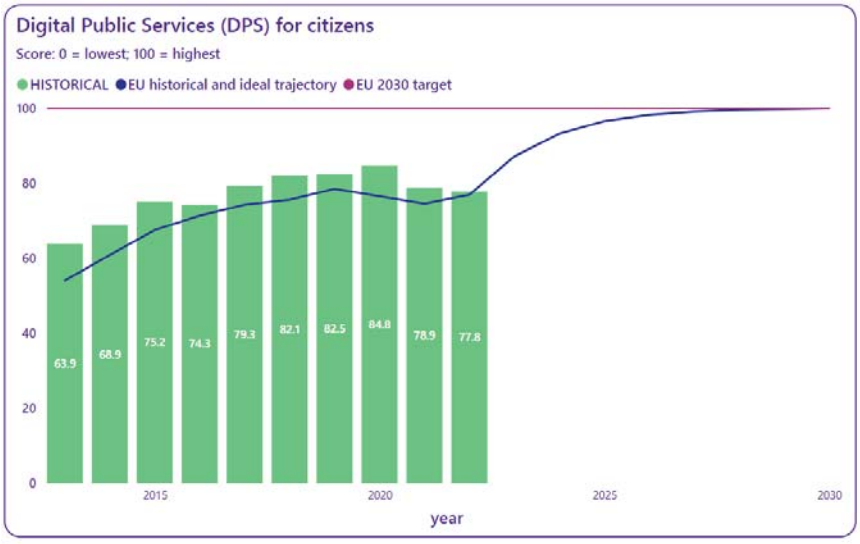
3.1.2.a e-ID

30.4% of Portuguese population used e-ID for private purpose within the last 12 months, markedly less than the EU average (41.1%). The two Portuguese e-ID schemes: Digital Mobile Key (DMK) and Citizen Card (e-ID card) both provide a high level of assurance compliant with the Regulation (EU) 910/2014 on electronic identification (eIDAS Regulation). From January 2023, the Digital Mobile Key can be activated using biometrics. Currently there are more than 3.3 million active DMKs. Access to a growing number of public services can be facilitated through the ID.gov application. For example, since October 2023, the app can be used to automatically renew the driving licence - licence holders receive a notification 5 months before the expiry date and only need to pay for the renewal, receiving the new licence in the app and the physical card by post. In December 2023, new legislation was adopted, clarifying the equal legal and probative value of documents presented through the ID.gov application. Efforts are being made to make digital signature (Professional Attributes Certification System (SCAP)) available to all public servants.

Portugal participates in the European consortia POTENTIAL (PilOTs for EuropeaN digiTal Identity wALlet) and DC4EU (Digital Credentials for Europe). The POTENTIAL consortium, which has received EUR 16 million in EU subsidies (through the Digital Europe programme), is a 'large scale pilot' aimed at piloting a prototype European Digital Identity Card through six use cases, of which Portugal has been actively participating in five: authentication in digital public services (national and cross-border); opening a bank account, mobile driving licence/vehicle rental; qualified remote signatures; and e-health/e-prescription.

The goal of widespread adoption of digital identity in Portugal is supported by six roadmap measures. Those measures are part of the national RRP with their total budget of almost EUR 25 million. According to the roadmap, a similar amount will be needed after the RRP funding to continue seamless functioning of the e-ID scheme.

3.1.2.b Digitalisation of public services for citizens and businesses



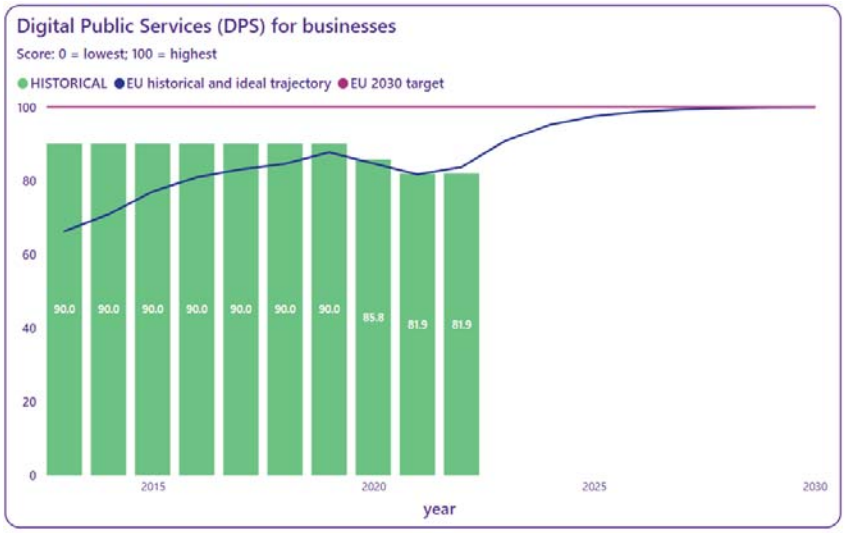
2023 state of play and recent progress

	Country level	EU level
FORECAST		87.2
DESI 2024	81.5	79.4
AVERAGE ANNUAL GROWTH %	4.8	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	81.9	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

Portugal brings a rather positive contribution to the EU's Digital Decade target for digital public services while also showing positive dynamic. On public services for citizens (81.5), Portugal ranks above the EU average both in absolute value (79.4) and annual growth (4.8% in Portugal versus 3.1% for the EU as a whole). On public services for businesses, Portugal has untapped potential to contribute the target, as it ranks below the EU average (81.9 versus 85.4) and stagnated compared to last year.

To further support the population in accessing public services online, in May 2023 the generative AI Virtual Assistant (VA) pilot was launched on ePortugal, the Portuguese single digital gateway. Based on ChatGPT 3.5 turbo, an avatar answers in writing and by voice to queries from the public on e-ID questions. Since its launch, e-ID activations have increased by 10%. Currently interacting in Portuguese, the next phases involve availability in 16 languages and an 'omnichannel' character, i.e., redirection to a human assistant. The aim is to expand the number of services supported. In addition, intensive efforts are under way to promote inclusive digital services. 2023 saw the creation of an ecosystem of web accessibility evaluation tools, such as (i) the **Portuguese Observatory of Web Accessibility**, which enables public bodies

to monitor their websites; (ii) the **Accessibility Declaration Generator**, which helps entities publish the mandatory declarations; (iii) the **Access Monitor** which is a web accessibility evaluator. These tools help public bodies comply with EU law, follow best practices, and enhance user experience.

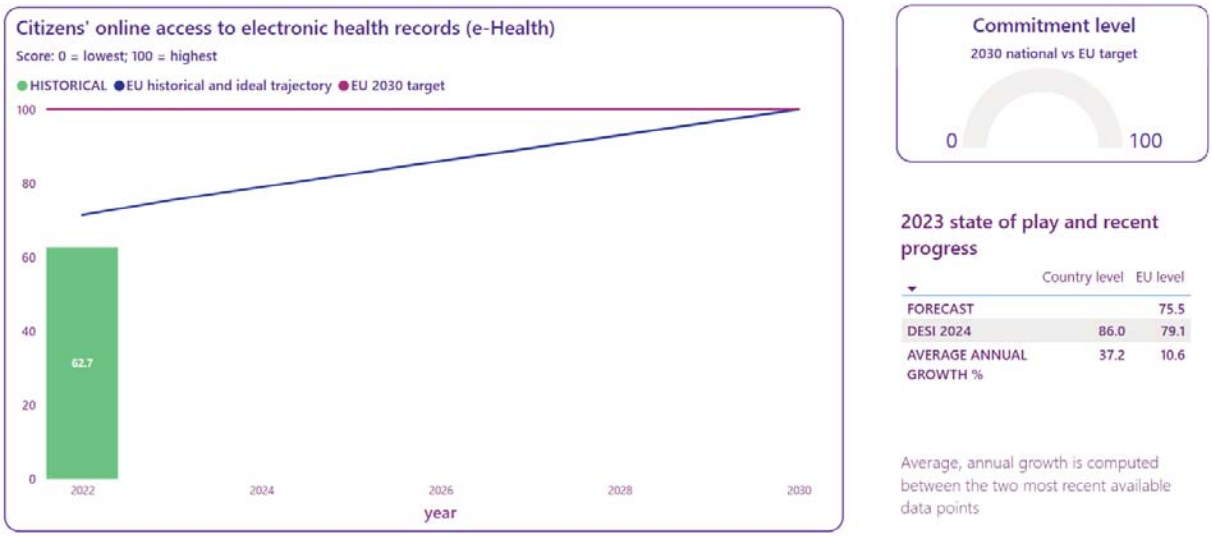
To relieve administrative burden in the registration of new businesses, the 'Enterprise 2.0' (*Empresa 2.0*) project was launched. The platform can be used to set up single-member limited companies, limited liability companies and public limited companies, using pre-filled information on the members. Having agreed to participate in the new company, future members only need to authorise the use of their data in the public administration databases, ensuring a fully digital experience.

Portugal shows commitment to collaborating with other Member States to improve public services online. In 2023 it actively participated in the Horizon 2020-funded **Digital Europe for All (DE4A) consortium** that aims to facilitate migration towards European digital public services co-delivered across borders.

Portugal has not set a national target value for its contribution to the EU level target of 100% digital public services by 2030. Despite the rather positive current growth in digitalisation, a clear target and trajectory in the roadmap would be useful to make sure the country reaches the EU target by 2030.

With three roadmap measures referring to the digitalisation of public services, Portugal plans to continue mapping the key opportunities and challenges for modernisation of its public administration and enhance its efforts to digitalise key public services. With the National Strategy for the Digital Transformation of Public Administration in force since 2021, the planned transformation is steadily materialising into solutions that are making citizens' and businesses' interactions with the state easier.

3.1.2.c e-Health



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

Portugal brings a positive contribution to the Digital Decade e-health target while showing a very strong dynamic. In 2023 Portugal scored 86.0 for the overall e-health maturity, above the EU average of 79.1 and significantly higher than last year (62.7 in 2022). The growth of 37.2% (compared to the EU average growth of 10.6%) is one of the highest developments noted for this indicator across the EU. In 2023 54.6% of people in Portugal sought health information online, which is slightly below the EU average (56%).

Portugal has not set a target in e-health for 2030. However, given the recent developments reaching the EU level target at national level seems feasible provided continued efforts. A centralised, nationwide access service to e-health records is available in the country and estimated 80-100% of the population is technically able to access it. The online access service follows the guidelines on web accessibility. Most

categories of data are available to citizens on the platform in a timely manner, with the exception of medical images and hospital discharge reports not yet available to citizens. The electronic results and reports are considered to have a high maturity level. Most categories of healthcare providers are supplying data, the only exceptions being private rehabilitation centres and private mental health facilities.

Nevertheless, digitalising the health sector is a priority for Portugal, as evidenced by the Portuguese RRP's EUR 300 million investment dedicated to this target. The set of measures, planned to run until 2026, is based on four pillars: (i) investment in data infrastructures; (ii) simplifying, standardising and digitalising communication channels between individuals and health facilities; (iii) guaranteeing the mobility and usability of health information systems; and (iv) standardisation and generalisation of critical data in the system. As part of these efforts, the **Portuguese population has access to the SNS24 application. With nearly 8 million downloads, the application has been one of the most sought-after services in the country.** More than 390 SNS24 physical counters are in place to help citizens access digital health and telehealth services. Now focusing on the public healthcare system, it is planned to expand data exchange through SNS24 with private healthcare institutions.

Portugal is strongly committed to collaborating on e-health solutions in a cross-border context. In 2023 Portugal actively participated in 13 projects co-financed by the EU. Through the **MyHealth@EU** infrastructure, with active services for patient summary, e-prescription, and e-dispensation, Portugal has increased the number of pharmacies and hospitals ready for digital cross-border care. For example, at the end of 2023, 82% of public hospitals were digitally prepared for continuity of care across the EU.

As envisaged by the roadmap, other cross-border projects will improve the way healthcare is delivered in Portugal, making it more efficient, accessible, and patient-centred. The Xt-EHR (extended EHR@EU Data Space for Primary Use) joint action will lay the foundations for the technical specifications and guidance needed that could be used for preparing the future implementing acts on the primary use of electronic health data under the upcoming European Health Data Space Regulation. Other projects will support the advancement of interoperability (SNO-PT, EU-HIP), artificial intelligence (TEF-Health), and medical image analysis in oncology settings (EUCAIM).

The key developments of 2023 and measures reported in the roadmap show Portugal's strong commitment to making public services accessible to all. However, it still needs to tackle questions how to encourage the people in Portugal to make full benefit of the solutions in place, how to fine-tune them and to ensure their easiest and most intuitive use.

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

According to a 2023 Eurostat survey, **35.5% of the Portuguese population encountered hostile or degrading online messages in the last 3 months**, placing the country slightly above the EU average of 33.5%. Promoting public participation free from hate speech is one of the Guidelines for a National Plan on Media Literacy adopted by the Portuguese government in November 2023. The Plan will be developed and implemented by an interministerial commission with a budget line of EUR 300 000 earmarked for 2024. Other guidelines include cooperation between stakeholders to promote media literacy, civic participation in literacy initiatives, strengthening public trust in the media and encouraging content accessibility. The actions under the plan should contribute to safe and inclusive participation in the digital public space. The plan will seek to build on the already strong public perception of digital technologies as an enabler to engage in democratic life, as according to the Digital Decade Eurobarometer 73% of Portuguese population (EU average: 74%) believe that by 2030 they will be important in that respect.

Best practice: Generative AI virtual assistant

To further support the population in accessing public services online, in May 2023 the generative AI Virtual Assistant (VA) pilot was launched on ePortugal (the Portuguese single digital gateway). Based on CHATGPT 3.5 turbo, an avatar answers in writing and by voice to queries from the public on e-ID questions. Since its launch, e-ID activations have increased by 10%. While the pilot currently operates in Portuguese, the next phases involve availability in 16 languages and an 'omnichannel' character, i.e., redirection to a human assistant. The aim is to expand the number of services supported by this solution.

4 Leveraging digital transformation for a smart greening

Portuguese enterprises and people are generally sensitive to the green transition of the digital sector. In 2022, 63.9% of Portuguese enterprises with or more 10 employees considered the environmental impact of ICT solutions and devices when choosing them and applied some measures to reduce paper use or energy consumption of ICT devices. This figure is much higher than the EU average of 48.7%. On the other hand, recycling digital devices follows a similar pattern to other EU countries, with 9.7% of the individuals recycling their mobile phones, 10.4% their desktop computers, and 11.8% their laptops or tablets. According to the Digital Decade Eurobarometer, 82% of people in Portugal consider that ensuring digital technologies serve the green transition should be important for the public authorities. This figure is slightly ahead of the EU average of 81%.

The Portuguese roadmap does not present measures contributing to twinning the green and digital transitions. However, several environmental initiatives launched in 2023 can influence more sustainable digital choices by the national public administration and private stakeholders. For example, the green procurement strategy, **ECO360**, makes provision for: (i) all public administration bodies having a strategy or plan by 2030 for integrating environmental criteria into their procurement strategy; and (ii)half of all contracts for the purchase of goods and services including circularity criteria. This strategy may already influence choices relating to ICT equipment and digital services provided to public authorities.

Through the complementary programme for greening Portugal's supercomputer Deucalion, it will operate solely on renewable energy sources, contributing to the decarbonisation of advanced technologies in Portugal.

Work is also ongoing among several industry stakeholders to reduce the environment footprint of telecoms networks and cloud applications. Some electronic communications operators reported that their network was fully powered by electricity from renewable resources, or they had increased renewable energy use and lowered their greenhouse gas emissions.

Multiple digitalisation measures are directly supporting the green transition. One example is digital invoicing. With the e-invoicing initiative (*Fatura Eletrónica na Administração Pública* – FE-AP) launched in 2019, public authorities receive and process invoices electronically; this reduces paper waste while increasing the efficiency and transparency of the process. Dematerialisation of invoicing is also promoted among enterprises, through a RRP measure under investment entitled 'Catalyst for Digital Transition of Enterprises'.

Portugal uses digital tools to become resource efficient and increase energy literacy. The RePower chapter of the Portuguese RRP involves digitalisation by creating a one-stop-shop for the licensing and monitoring of renewable energy projects. **Barómetro ECO.AP** is a tool that supports the performance and monitoring of the ECO.AP 2030 public administration resource efficiency programme. This digital tool characterises and compares public bodies' consumption of energy, water and materials, energy production and greenhouse gas emissions. The Portuguese Energy Agency (ADENE) has created a set of publicly available digital tools which enable more sustainable choices. An online platform **CINERGIA** – Energy Information Centre, provides educational information on the energy sector to the public. Via ADENE's **casA+** one-stop-shop platform consumers (homeowners or tenants) receive information about their domestic energy and water usage and how to increase its efficiency through renovations. Moreover, the **Poupa Energia** platform enables consumers to compare electricity and natural gas tariffs to make an informed choice or change energy supplier, thus promoting efficiency in energy consumption.

Portugal is a founding member of the LDT CitiVERSE EDIC. The LDT CitiVERSE initiative aims to connect existing local digital twins across Europe to support the green transition, for example by advancing generative AI applications in smart cities, including simulations addressing the impact of changing traffic conditions on air quality, decarbonisation and congestion.

Annex I – National roadmap analysis

Portugal's national Digital Decade strategic roadmap

Portugal submitted its national strategic roadmap on 7 December 2023. The roadmap is based on the National Strategy for the Digital Transformation of Public Administration for 2021-2026. As such, there was no stakeholder consultation on the roadmap. However, stakeholders were involved in the underlying strategy, initiatives and some of the described measures. As the roadmap has not been endorsed at political level, it is not publicly available.

The national strategic roadmap includes **five national target values** for 2030 The target value for at least a basic level of digital skills is in line with the EU target, while the value for ICT specialists in employment is lower than that of the EU (7% versus 10%). Portugal also adopted an additional target of having 30% of women among total ICT specialists in employment by 2030. The roadmap includes intermediate targets for 2025 but does not include national projected trajectories. Portugal used the EU-level targets as its own also for digital intensity of enterprises (90%), joint uptake of AI/cloud/data analytics (75%) and unicorns (a doubling of their number). However, the targets are not accompanied by trajectories.

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

Digital Decade Target/objective	Budget (EUR million)	Number of measures
Connectivity Gigabit	-	-
Connectivity 5G	-	-
Semiconductors	-	-
Edge nodes	-	-
Quantum computing	-	-
SME take up	470.0	5
Cloud/AI/Big Data uptake	60.0	1
Cloud only uptake	-	-
AI only uptake	-	-
Big data uptake	-	-
Unicorns	-	-
Basic Digital Skills	0.0	21
ICT Specialists	0.0	6
eID	24.5	6
Key Public Services	0.1	3
e-Health	299.9	4
Objectives	-	-
Total	**854.5**	**46**

The roadmap submitted by Portugal describes **policies, measures and actions supporting most of the targets. Several measures address Digital Decade objectives such as cybersecurity.** More than half of the roadmap measures supports targets for basic digital skills and ICT specialists, while many support basic digital intensity of SMEs, with some measures supporting the take-up of advanced technologies by enterprises, e-ID and e-health solutions. Measures supporting gigabit connectivity and 5G are absent. The timespan of most measures is projected to run until 2030 or coincides with the timeframe of structural funds and RRP implementation. This is because most of the budget specified in the roadmap comes from

those sources of funding, with prominence given to the RRF. Assessing the scale of measures was not always possible as funding information was frequently lacking.

The roadmap measures seem to **represent a continuation of the existing national digital strategy supporting development of basic and advanced digital skills across demographics and efforts to ensure complementarity of measures available for digitalisation of enterprises.** The measures respond to challenges identified in the roadmap's state of play, addressed under the RRF and covered under the Digital Decade Policy Programme recommendations. New policies, measures and actions relate to technological leadership by creating or updating national strategies and action plans concerning AI, data, Web 3.0 and advanced computing. The measures presented cannot be contextualised without national target values determining Portugal's level of ambition.

Overall, Portugal's roadmap partly reflects the efforts needed in all dimensions of digitalisation. However, some aspects may require more effort. For example, given the ambitious targets at EU and national levels, the measures on digital skills could benefit from a re-focus, especially for ICT specialists, since Portugal needs to roughly double the current number of ICT professionals. Also, the resources dedicated to the digitalisation of enterprises (both basic intensity and adoption of advanced technologies) could be increased given the delay observed in Portugal compared to the EU. Finally, to ensure better coordination at EU level, a comprehensive roadmap outlook remains crucial also for the fields where Portugal performs well, such as connectivity.

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

MCP and EDICs

Portugal is a member of the already established Local Digital Twins towards the CitiVERSE EDIC (LDT CitiVERSE EDIC) and of the European Blockchain Partnership and European Blockchain Services Infrastructure (EUROPEUM-EDIC). Portugal is also an observer in the already established Alliance for Language Technologies EDIC (ALT EDIC). The country is developing the Statute and other relevant documents of the possible future Cybersecurity Skills Academy and the Genome EDICs, within informal working groups. It is also engaging in discussions on the setup of the possible future Cancer Image Europe (EUCAIM) EDIC, within an informal working group[8].

Portuguese companies participate in the IPCEI on Microelectronics and Communication Technologies (IPCEI-ME/CT).

As part of EuroHPC JU, Portugal is a partner for 2 supercomputers: MareNostrum 5 in Spain and Deucalion in Portugal.

EU funding for digital policies in Portugal

The Portuguese recovery and resilience plan devotes EUR 4.5 billion (21% of the total) to the digital transformation of which 4.4 billion directly contribute achieving Digital Decade targets, according to a JRC study[9].

The biggest digital measures of the plan are investment in 'Digital transition of education' (EUR 609 million) and 'Modernisation of supply and vocational education and training institutions— Equipment for digital skills' (EUR 521 million), followed by the 'Digital Transition of Enterprises' (EUR 475 million), 'Digital Health Transition' (EUR 300 million) and several measures related to digitalisation of the national administration.

As of March 2024, implementation of the Portuguese RRP is advancing as evidenced by payment requests that successfully led to the disbursement of EUR 7.8 billion.

According to a JRC study[10], Portugal also received EUR 1.7 billion of Digital Decade-relevant budget from cohesion policy funds with the emphasis on enterprises and unicorns.

[8] Information updated on 31 May 2024.

[9] Joint Research Centre report 'Mapping EU level funding instruments to Digital Decade targets - 2024 update' (Signorelli et al., 2024).

[10] See the reference above.

State of the Digital Decade 2024

Romania

1 Executive summary

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

In 2023, Romania made **notable progress in digitalising public services and in digitalising SMEs** and continued to have an outstanding performance on **FTTP coverage**. However, in spite of the ongoing efforts, important **challenges persist in improving basic digital skills** across the population and in rolling out **5G networks**.

Digital transformation has gained political importance in Romania over the last few years, and currently benefits from significant amounts of EU funding. Romania dedicates 21.8% of its total Recovery and Resilience Plan to digital (EUR 5.8 billion)[11]. Under Cohesion Policy, an additional EUR 3 billion (10% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[12]. Some of the ongoing measures already start to generate improvements in key performance indicators (KPIs), but for now the large-scale benefits to citizens and businesses in terms of digital education and inclusion, competitive and innovative business or better and more transparent public services remain insufficient.

According to the Special Eurobarometer 'Digital Decade 2024'[13], **59% of Romania's population considers that the digitalisation of daily public and private services makes their life easier.** This is one of the lowest scores in the EU, much below the EU average of 73%.

Regarding participation in European Digital Infrastructure Consortia (EDICs), Romania is a member of the EUROPEUM EDIC (in the area of blockchain, already set up) and is participating in the Working Groups developing the Statues and other relevant documents of the possible future Genome and IMPACTS (Connected Public Administration) EDICs[14].

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

[12] 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.

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

[14] Information last updated on 31 May 2024.

Digital Decade KPI [1]	Romania			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	RO	EU
Fixed Very High Capacity Network (VHCN) coverage[15]	95.6%	95.0%	-0.6%	78.8%	7.4%	99%	100%
Fibre to the Premises (FTTP) coverage	95.6%	95.0%	-0.6%	64.0%	13.5%	99%	-
Overall 5G coverage	26.8%	32.8%	22.4%	89.3%	9.8%	62%	100%
Semiconductors		NA					
Edge Nodes		5		1 186		113	10 000
SMEs with at least a basic level of digital intensity	22.2%	26.8%	9.9%	57.7%	2.6%	75%	90%
Cloud	11.3%	15.5%	17.1%	38.9%	7.0%	40%	75%
Artificial Intelligence	1.4%	1.5%	3.5%	8.0%	2.6%	10%	75%
Data analytics	NA	21.9%	NA	33.2%	NA	15%	75%
AI or Cloud or Data analytics	NA	28.7%	NA	54.6%	NA		75%
Unicorns		0		263		x	500
At least basic digital skills	27.8%	27.7%	-0.2%	55.6%	1.5%	50%	80%
ICT specialists	2.8%	2.6%	-7.1%	4.8%	4.3%	4%	~10%
eID scheme notification		No					
Digital public services for citizens	47.6	52.2	9.7%	79.4	3.1%	100	100
Digital public services for businesses	44.6	50.0	12.1%	85.4	2.0%	100	100
Access to e-Health records	57.1	58.6	2.7%	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 **Romania'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, 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.**

Romania endorsed national targets corresponding to all Digital Decade 2030 targets, with the exception of e-Health, quantum, edge nodes and semiconductors. The targets for digital skills, the digitalisation of businesses, and 5G coverage are set significantly below the levels of the EU targets.

The 97 measures included in the roadmap largely build on the Romanian Recovery and Resilience Plan (RRP) and, to a more limited extent, on the relevant cohesion policy funding. Based on the budget information that is included in the plan, it appears that most funding efforts concentrate on the digitalisation of public services (11 measures worth over EUR 1 billion) and on improving digital skills (23 measures worth over EUR 1 billion), which are seen as key drivers of Romania's digitalisation. On the digitalisation of businesses, most

[15] Compared to the previous DESI data, where operators used to report estimated figures for broadband coverage in terms of homes passed, in DESI 2024 the households' broadband coverage has been processed using data provided by operators at the address level. Due to the detailed geographical spatial resolution, the reporting became more robust and pertinent, leading also to minor differences compared to previous editions.

measures included in the roadmap are taken at regional level via the European Digital Innovation Hubs, and as such they are not likely to address all the identified challenges. The roadmap acknowledges that further action is needed to support digital R&D, innovation, and the digital transformation of businesses. Interinstitutional processes have started to develop policies in areas such as semiconductors, quantum and, to a lesser extent, edge nodes, partly building on Romania's participation in multi-country projects. Overall, the roadmap could be further developed to reflect the general objectives of the programme.

Recommendations for the roadmap

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

- **TARGETS:** (i) propose targets and trajectories for edge nodes and eHealth; (ii) revise the unicorns target in line with the current KPI definition; (ii) Raise the level of ambition for 5G, basic digital skills, ICT specialists, digitalization of SMEs and the take up of advanced digital technologies.
- **MEASURES:** (i) review the measures supporting the targets for the digitalisation of business and take up of advanced digital technologies, to ensure a more comprehensive overview, as well as the objectives of the programme; (ii) continue the institutional process to develop policies in the areas of semiconductors, edge, and quantum; (iii) review the budget description of the measures funded by national budget and cohesion policy; (iv) classify the measures according to the target and/or objective that they contribute to; (v) Provide more information on the implementation of digital rights and principles (and Digital Decade general objectives), including on contributing measures.
- **CONSULTATION:** Ensure a consultation process for the revised roadmap, giving interested stakeholders sufficient time to react, and report on it in the roadmap.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' reveals key insights into Romanian perceptions of digital rights. 45% believe the EU protects their digital rights, just like the EU average. Confidence in digital privacy is at 48%, slightly below average. Concerns include online safety for children (48%) and control over personal data (41%), both showing a prominent increase. Positive trends include the importance attributed by Romanians to digital technologies for accessing public services (64%) and connecting with friends and family (71%). 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[16].

A competitive, sovereign and resilient EU based on technological leadership

With 95% coverage of households (second highest in the EU), Romania is close to delivering almost full FTTP coverage to its citizens and businesses, including in rural areas, where coverage is 92.5% already and still progressing quickly. The country also has the highest take up of high-speed internet in the EU: 94% of internet connections are at speeds of 100Mbps or above. Following the recent spectrum allocation and various regulatory measures, **5G coverage is improving, but still severely lagging behind the EU average**. Performance on **the digitalisation of businesses remains much below the EU average**, although a positive dynamic has been observed for basic digital intensity and some other related indicators, in particular **e-**

[16] 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.

Invoicing. Despite efforts, a significant gap remains to achieve the digitalisation of business targets by 2030 and to implement the roadmap, including to **increase the level of R&D and innovation in the ICT sector**. **Significant developments in the field of cybersecurity were also observed in 2023**, initiated by both private and public actors, including efforts to raise awareness and build relevant skills.

Recommendations – Romania should:

- **CONNECTIVITY INFRASTRUCTURE**: (i) Undertake additional efforts to support a higher level of ambition for the 5G target, including possible support for use cases and pilots, in view of the importance for EU and Romania's future competitiveness and building on the current positive trend; (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.
- **SMEs:** Intensify action on digitalisation of business, starting with providing a comprehensive overview of the available support measures and identifying potential gaps in terms of meeting existing needs, as well as with ensuring the good functioning of the EDIHs.
- **CLOUD/EDGE:** (i) 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 Member States participating in the IPCEI-CIS; (ii) Consider edge node deployment when creating investment programmes and strategies in these areas of AI, future network deployment, and the Internet of Things, as edge computing is an important component of those.
- **UNICORNS:** Extend the measures to support an innovative, R&D driven ICT sector, as part of the competitiveness and technological leadership objectives in the roadmap.
- **QUANTUM/SEMICONDUCTORS:** Develop a policy and further measures to support the semiconductors, quantum, and edge nodes targets, building on the growing national interest and existing assets, as well as multi-country cooperation.
- **CYBERSECURITY:** (i) Extend the roadmap to better reflect the growing interest in and activities related to cybersecurity, setting clear objectives in this respect; (ii) Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

Protecting and empowering EU people and society

Romania is making massive efforts to raise the level of digital skills, in a context where **more than 72% of its population still lacks basic digital skills**. The focus is currently on integrating digital skills into all levels of formal education, including through curricula reforms, teacher trainings, infrastructure and learning resources. Some more limited measures target adults by transforming public libraries into hubs for digital skills, upskilling/reskilling working adults, and training young people. While **Romania continues to perform very well on training ICT specialists, the proportion of ICT specialists in its workforce is relatively low**, partly due to difficulties to retain them in the country.

The performance concerning the **digitalisation of public services remains low, but continuous action could lead to radical improvements in the coming years**, in terms of transparency, simplification, and quality. Important in this respect are the efforts to digitalise key national and regional services and to set up a governmental cloud and an interoperability portal and framework. **An e-ID solution, ROeID, is in the pre-notification process**. **Access to health records remains poor** but has the potential to improve as a result of a wider RRF investment. Finally, Romania pays increasing attention to **protecting children online**, and to societal issues such as **disinformation and trust** in online services.

Recommendations – Romania should:

- **BASIC DIGITAL SKILLS:** (i) Intensify the measures related to upskilling and reskilling of the workforce; (ii) Continue to improve the quality and the relevance of courses, teaching digital skills not only as a separate subject but also integrating digital skills and digital education into all levels, while taking a cross curricular approach.
- **ICT SPECIALISTS:** Consider additional measures targeting to retain ICT specialists in the country.
- **DIGITAL PUBLIC SERVICES**: Maintain the efforts needed to implement the ambitious ongoing agenda for the digitalisation of public services, including by ensuring sufficient levels of funding, project management capacity and ICT specialists, and extensive/strong coordination across the various relevant authorities.
- **E-HEALTH**: Expand the coverage of the online access service, make the data regarding medical devices/implants, laboratory tests, and medical images available to citizens through this online access service and onboard more categories of healthcare providers to it.

Leveraging digital transformation for a smart greening

Romania underlines that its major efforts to digitalise government services, in particular environmental services, will also bring significant benefits in terms of climate action. As of 2023, digital and green education are brought to school children as optional courses. Importantly, a dynamic clean-tech sector seems to be emerging and benefits from several support measures at national and regional levels.

Recommendations – Romania should:

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

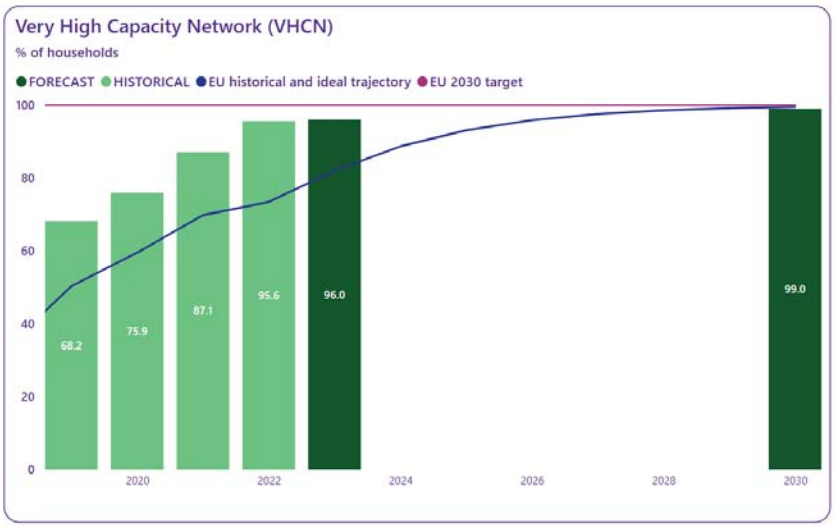
2 A competitive, sovereign and resilient EU based on technological leadership

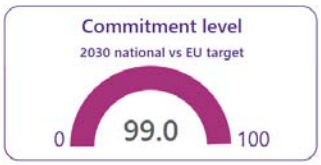
With significant support from EU funds, Romania is paying increasing attention to digitalisation, which holds major untapped potential to increase the country's productivity, innovation and overall competitiveness. Romania's close to full Fibre to the Premises (FTTP) coverage, including in rural areas, coupled with the highest take-up of high-speed internet in the EU, a competitive telecoms sector, and a relatively strong and dynamic ICT sector, is a major asset. Nevertheless, Romania's performance on digitalising businesses remains to be improved, and the ICT sector, which is largely based on outsourcing by international companies, is still to become R&D- and innovation-driven. It is important for Romania to develop capabilities for all Digital Decade targets, including semiconductors, quantum, and edge nodes, as these areas will become increasingly important for competitiveness, capitalising on Romania's participation to multi-country projects and on emerging activities in its market.

2.1 Building technological leadership: digital infrastructure and technologies

Romania has an outstanding performance on gigabit coverage. On the other hand, it shows a low level of ambition and lags behind the EU average when it comes to 5G rollout.

2.1.a Connectivity infrastructure (Gigabit)



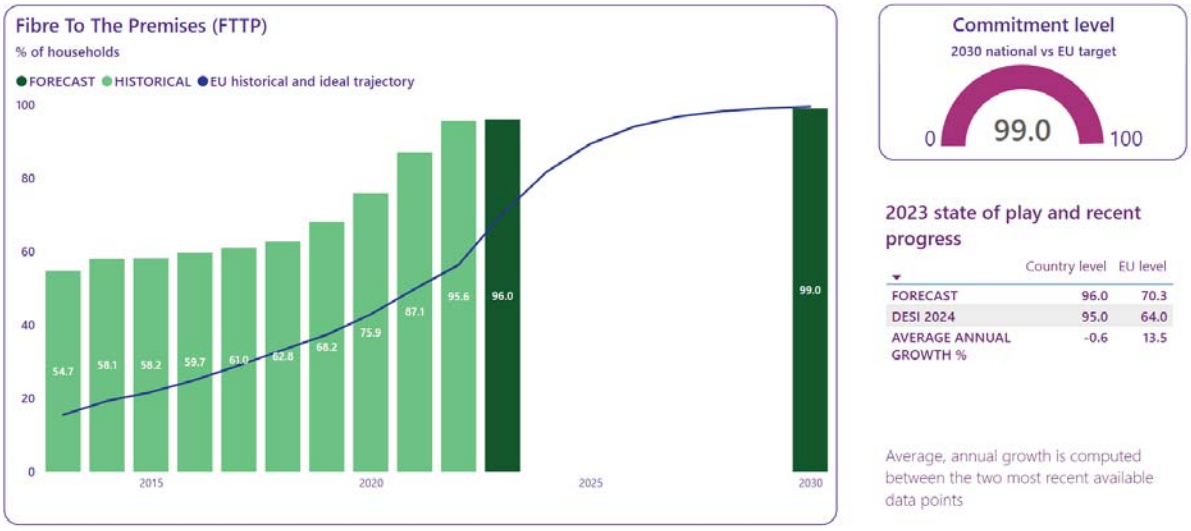


2023 state of play and recent progress

	Country level	EU level
FORECAST	96.0	82.0
DESI 2024	95.0	78.8
AVERAGE ANNUAL GROWTH %	-0.6	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



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

With 95% coverage of households with very high-capacity networks (VHCN), which equals to Fibre-to-the-Premise (FTTP), Romania brings a very strong contribution to the Digital Decade Gigabit connectivity target. These values are significantly above the EU averages of 79% (for VHCN) and 64% (for FTTP), but their overall dynamic during 2023 was very limited[17]. However, it is worth noting that FTTP coverage of rural areas went up from 90% to 92.5% during 2023, continuing the strong growth observed during the previous 5 years and reaching the highest FTTP rural coverage in the EU.

While FTTP rollout may be slowing down as it has reached the last 5% to be covered, the take up of fast internet subscriptions developed positively in 2023. At the middle of 2023, over 94% of fixed internet connections were at speeds of 100Mbps or above, the highest percentage in the EU. Also, Romania had the third highest percentage of connections of 1Gbps or above. This performance is linked not only to high coverage, but also to positive market dynamics and to low prices. In 2023 one operator launched retail offers with speeds of 2.1 Gbps. More generally, competitive retail offers with speeds above 1 Gbps lead the competitive dynamics for customer acquisition and retention. End user prices are rising across all baskets, but remain well below the EU average.

In terms of measures to support further roll-out in the remaining white areas, steps were taken to use the budget available under the Recovery and Resilience Plan (RRP), which amounts to EUR 94 million. In particular, the Romanian National Regulatory Authority (ANCOM) has provided to the implementing authority, following a public consultation, the list of areas that could be covered and has approved the technical and economic conditions for access to the electronic communications infrastructures/networks that are to be financed. The call for projects was published in April 2024, with the evaluation foreseen for September.

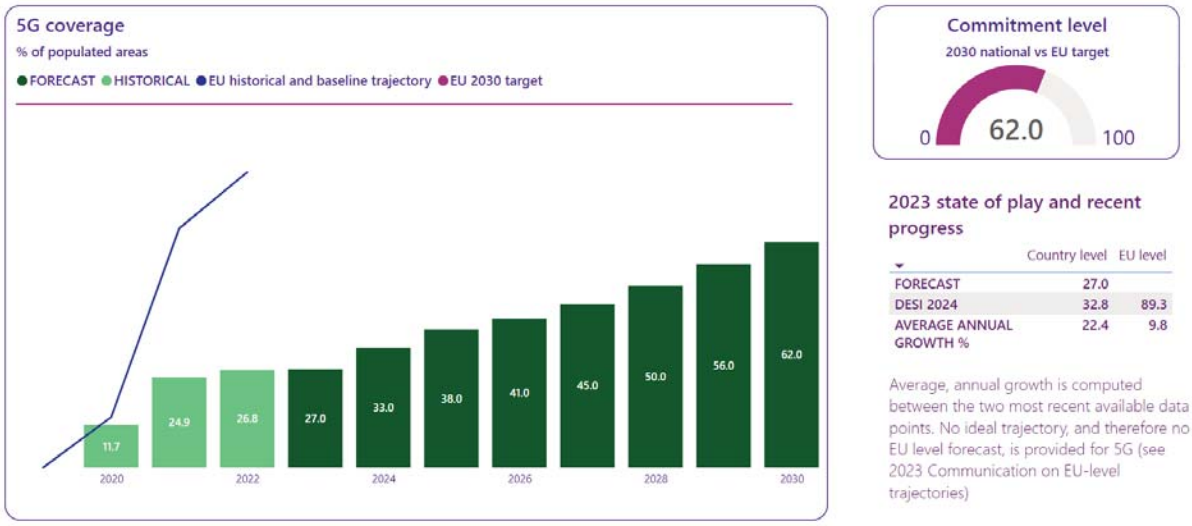
In terms of regulatory developments, ANCOM started gathering geolocated data to update the inventory of electronic communications networks and related infrastructure, in order to obtain a clearer view of the level of development of high-speed networks and services across the country's various regions and communities, and inform future policy decisions.

[17] Compared to the previous DESI data, where operators used to report estimated figures for broadband coverage in terms of homes passed, in DESI 2024 the households' broadband coverage has been processed using data provided by operators at the address level. Due to the detailed geographical spatial resolution, the reporting became more robust and pertinent, leading also to minor differences compared to previous editions.

Furthermore, the national Digital Decade roadmap includes two new measures to facilitate further network deployment: one setting indicative tariffs for access to road physical infrastructures, the other one laying down technical norms for the design and construction of physical infrastructure, including provisions for in-house wiring and underground networks, expected to produce effects from the second half of 2024 onwards.

The level of ambition for the Gigabit target set in the national roadmap is 99% for both VHCN and FTTP. This value is very close to the EU target of ensuring full coverage and takes into consideration Romania's good starting position. Nevertheless, the value observed in 2023 is lower than the one forecasted by the Romanian authorities for the same year and the country would need to see a return to a positive dynamic to achieve this goal.

2.1.b Connectivity Infrastructure (5G)



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

Romania has scope to improve its performance to contribute to the EU's 5G target: the current level of 5G coverage of 33% of populated areas remains significantly behind the EU average of 89.3%. However, a positive dynamic was noted in 2023, with a 22% growth. Moreover, 5G coverage of rural areas more than doubled since the last reporting exercise, but remains very low at 6.3%. It should also be noted that 5G coverage in the 3.4-3.8 GHz band stands at 29%, therefore most of the 5G roll-out in Romania is within this band.

At 89%, the overall mobile broadband take up (4G/5G) is significantly below the EU average. Nevertheless, some positive dynamics were noted by ANCOM in the first half of 2023, including a 9% increase in mobile internet traffic, up to 9.7 GB per month per inhabitant, and a doubling of the active 5G SIM cards, to 1 .5 million, representing 7% of all active SIM cards.

Licences for 30 MHz (2x15 MHz) in the 700 MHz FDD band and for 40 MHz in the 1500 MHz band (valid until December 2047), as well as licences for 40 MHz (2x20 MHz) in the 2600 MHz FDD band (valid until April 2029), entered into force on 1 January 2023, following the spectrum allocation procedure organised in 2022. This leads to 39% of the pioneer 5G bands being assigned, compared to an EU average of 73%.

This assignment, together with a significant reduction in spectrum usage fees, which entered into force in January 2023, is likely to lead to a speeding up of 5G deployment over the next year.

A list of authorised equipment manufacturers under the 5G Networks Security Law (Law 163/2021) was adopted and published during 2023. Telecom operators will have to eliminate, at their own cost, equipment from non-authorised producers by 2026 for core networks and by 2028 for radio access networks.

At 62%, the level of ambition for 5G coverage in 2030 remains significantly below the EU level target of 100%. The roadmap justifies this based on the limited demand (the 5G SIM cards share of population in Romania is at 7.9% compared to 24.6% EU average), the widespread availability of affordable FTTP networks, the replacement effect expected following the entry into force of the 5G Networks Security Law, and the relatively late assignment of the 700 MHz spectrum band. However, based on the current rate of progress, and to avoid missing opportunities linked to future industrial developments related to 5G services, a higher level of ambition for this national target can be envisaged, at it appears that, assuming current conditions do not change, the current national target will be reached before 2030.

2.1.c Semiconductors

Currently no semiconductor production capacities exist in Romania. The roadmap acknowledges the situation. As a potential avenue for developing such capacities, it identifies participation in international cooperation projects including the Important Project of Common European Interest (IPCEI) on low-power processors and semiconductor chips, which benefits from EUR 400 million of funding under the RRP.

The objectives of the project include structuring and developing competencies in designing, manufacturing and applying microelectronic components and systems in a coherent national ecosystem, as well as coordination with the capabilities and needs at EU level.

An important step in the consolidation of the national ecosystem of semiconductors was the selection, during 2023, of three companies that would benefit from the RRP funding.

Furthermore, a National Platform of Technologies and Semiconductors is expected to be proposed for financing as a priority project under the 2021-2027 Operational Program Intelligent Growth, Digitization and Financial Instruments (POCIDIF). The project aims to bring together and consolidate the R&D capacities in the area of semiconductors.

2.1.d Edge nodes

Romania is among the Member States adopting edge technology at a slower pace: it counted 5 of the estimated 1186 edge nodes deployed in the EU at the end of 2023, or 3 additional units compared to the end of the previous reporting period. According to the roadmap, the number of edge nodes is expected to reach 113 by 2030. However, no measures are in place yet to support this objective and therefore the target is not supported adequately.

The Romanian authorities are preparing to set up a working group with various ministries, regional development agencies, and the national regulatory authority to assess the current situation and identify and adopt a policy and concrete measures that could support this national target.

2.1.e Quantum technologies

There is a growing interest in the field of quantum computing and quantum communication, across academia, business, and governmental stakeholders in Romania. The roadmap does not set a specific target for quantum, but describes the ongoing work to develop a policy in this area.

A national consortium led by the Babeș-Bolyai University (Cluj-Napoca), in partnership with the National Institute of Materials Physics, designed a draft strategy for the development of national capabilities in the field of quantum technologies, which was delivered in November 2023 (QTSTRAT, https://qtstrat.granturi.ubbcluj.ro/). The project includes a state of play of quantum technologies at

national level, a plan for the development of quantum technologies in Romania, and a portfolio of potentially relevant projects.

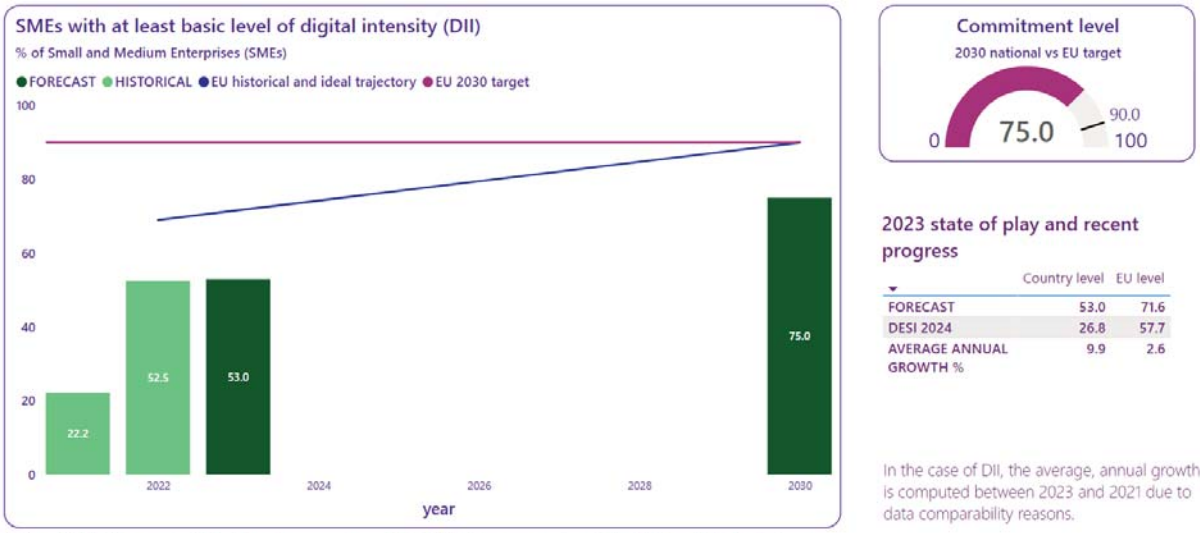
In parallel, the government is taking steps to create an interministerial group to develop a policy to support the development of quantum technologies and to adopt a national strategic plan. Such plan would include measures for R&D, public-private partnerships and the development of the relevant education and training. Steps are also taken to include the quantum technologies as an area of strategic interest within the National Research, Development and Innovation Plan for 2022-2027.

Meanwhile, in March 2023 the Politehnica University of Bucharest launched the RoNaQCI (Romanian National Quantum Communication Infrastructure) project. With EUR 10 million of funding under the Digital Europe Programme, the project aims to develop a quantum communication infrastructure in Romania. By doing so, the Politehnica University of Bucharest became the first functional node of the European quantum communications network in Romania.

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

The level of digitalisation of small and medium-sized enterprises (SMEs) in Romania remains very low. This represents an enormous potential for the Romanian economy to become more innovative, productive and competitive, including for the relatively strong and fast-growing ICT sector.

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



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

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

Fewer than 27% of Romania's SMEs meet the criteria for basic digital intensity, i.e., using at least 4 of the 12 selected technologies in the Digital Intensity Index. This means that **Romania has scope to improve its performance to contribute to the EU's 2030 target for digitalisation of SMEs**. A **strong growth was observed compared to the last comparable reporting period (2021)**. However, the value remains low compared to the EU average of 57.7% and very far from the EU 2030 target of 90%, and the national target of 75% set in the roadmap.

Other relevant indicators confirm the need to step up action. Only 22.6% of Romanian SMEs are using an enterprise resource planning software package to share information between different functional areas (e.g., accounting, planning, production, and marketing), compared to an EU average of 43%. 15.3% of the Romanian SMEs use social media, compared to an EU average of 31.5%. Just under 12% of the Romanian SMEs sell their products and goods online, compared to an EU average of 19.1%. It should be noted that

while these figures are significantly below the EU average, have all grown over the last reporting period. The percentage of turnover from e-Commerce is an exception as it has remained constant at 7.6%, not too far from the EU average of 11.9%.

Notably, at 35%, **the percentage of enterprises using e-Invoices is close to the EU average of 39%, having made major progress since 2020 (17%)**. The growth coincided partly with the entry into force of a fiscal reform measure in 2022 that made e-Invoicing becomes compulsory in all business to government relations, via a unique national online platform. In 2024, this platform was extended to also cover invoicing between businesses.

Several measures are in place to support the digitalisation of enterprises, some financed from the national budget, some supported by cohesion policy (with a contribution of EUR 291 million, as estimated by the JRC) and some included in the RRP (an estimated contribution of EUR 363 million). Examples of ongoing measures include a EUR 347.5 million RRP measure for the take up of digital technologies by SMEs; various financial instruments and grants schemes under cohesion policy funds; the "Start-Up Nation" and the "The Entrepreneur Woman" programmes, which aim to stimulate entrepreneurship, innovation and digitalisation; and an online platform for information, education and training, and matchmaking for Romanian entrepreneurs (IMM Mentor).

Romania's roadmap thoroughly describes the **challenges faced by the SME sector towards achieving a higher degree of digitalisation and competitiveness**. These include a low level of digital skills and entrepreneurial skills (including budgeting, financial analysis, and financial literacy), a poor match between the educational system and the demands in the job market, as well as poor access to finance.

Moreover, while various support schemes exist, SMEs often lack an overall picture of the existing options, which makes it difficult to choose the most suitable option. Some of the available support schemes are also considered to be too far from the current business needs of the SMEs, with entrepreneurs finding it difficult to translate the adoption of digital technologies into benefits such as increased productivity, profits or competitiveness.

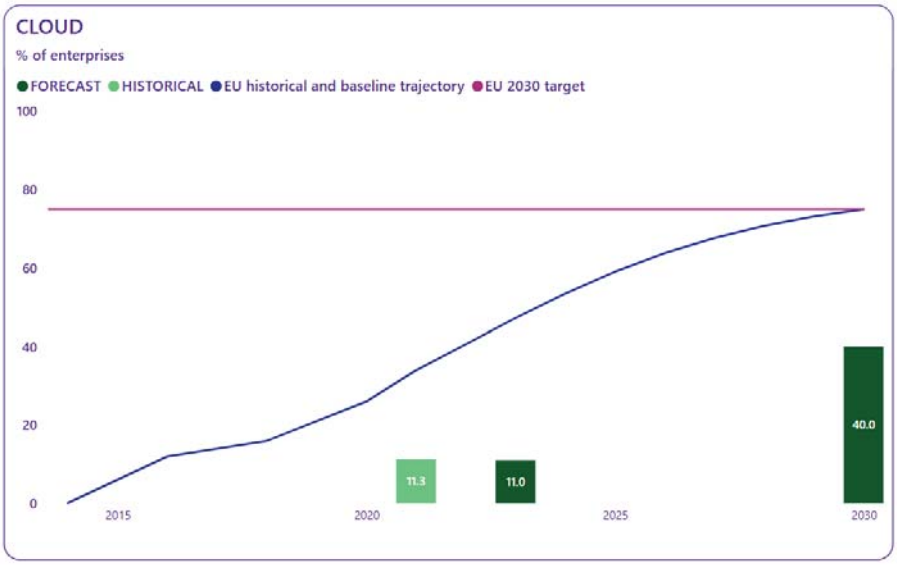
In this respect, **the 7 European Digital Innovation Hubs (EDIHs) that are now operational ensure regional presence and were also granted co-funding from the European Regional Development Funds (ERDF) in 2023**. The recent National Strategy for the development and support of Digital Innovation Hubs in Romania (2024-2027) which aims to strengthen, coordinate, and optimize action on digital transformation, recognises the EDIHs as key instruments in this process. Furthermore, the document provides a strategic framework for supporting and developing the quality of these hubs to enable them to overcome barriers that currently position Romania at the lower end of European rankings in the areas of innovation and digitisation.

Each of the EDIHs has its own specific objectives, areas of focus, and targets, but they are all expected to make a key positive contribution to digitalising the private and public sectors across Romanian regions. Their most common activities relate to digital skills training, facilitating access to funding, bringing together SMEs and service providers, as well as other public and private stakeholders, and providing a platform for businesses to test digital technologies before investing in them.

Overall**, the target included in the roadmap of 75% of SMEs having reached at least a basic level of digital intensity by 2030 can be praised as ambitious, given the starting point. However, it is not clear how the measures included in the roadmap will deliver the target**. In all cases, reaching the national target for 2030 will require an acceleration of the rate of progress and most likely an intensification of action.

2.2.b Take up by enterprises of AI or Cloud or Data Analytics

- **Cloud**



2023 state of play and recent progress

	Country level	EU level
FORECAST	11.0	47.3
DESI 2024	15.5	38.9
AVERAGE ANNUAL GROWTH %	17.1	7.0

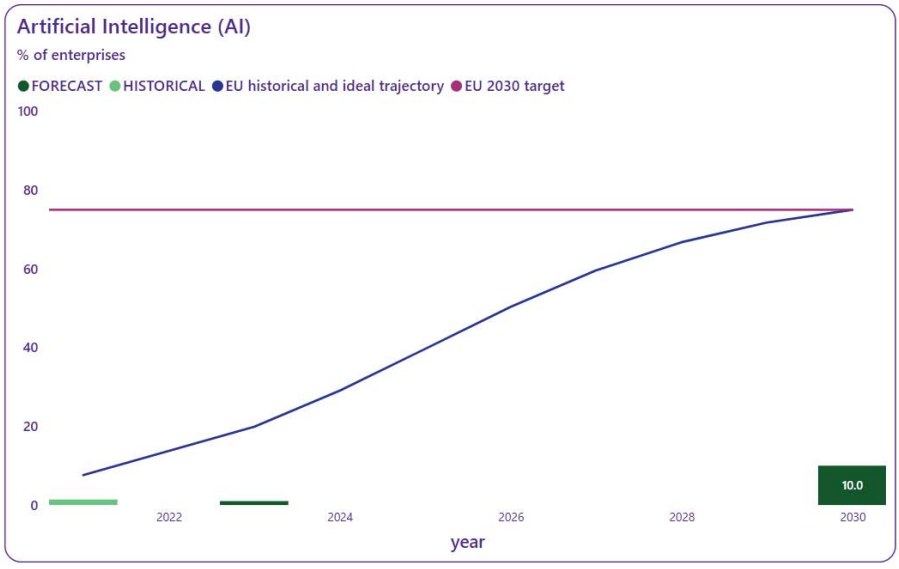
Average, annual growth is computed between the two most recent available data points

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

More specifically, **only 15.5% of Romanian businesses use cloud services, compared to an EU average of 38.9%.** While this percentage is less than half the EU average**, it has grown strongly** over the last reporting period.

The Romanian roadmap commits to a national target of **40% of the Romanian businesses adopt cloud services**. Given the very strong annual growth observed recently, **this target, which is very low compared to the EU value of 75%, could be revised upwards.**

- **Artificial Intelligence**



2023 state of play and recent progress

	Country level	EU level
FORECAST	1.0	19.9
DESI 2024	1.5	8.0
AVERAGE ANNUAL GROWTH %	3.5	2.6

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

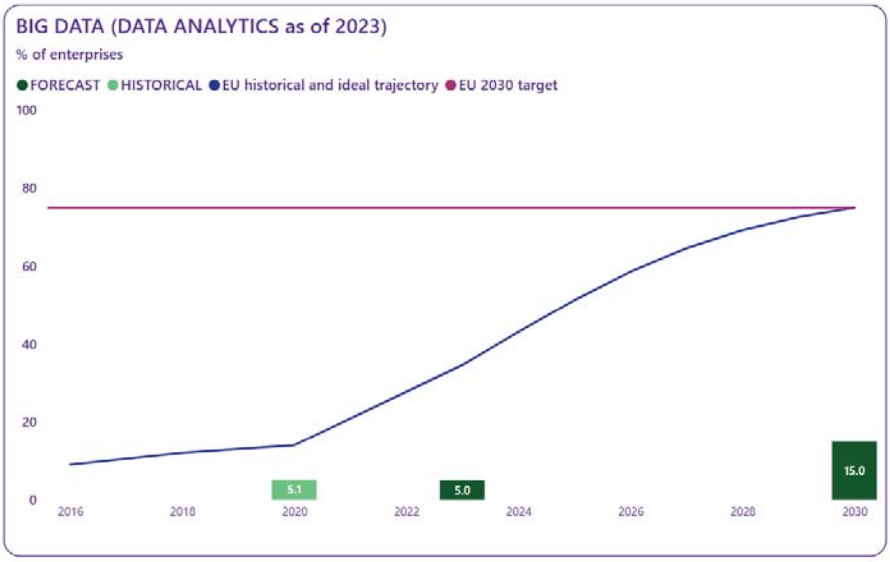
Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

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

By contrast, **only 1.5% of Romanian businesses use Artificial Intelligence (AI), compared with an EU average of 8%.** Although over the last reporting period the growth has been higher than the EU average

growth, and although the observed 2023 value is higher than the value forecasted in the Romanian roadmap for 2023, the **dynamic of the indicator is rather limited**. While the **national target set in the roadmap of 10% is very low compared to the EU level target of 75%, it is not likely that it will be reached by 2030 with the current growth rate.**

- **Data Analytics (Big Data)**



2023 state of play and recent progress

	Country level	EU level
FORECAST	5.0	34.6
DESI 2024	21.9	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

Finally, the take up of big data, measured as of 2023 using a Eurostat **data analytics indicator, stands at 21.9%, compared to an EU average of 33.2%**. Due to the change of indicator, which now covers a broader range of technologies including Big Data, it is not possible to analyse the trend in this indicator nor to compare it to the values forecasted in the roadmap, including the national target value. The RRP measure supporting the digitalisation of SMEs, described above, can be considered relevant to these targets, as it includes funding for integrating advanced digital technologies.

With regard to AI in particular, Romania is developing a **National Strategy in the field of Artificial Intelligence 2024-2028**, aimed to stimulate the development and adoption of AI technologies in Romania, in alignment with the European vision. The strategy is in the process of being formally approved.

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

Romania has room to improve its performance to contribute to EU's 2030 targets on the use of advanced digital technologies by businesses, as only 28.7% of Romanian enterprises make use of cloud services, AI or data analytics, a very low percentage compared to the EU average of 54.6%.

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

As regards the unicorns Digital Decade target, Romania is among the 6 EU Member States without any unicorn, according to Dealroom portal. However, in recent years, Romania has seen the emergence of several successful startups in areas such as robotics and process automation, cybersecurity, fintech and e-commerce.

More generally, the Romanian ICT sector is one of the five most important sectors of the economy in terms of employment. In 2020 it accounted for 4.25% of GDP (compared to an EU average of 5.2%), having grown much faster than the rest of the economy over the previous five years and contributing to Romania's GDP growth more than its share in the economy. According to the Romanian roadmap, the ICT sector is

increasingly specialised in areas such as cybersecurity and process automation, and more and more considered as an engine of business growth in Romania.

Some of the key drivers behind these positive trends are the competitive cost structure of the sector and a good pool of ICT graduates, leading to many international companies outsourcing their ICT activity to Romania. However, the existing tax cuts for ICT specialists are being phased out, as part of a larger effort to increase tax collection. Moreover, the sector still has significant untapped potential in terms of R&D intensity, which remains lower than EU averages. Access to capital, and in particular to risk capital, also remains significantly below the EU average.

The 2030 targets set in the Romanian roadmap in relation to the unicorns', scale-ups and start-ups include 5000 innovative digital SMEs, a 2% contribution to GDP of all innovations realised in Romania and 4 unicorns founded in Romania and active globally, with either headquarters or secondary offices in Romania[18].

Achieving these targets will require an intensification of the measures to support the startup ecosystem in Romania, in particular the support for R&D and technology transfers, the framework conditions for and ease of doing business, and the access to capital for startups and scale ups. In all these areas, ongoing measures exist, but they need to be extended for the targets to be reached.

2.3 Strengthening Cybersecurity & Resilience

As companies rely increasingly on digital technologies, and as digital technologies become ubiquitous in people's everyday lives, the risk of exposure to cybersecurity incidents is also increasing. In Romania, in 2023, 86.5% of enterprises with 10 or more employees reported using ICT security measures. Only 7% reported being insured against ICT security incidents.

Romania has a **National Cybersecurity Strategy** in place, as well as an accompanying Action Plan covering the 2022-2027 period. The strategy mainly aims to strengthen the security and resilience of ICT networks and systems, to strengthen the regulatory and institutional framework for cybersecurity, including international cooperation, and to build public-private partnerships. The strategy is coordinated and implemented by various governmental bodies including the National Cybersecurity Directorate, set up in 2021 under the responsibility of the Prime Minister, CERT-RO (Computer Emergency Response Team of Romania), and ANCOM.

Various legislative and regulatory activities were observed in 2023, including capacity building following the entry into force of **Law 58/2023 on Cybersecurity and Cyberdefense** and preparations for the transposition of the NIS2 Directive. ANCOM updated its **regulation regarding the security of electronic communications networks and services**, to strengthen the resilience and the continuity of provision of public communications, in line with the European Electronic Communications Code and the EU Toolbox for 5G Security. These changes are expected to support the further development of both the digital services and the related new services in areas like IoT, Smart Cities/Communities, eHealth, in both rural and urban areas.

Furthermore, an important RRP project (EUR 100 million) is being implemented, with the aim to ensure the **cyber protection of key public and private ICT infrastructure and entities,** preventing cyber-attacks against institutions whose activity is essential for the proper functioning of the Romanian state from happening.

[18] Commission Implementing Decision 2023/1353 setting out key performance indicators to measure the progress towards the digital targets established by Article 4(1) of the Digital Decade Policy Programme Decision (Decision 2022/2481) as well as Decision 2022/2481 itself refer to the doubling of the number of unicorns within the European Union, implying headquarters in the European Union, avoiding the risk of double counting for unicorns registered in several Member States.

EUR 60 million of ERDF funding has been allocated to supporting the implementation of cybersecurity solutions for public administration.

Other notable activities concern **awareness raising campaigns and support measures for cybersecurity skills**: the first edition of the Cyber Security Olympiad, leading to a bootcamp that prepares the national team for the European Cybersecurity Challenge; targeted measures envisaged by various EDIHs; several new university programmes on cyber skills; an annual Cyber Security Conference; and a Cyber Citizen Initiative consisting of workshops and public debates.

It is also relevant to mention that Romania has a **growing cybersecurity industry, with both domestic companies and international firms operating in the country. Romania is also hosting the European Cybersecurity Competence Centre, launched in May 2023**. All these developments raise Romania's interest in and commitment to helping achieve the EU's cybersecurity objectives. Nevertheless, this interest and commitment are not very much reflected in the national roadmap, where the relevant parts could be further developed.

3 Protecting and empowering EU people and society

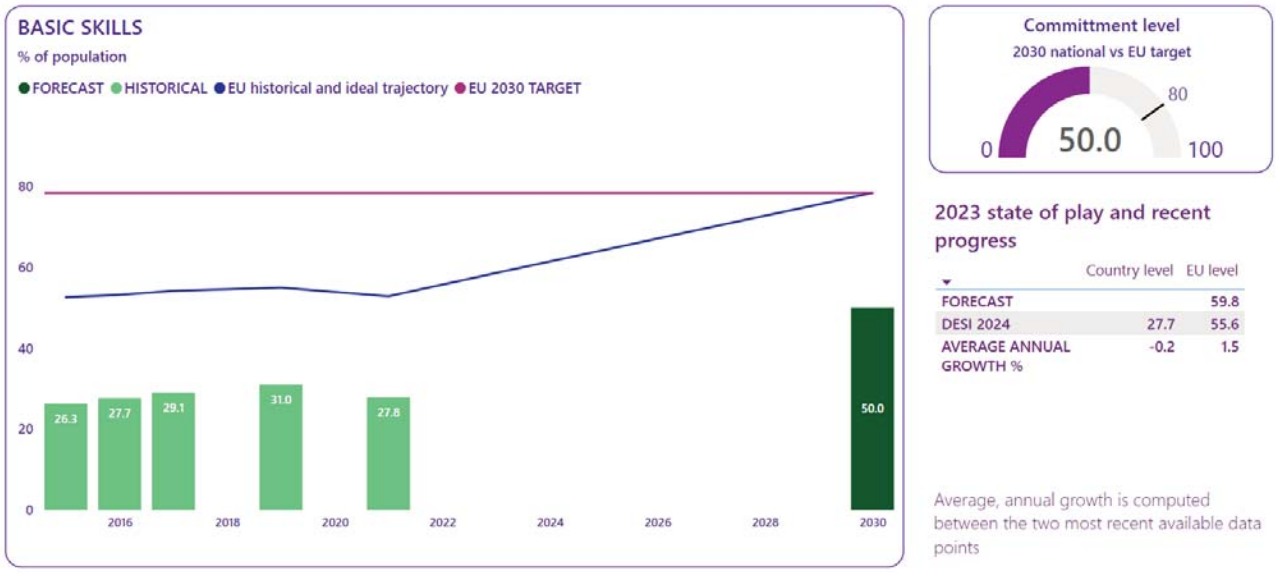
3.1 Empowering people and bringing the digital transformation closer to their needs

More than two thirds of Romania's population still lack basic digital skills and massive efforts are ongoing to address this issue, as part of wider action to improve formal education, reduce school abandonment especially in rural areas and achieve a higher rate of post-secondary education. Better digital skills acquisition in pre-university education and a larger pool of post-secondary education graduates would have a positive impact on the overall number of ICT specialists in employment, whereas Romania already performs very well on training ICT specialists. Supplementing its action on digital skills, Romania pays increasing attention to protecting children online, and to societal issues such as disinformation and trust in online services. The country's performance concerning the digitalisation of public services remains low, but if the current levels of effort are maintained and supported appropriately, there is potential for radical improvements in terms of transparency, simplification and quality in the coming years.

3.1.1 Equipping people with digital skills

Romania is making massive efforts to improve digital skills and achieve a higher number of ICT specialists, but these still need to translate into a better performance on key performance indicators.

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

Romania has scope to improve its performance and contribute to the EU's digital decade target for basic digital skills. In 2023, only 27.7% of the population had at least basic digital skills, compared to an EU average of 55.6%. Moreover, the KPI's development during the last reporting period has shown a limited dynamic. However, great discrepancies exist among age groups, with only 6.2% of the population over 65 having at least basic digital skills, while 47.2% of the population between 16 and 24 has such skills. No major discrepancies exist between genders.

A similar situation is observed for other indicators related to skills, where for example Romania, with 40.9% of its population having at least basic digital content creation skills, is significantly below the EU average of 68.3%. Moreover, only 9.0% of the Romanian population has above basic digital skills, compared to an EU average of 27.3%. Both indicators have shown very limited growth over the last reporting period.

By contrast, the use of internet by individuals aged 16 to 74 is growing relatively fast and has reached 88%, closing the gap with the EU average of 90.3%.

The target set in the national digital decade roadmap is 50% of the population having reached a level of at least basic digital skills by 2030. This value is significantly below the EU target of 80%, but takes into account Romania's difficult starting position and the naturally slow development expected for this indicator. However, **it should be noted that the current level of growth is insufficient to reach the national target by 2030.**

A new law on pre-university education (Law no. 198/2023) entered into force in September 2023, introducing mandatory modules to promote digital skills and digital education in primary, secondary and high school education, taking a cross-curricular approach. The law envisages measures for teacher training, piloting of a new curriculum for developing digital competences, and the creation of a monitoring mechanism for specific action to improve the digital competences of both teachers and students.

In parallel, several relevant projects were delivered in 2023 including 21 new optional courses in the school curricula, starting with the2023-2024 academic year, such as 'EduGaming', which aims to develop responsible and safe online gaming behaviour, and 'Digital Culture', which aims to stimulate digital cultural expression. The projects also included a successful large scale piloting of the digitised evaluation of the written tests that are part of the national assessment of 8th grade graduates and of the national baccalaureate exam.

In 2023, the RRF budget of EUR 338 million allocated to the development of regional consortia and to 29 dual training campuses in the eight regions of Romania was increased with national funds to over EUR 588 million, because of the high number of applications received. The project is expected to deliver, among other things, smart labs for teaching and learning and for developing new professional qualifications.

Romania is also implementing other important RRF funded projects are being implemented, most of which are in the phase of selecting beneficiaries and partners. In particular, these projects aim to: (i) turn libraries into hubs for developing digital skills in local communities, by providing technical equipment to 1 030 libraries, training 1 100 librarians and serving 100 000 community members and (ii) provide digital equipment and technological resources to educational institutions and create at least 1 100 Smart Labs, to support inter alia the development of advanced digital skills. The Education and Employment Programme 2021-2027 co-funded by the European Social Fund Plus (ESF+) envisages several measures to improve the accessibility and quality of vocational and technical training.

In the medium and long term, such measures are expected to have a major impact on the level of digital skills of the Romanian population. In the shorter term however, it is essential to also target the upskilling and reskilling of workers, in line with the recommendations of the 2023 State of the Digital Decade report. Such measures are particularly necessary given the specificity of the Romanian economy: according to the roadmap, the vast majority of Romanian companies (91%) are microenterprises, a very small number of which offer ICT training to their employees.

Some relevant measures are in place. An example concerns the RRP measure to upskill employees of at least 2000 SMEs by increasing their skills levels in 9 advanced digital technology areas (AI, robotics, machine learning, automation, etc.), for which tendering of the learning platform and selection of the SMEs and of the implementation partners are ongoing. Also very relevant are measures supporting young job seekers (aged under 30), long term unemployed people and people from disadvantaged groups in accessing the job market, including by developing their basic digital skills, and measures to stimulate the employees' participation in lifelong learning processes. Both type of measures receive funding under the 2021-2027

Education and Employment Programme. Digital skills trainings delivered to SMEs via EDIHs is also expected to help bring about progress in this specific area.

The roadmap describes further measures specifically targeting the level of digital skills of public sector employees: horizontal trainings, including via EDIHs, a platform for e-Learning, as well as specific trainings accompanying the digitalisation of specific sectors (e-Health, environment, and social protection). An in-depth evaluation delivered via the Technical Support Instrument in 2023 confirmed the continued stringent need for digital upskilling in the public administration and emphasised the need to have a long-term strategy in this field.

Overall, the part dedicated to digital skills is among the most developed ones in the Romanian roadmap. It includes 14 measures, taking various forms, but mostly with a focus on reforms and investments in formal education. While the roadmap does not include exact budgets, this target appears to benefit from the second largest budget share, following the budget supporting the digitalisation of public services. This support comes from various sources, with the RRF as main contributor, followed by cohesion policy funds. According to an estimation by the Joint Research Centre (JRC)[19]: Romania's RRP contribution to raising basic digital skills levels is estimated at EUR 752 million, while the contribution from cohesion funds at EUR 14.5 million.

In view of Romania's current performance and dynamic, and in view of the national target included in the roadmap, the efforts to upskill and reskill workers, and to stimulate lifelong learning seem insufficient. **Moreover, despite the massive action and good progress made in the area of formal education, stakeholders indicate that further efforts are needed to increase the quality and relevance of trainings for teachers and students in pre-university education, across various fields.**

3.1.1.b ICT specialists

2023 state of play and recent progress

	Country level	EU level
FORECAST	2.8	5.4
DESI 2024	2.6	4.8
AVERAGE ANNUAL GROWTH %	-7.1	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

There is scope for Romania to improve its performance and contribute to EU's target of having 20 million ICT specialists in employment by 2030, representing an estimated 10% of its population. **With 196 000 ICT**

[19] JRC report "Mapping EU level funding instruments 2020-2027 to Digital Decade targets - 2024 update" (Signorelli et al., 2024)".

specialists in employment, representing 2.6% of total employment, Romania is below the EU average (4.8%) and displays a very limited dynamic for this indicator.

By contrast, **6.9% of all post-secondary education graduates are ICT specialists, putting Romania among the EU's leaders**. The discrepancy between the share of ICT graduates and employed specialists is explained to a large extent by the difficulty in retaining talent in Romania, but also by other aspects of the wider context, such as the low rate of post-secondary education graduates among the entire population.

Romania's performance as regards women in the digital sector stands out as well and continues to improve: female ICT specialists represent 26% of ICT specialists, against an EU average of 19.4%.

In 2023, Romania continued to take new, specific measures to increase the number of ICT specialists. An important amendment to the Higher Education Law (Law 199/2023) includes, among other things, a national programme to support learning in the fields of Science, Engineering, and Mathematics, new strategies for the digitalisation of higher education institutions and the inclusion of digital skills in university curricula and adult training programmes, and further investments in advanced digital infrastructure and research. An example of specific support is the fact scholarships for STEM students are higher than scholarships for other studies.

It is also worth noting that in 2023 several new academic programmes were created in the most important university centres in Romania, targeting specific advanced ICT skills, for example various cybersecurity related programmes.

In accordance with its roadmap, **Romania's ambition is to have 400 000 ICT specialists in employment by 2030,** compared to approximately 256 000 expected under a business-as-usual scenario. This would be equivalent to 4% of the workforce. **The current progress rate suggests that the target can be reached before 2030 and thus that a higher level of ambition can be envisaged**.

The roadmap does not distinguish between measures supporting basic digital skills and measures supporting the ICT target, but 9 measures are considered more closely linked to the ICT target, including programmes for advanced digital skills for civil servants, efforts to digitalise universities and prepare future digital professions, as well as various targeted measures planned by EDIHs. Most of the budget attributed to ICT specialists comes from the RRF, with a contribution estimated by the JRC at EUR 507 million, and cohesion policy funds, with a contribution estimated at EUR 9.7 million.

Romania's performance in terms of ICT graduates has positive implications for the EU's collective efforts to reach the Digital Decade target of 20 million ICT specialists, with an increased gender convergence. The ongoing efforts to reduce school abandonment and achieve a higher overall rate of post-secondary education graduates, together with continued measures to improve the level of basic digital skills in pre-university education will translate in even higher absolute numbers of ICT graduates. However, additional measures to retain ICT specialists seem needed to drive a better performance of Romania in increasing the number of ICT specialists in employment in the country.

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

While Romania's performance on digital public services remains below the EU average, major projects and reforms are being implemented, supporting an ambitious vision of transforming government services to render them more efficient, more transparent and more consumer and environmental friendly.

3.1.2.a e-ID

Romania has pre-notified one e-ID scheme with a high level of assurance, ROeID. In May 2023, a beta version of the ROeID application, a centralized software platform for digital identification was launched

for public use. The platform enables the centralised management of citizens' electronic identities and credentials, as well as the provision of identity information to target systems that provide electronic services, so that citizens can use a single account to connect to any e-government service. The notification is planned for 2024, followed by the progressive integration of the ROeID system with the digital public services.

In the meantime, the use of the ROeID platform is growing, with 128.000 users in the past 12 months. However, according to Eurostat data, the percentage of individuals in Romania who have used their eID to access services provided by public authorities or public services of their country in the previous 12 months is 1.6%, compared to an EU average of 35.8%.

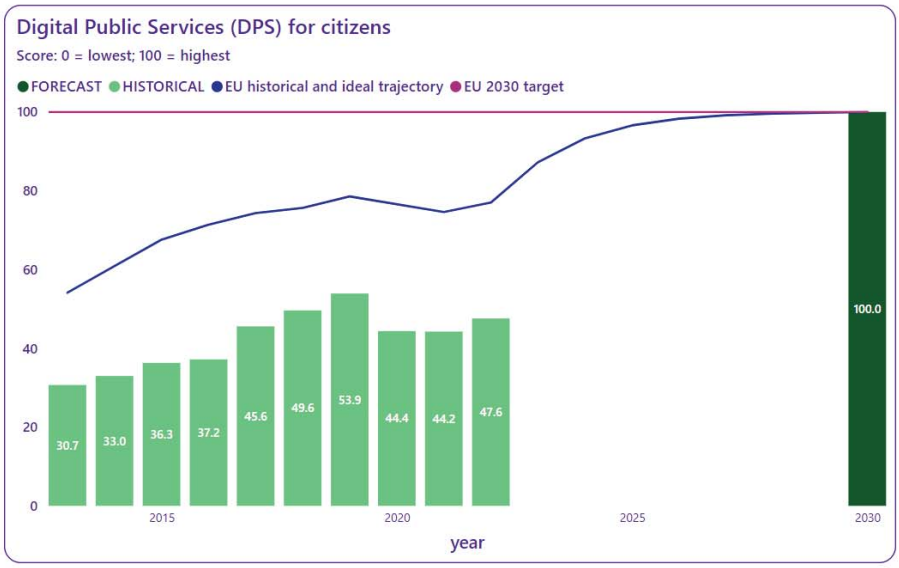
Various ongoing projects are relevant to the e-ID target and are described thoroughly in the roadmap. The construction of Romania's eIDAS node and its interconnection with the eIDAS nodes of the other Member States, in accordance with the eIDAS Regulation, is being carried out through the SITUE project, benefiting from approximatively EUR 2 million of ERDF funding. The construction of the node was completed in 2023 and its interconnection with the rest of the European nodes is expected to be completed by December 2024.

The Romanian RRP includes a EUR 150 000 investment supporting the e-ID target. The project aims to provide 5 million citizens with electronic identity cards and digital signatures by 2026. While the target number was reduced during the 2023 RRP revision due to implementation difficulties, the objective of this investment is to support the transition towards electronic identity cards, and to facilitate the digital interaction between public or private entities and individuals.

Furthermore, in preparation for the implementation of the revised eIDAS Regulation, **Romania is actively participating in two large-scale pilot projects testing the European Digital Identity Wallet across various real-life scenarios**: (i) EWC, which is piloting use-cases for digital travel credentials, payments, and organisational digital identities; and (ii) DC4EU, which is testing education/professional qualifications and social security documents.

Romania also participates in the blockchain EDIC, with the objective to increase the level of confidence in governmental transactions, in particular in a cross-border context.

3.1.2.b Digitalisation of public services for citizens and businesses



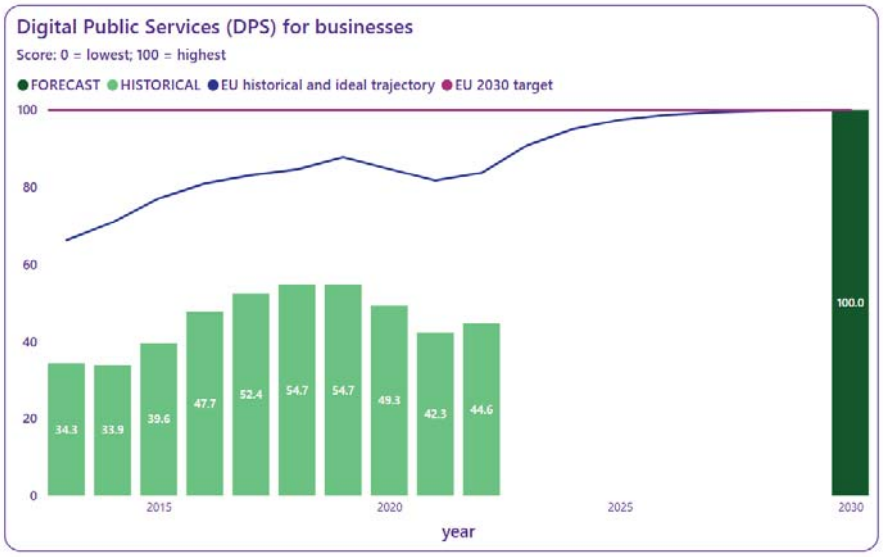
2023 state of play and recent progress

	Country level	EU level
FORECAST		87.2
DESI 2024	52.2	79.4
AVERAGE ANNUAL GROWTH %	9.7	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	50.0	85.4
AVERAGE ANNUAL GROWTH %	12.1	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

Romania has scope to improve its performance to contribute to EU's 2030 targets of full availability of digital public services for citizens and for businesses. With aggregate scores of 52.2 and 50 respectively, the gap with the EU averages of 79.4 and 85.4 respectively is still quite significant. **Yet, growth rates in the range of 10-12% indicate a very strong dynamic compared to that of the EU averages** and therefore a tendency of convergence.

Various support indicators nuance this picture. On transparency of service delivery, design and personal data, Romania scores 42.6 compared to an EU average of 67, while on pre-filled forms, Romania stands at 39.6 compared to an EU average of 70.8, both indicators displaying a very limited dynamic. The score for user support has increased to 71.2 but remains low compared to the EU average of 86.4. Finally, with the

proportion of the population using e-Government services being only 24.6%, Romania is much below the EU average of 75%.

In the national roadmap, the Romanian authorities commit themselves to target scores of 100 for both digital services for citizens and for businesses, aligning the national targets to the EU level of ambition. While these targets are ambitious given Romania's starting point, **if the current level of progress is maintained, the values will be reached either before or just around 2030.** A significant number of reforms and measures have been carried out in recent years and are still ongoing. The roadmap estimates that these will start showing impact on the ground, and implicitly on the KPI performance of Romania, as of 2026.

Several new measures were taken in 2023 and other important projects have continued throughout the year. **Law No 9 of January 2024 is expected to reduce bureaucracy, improve transparency, and further drive the digitalisation of public services**. Among others, public institutions are mandated to publish updated information and application forms for all public services they provide in electronic format. Furthermore, they must accept electronic copies of identity cards, eliminate the requirement to submit legalised copies of documents, and not request any paper item.

Meanwhile, work to digitalise specific public services continues. Significant ERDF funding, estimated at over EUR 860 million, is dedicated to supporting this digital transformation of the administration and the way it delivers services, both at national level and through the various regional programmes. Several important projects are ongoing with the aim of digitally transforming specific national services, including the digitalisation of the medical system (see below), of environmental services, of labour and social protection services, etc.

For example, the Romanian National 112 Emergency Communication System is in the process of migrating from circuit-switched to all-IP technologies, aiming for a high level of connectivity and an increased accessibility for all citizens, including people with a disability. Another ongoing initiative concerns the digitisation of more than 10 000 000 civil status documents currently available in physical format. These documents are expected to be made available electronically through a service portal in 2024.

Best practice: hub.mai.gov.ro

The Hub of Services of the Ministry of Interior Affairs was launched in February 2023 to simplify citizens' and businesses' access to the Ministry's services. 8 new digital services were launched on the platform: access to criminal records, history of traffic penalties, building permits, etc. The user base and the total number of visits has grown steadily, reaching over 5.9 million visits during the first year of operation.

Furthermore, two RRF-funded projects, worth over EUR 560 million, aim to deliver a cloud government infrastructure, with at least 30 public institutions connected to and using the government cloud by the end of 2024 and 4 data centres, cloud hardware and software by the end of 2025 and at least 40 governmental applications developed for cloud or migrated to cloud by 2026.

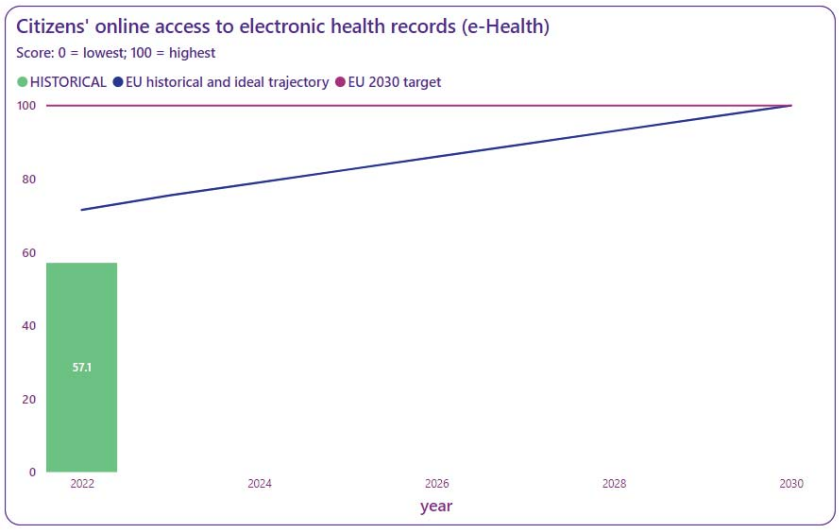
A national interoperability nodal point (platform) will be set up over the coming 6 years to support the implementation of the Interoperability Law adopted in 2022, by facilitating the exchange of data between institutions, eliminating the need to duplicate databases and the obligation for citizens to provide – during administrative procedures - information and documents that are already available to at least one institution or public authority.

Finally, the RRP also envisages the creation of a **Single Digital Portal (PDUro) aiming to help citizens and businesses access information on administrative procedures online**, with the important administrative procedures for cross-border users being available online.

The Inter-ministerial Committee for e-Governance and Red Tape (CERB), chaired by the prime minister and consisting of representatives from 27 public institutions, oversees the implementation of the e-Government policy in Romania, ensures coherence and coordination and creates a compliance framework for technical standards. Moreover, the Observatory for Digital Transformation, funded with EUR 100 000 from the Technical Support Instrument has been set up to monitor actual progress.

Major work is ongoing and has the potential to radically transform the delivery of public services in Romania, but this work will need to be sustained over time. Delivering these ambitious projects in a timely manner will require **maintaining sufficient levels of funding, continuously investing in administrative capacity, including project management and ICT specialists in the public administration, and ensuring effective coordination across the relevant authorities**.

3.1.2.c e-Health



2023 state of play and recent progress

	Country level	EU level
FORECAST		75.5
DESI 2024	58.6	79.1
AVERAGE ANNUAL GROWTH %	2.7	10.6

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

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

With an overall e-Health maturity score of 59, compared to an EU average of 79, Romania has scope to improve its performance to contribute to the digital decade target for access to e-Health records. No target is included in the national roadmap, but the state of play and the ongoing projects that are relevant for this target are explained. A centralised, nationwide service to access e-Health records is available in Romania, but only an estimated 40-59% of the population is technically able to access it and the online access service does not follow guidelines on web accessibility. Moreover, Romania scores 38 on categories of health data, compared to an EU average of 74: all data categories investigated in this framework, except medical devices/implants, laboratory tests, and medical images are made available to citizens, although generally not in a timely manner. Across all sub-indicators, the country's lowest-score is for electronic results and reports, with a maturity score of 13. On a positive note, in 2023, more categories of healthcare providers have started to supply data, with both public and private secondary and tertiary hospitals and clinics now connected to the access service. However, rehabilitation centres, geriatric nursing homes, and mental health facilities are not yet connected and supplying data.

The Romanian roadmap announces **a first national strategy for the digitalisation of the health system**, which is expected to be delivered in 2024. The strategy takes into account certain shortcomings and bottlenecks, including the fragmentation of data management and underuse of data, the lack of interoperability, the poor functioning of the national information platform for health insurance (PIAS), and the electronic health records, which are uploaded on this platform in a non-systematic manner.

Meanwhile, **important projects benefitting from EU funding are ongoing**. A EUR 400 million RRF project aims to improve the Health Insurance Information Platform (PIAS), to digitalise certain institutions with healthcare responsibilities and certain public healthcare units, and to deliver telemedicine solutions in remote areas.

Moreover, the ERDF funded Operational Programme for Health includes investments of EUR 143.4 million to create a National Observatory for Health Data as well as to deliver various e-Health solutions. Romania is also participating in the Working Group establishing the Statute and other relevant documents for the Genome EDIC, with the objective to improve access to health data throughout the EU.

When implementing these projects, it is important to take into account the open issues concerning access to e-Health records, in particular the coverage of the access services, the availability of data types, the data supply by healthcare providers, and the various considerations on ease of access.

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

According to the Digital Decade Eurobarometer, 59% of Romania's population considers that the digitalisation of daily public and private services is making their life easier. This score is below the EU average (73%), confirming the existence of a significant untapped potential and of major bottlenecks to be tackled for accompanying people through the digital transition. The aspects that the Romanian population identifies as most important in facilitating the daily use of digital services and technologies are connectivity (68%), products and services that are better adapted to personal needs (67%), safety and security (66%) and human support (60%).

According to the same Eurobarometer results, the Romanian population has identified the following issues as most worrying/impactful in relation to the behaviour and use of online platforms: fake news and disinformation (43%), misuse of personal data (32%), untrustworthy online sellers (28%), insufficient protection of minors (25%). Moreover, Eurostat data indicates that 20.8% of individuals in Romania have reported encountering messages online that were considered to be hostile or degrading towards groups of people or individuals in the last 3 months, which is the lowest rate in the EU.

Developments relevant to building a transparent, open and safe digital environment took place in 2023. The Telecom National Regulatory Authority for telecommunications, ANCOM, was designated as Digital Services Coordinator, in accordance with the Digital Services Act. ANCOM also performs the function of single contact point, in charge of reporting and sharing data with the European Commission and the other Digital Services Coordinators across the EU.

Furthermore, the Audiovisual Law (Law 504/2002), was amended in 2022 to transpose the provisions of the Audiovisual Media Services Directive, requiring video-sharing platform providers (VSPs) under Romania's jurisdiction to take measures to protect minors from audiovisual content that may impair their physical, mental or moral development, in particular programmes containing pornography or unjustified violence, and also to protect the general public from content that contains incitement to violence or hatred directed against specific groups of people, or other forms of illegal content. The National Audiovisual Council is in the process of creating, through secondary legislation, mechanisms to assess the appropriateness of the measures taken by VSPs.

By monitoring audiovisual programmes and sanctioning service providers, the National Audiovisual Council also helps fight the spread of disinformation and misinformation, implementing relevant provisions of the same Law 504/2002.

According to the Romanian roadmap, particular attention is paid to the protection of minors online. In 2023, **the government approved the new National Strategy for the Protection and Promotion of the Rights of**

the Child 'Protected Children, Safe Romania' for 2022-2027 and its operational plan. The general objective of these documents is the safe use of the online space by children.

Public education activities on how to recognize and critically evaluate information sources are key components in the fight against disinformation and misinformation. **Media literacy campaigns are run by both public authorities and non-governmental organisations**. In particular, Save the Children Romania runs the '*Ora de Net'* programme which promotes online safety and safe internet use by children. Furthermore, a series of events took place as part of the Global Week of Media Education and Information Education, organised annually under the auspices of UNESCO.

Still, according to research conducted by Save the Children Romania, 77% of children interviewed declared spending more than 3 hours a day on the internet and 40% of them declared having been victim of cyberbullying. The same research suggests that most parents believe that their kids spend less than 3 hours a day online and that only about 10% of kids have been victim of cyberbullying. Such findings illustrate the need to strengthen media literacy training at all levels of education.

The Romanian roadmap also underlines the action taken to support digital inclusion, for example the measures to support accessibility for people with a disability and the measures to combat illegal content and hate speech, reflecting a growing concern for these issues.

4 Leveraging digital transformation for a smart greening

Of all the Romanian enterprises of 10 employees of more, 52.7% consider the environmental impact of ICT solutions and devices when choosing them and apply some measures to reduce paper or energy consumption of ICT devices, compared to an EU average of 48.7%. By contrast, recycling rates are lower than in other EU countries, with only 8% of individuals recycling their mobile phones, 7% recycling their desktop computers, and 5% recycling their laptops or tablets.

An important development observed in 2023 in relation to the twinning of the green and digital transitions is **the adoption of the first national strategy of Romania on education and climate change for 2023 - 2030**, which includes the development of a digital ecosystem for education and climate change (Government Decision No. 59 of 18 January 2023).

An example of a specific initiative is the development of the national digital platform www.saptamanaverde.edu.ro (Green Week) which provides useful interactive information on protected natural areas and educational routes, teaching materials, as well as a library of open educational resources. The platform accompanies the 'Green Week' national programme in schools, which aims to implement environmental education and climate resilience activities in schools. Furthermore, a new optional course 'Education and Climate Change' has been introduced into the secondary school curriculum (7th-8th grades) from the 2023/2024 school year. It aims to promote a healthy lifestyle and develop resilience to climate change using digital resources.

Furthermore, the Romanian roadmap underlines that the major digitalisation efforts in the areas of public services, including the digitalisation of environmental services, have strong synergies with climate action. For example, the RRP funds an integrated IT system to support sustainable development, improve infrastructure and environmental quality, protect nature and preserve biodiversity. This includes infrastructure for the supervision, control and assurance of forest integrity and the transport of wood and the digitalisation of at least 32 environment-related public services, related to emission inventories, Natura 2000 reporting, waste management services, etc.

Importantly, the Romanian RRP includes 165 measures that are tagged as both green and digital, covering areas such as the digitalisation of energy grids, energy efficiency and renewables, smart mobility, etc.

Finally, **specific measures targeting innovation in cleantech exist, supporting an emerging cleantech start up ecosystem**, either through national programmes (with a significant percentage of public funding sources dedicated to renewable and energy efficiency, energy storage, green mobility, etc) or via EDIHs.

Annex I – National roadmap analysis

Romania's National Digital Decade Strategic Roadmap

Romania **submitted** its draft national strategic roadmap in December 2023, in accordance with Article 7 of the Digital Decade Policy Programme Decision. The roadmap was published[20] for public **consultation in March 2024**, ahead of its formal **approval by the government.**

Romania's roadmap is well developed and ambitious in some aspects, although not complete, nor always very specific in terms of conformity with the aspects required by the Commission's Guidance.

The roadmap includes national target values for all targets except quantum, semiconductors, edge, and eHealth. For unicorns, the definition of the EU KPI is not followed. Moreover, in some cases (e.g. digitalisation of business, 5G coverage, digital skills) the values are set significantly below the corresponding EU targets. Justification for these levels is provided, but based on the current performance, there is scope to raise the level of ambition, in particular for the 5G, ICT specialists and cloud adoption targets. For edge nodes e-Health, and unicorns', trajectories are also missing.

Furthermore, the measures included seem to support the targets and objectives of the Digital Decade Policy Programme, although they are not clearly attributed to these, nor is the information provided on timing and budgets sufficiently detailed. However, it is clear that most measures are funded under the Romanian RRP, followed by measures funded by the European Regional Development Fund. It is also clear that the timing is aligned with these programmes.

The following table reflects a best effort attempt to estimate and categorise the number of measures and their relative budgets contributing to the targets, made by the Commission:

Digital Decade Target/objective	Budget (EUR million)	Number of measures
Connectivity Gigabit	0,0	3
Connectivity 5G	0,0	2
Semiconductors	0,0	1
Edge nodes	-	-
Quantum computing	10,0	2
SME take up	65,4	15
Cloud/AI/Big Data uptake	60,0	8
Cloud only uptake	-	-
AI only uptake	-	-
Big data uptake	-	-
Unicorns	444,5	16
Basic Digital Skills	808,0	16
ICT Specialists	253,0	7
eID	220,0	2
Key Public Services	1 078,0	11
e-Health	559,0	3
Objectives	69,3	11
Total	3 567,2	97

[20] Plan-national-de-actiune-roadmap-pentru-publicare.pdf (gov.ro)

The overall vision is consistent with Romania's strengths and weaknesses, with a solid analysis of the factors influencing digitalisation in Romania. The measures set out in the roadmap address, to various extents, the main challenges that Romania deals with in its digital transition, in line with previous Digital Decade and country specific recommendations. Most efforts, in terms of overall budget, concentrate on the digitalisation of public services and digital skills, considered at this point the most pressing issues. Significant funding is dedicated also to the digitalisation of businesses, although most measures included in the roadmap are taken at regional level via the European Digital Innovation Hubs and as such they are not likely to address all the identified challenges. Indeed, the roadmap acknowledges that further action is needed to support digital R&D, innovation, and the digital transformation of business. Finally, the Romanian authorities have kick-started discussions and/or institutional processes to develop support policies in areas where less activity exists (e.g. edge nodes, quantum, twinning the green and digital transitions). Overall, the roadmap could be further developed when it comes to the general objectives of the programme, including to better reflect ongoing activities.

Annex II – Factsheet multi-country projects and funding

Multi-Country Projects and European Digital Infrastructure Consortia

Romania participates, using a EUR 400 million contribution from the RRF in the important project of common European interest (IPCEI) on semiconductors and low power processors. Romania also participates in the multi-country project setting up and linking European Digital Innovation Hubs. It is expected that this participation will be beneficial in terms of capacity and performance in the respective areas.

Concerning European Digital Infrastructure Consortia (EDICs), out of the currently established ones, Romania participates in 3 of them: EUROPEUM (Blockchain), where Romania is already a member, as well as Genomics and Public Administration, where Romania is part of the Working Groups developing the Statutes and other relevant documents. Romania's main interests lie with enabling a cross-border exchange of information in a reliable, secure and verifiable way, making the Romanian language more available via advanced European translation solutions, and contributing with data to personalized medicine and advanced clinical information.

EU funding for Digital in Romania

EU funds support Romania's digitalisation efforts. In accordance with an analysis by the Joint Research Centre[21], most of the funding that directly supports the Digital Decade targets comes from the RRF, with a contribution estimated at EUR 4792 million (out of a total of 5772 million dedicated to digital from the Romanian RRP), followed by cohesion policy funds, with a contribution estimated at EUR 1873 million.

In total, measures under Romania's Recovery and Resilience Plan contribute approximately EUR 5.8 billion (i.e., 21.8% of Romania's total allocation) to the country's digital transformation. As a result of the 2023 revision of the plan, the percentage dedicated to digital increased, in spite of an overall downward revision of Romania's RRF grants allocation of EUR 2 billion. Most of this funding focuses on the digital transformation of the public sector, digital education, digitalisation of transport, cybersecurity and connectivity, digitalisation of businesses and digital innovation.

[21] JRC report "Mapping EU level funding instruments 2020-2027 to Digital Decade targets - 2024 update" (Signorelli et al., 2024)".

State of the Digital Decade 2024

Slovakia

1 Executive summary

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

In 2023, Slovakia made notable progress in enhancing digital public services for citizens and businesses, as well as advancing e-Health initiatives. However, **significant challenges** persist in expanding gigabit network coverage and improving basic and advanced digital skills across the population.

Digitalisation has been at the centre of the government's latest reforms and plans. In addition to the Action plan for the digital transformation of Slovakia for 2023-2026 and the National Digital Skills Strategy of the Slovak Republic and the 2023-2026 Action Plan, Slovakia has published the Smart Cities and Regions Plan 2023-2026 and the National Research & Development & Innovation Strategy 2030, adopting comprehensive and challenging objectives at all levels for a better quality of life. The implementation of these strategies should boost Slovakia's digital transformation, as it still lags behind the EU average in all but one Digital Decade key performance indicators (KPIs).

According to the Digital Decade Eurobarometer[22], 82% of Slovakia's population consider that the digitalisation of daily public and private services makes their life easier. This score is significantly above the EU average of 73%.

Slovakia is a member of the Local Digital Twins – CitiVERSE European Digital Infrastructure Consortium (EDIC), an observer in the Alliance for Language Technologies EDIC, (all already set up). Slovakia is a member of the working groups aiming to set up the IMPACTS EDIC, the Mobility and Logistics Data EDIC, the Genome EDIC and the Digital Commons EDIC[23], and of working groups exploring other possible areas to set up EDICs. It is also a member of the important project of common European interest in the field of microelectronics and communication technologies (IPCEI-ME/CT).

Slovakia's Recovery and Resilience Plan (RRP) allocates 20.5% to digital (EUR 1.2 billion)[24]. It was updated in July 2023 to include reforms and investments that address REPowerEU objectives. Under Cohesion Policy, an additional EUR 0.9 billion (7% of the country's total Cohesion Policy funding) is allocated to the country's digital transformation[25].

[22] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351
[23] Information last updated on 31 May 2024.
[24] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.
[25] 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]	Slovakia			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	SK	EU
Fixed Very High Capacity Network (VHCN) coverage	71.3%	69.1%	-3.1%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	66.9%	64.2%	-4.0%	64.0%	13.5%	x	-
Overall 5G coverage	55.3%	79.0%	42.8%	89.3%	9.8%	98.5%	100%
Semiconductors		NA					
Edge Nodes		8		1 186		x	10 000
SMEs with at least a basic level of digital intensity	43.0%	42.2%	-0.9%	57.7%	2.6%	90%	90%
Cloud	30.8%	30.2%	-1.0%	38.9%	7.0%	75%	75%
Artificial Intelligence	5.2%	7.0%	16.0%	8.0%	2.6%	75%	75%
Data analytics	NA	30.2%	NA	33.2%	NA	75%	75%
AI or Cloud or Data analytics	NA	45.8%	NA	54.6%	NA		75%
Unicorns		0		263		3	500
At least basic digital skills	55.2%	51.3%	-3.6%	55.6%	1.5%	70%	80%
ICT specialists	4.3%	4.2%	-2.3%	4.8%	4.3%	6%	~10%
eID scheme notification		Yes					
Digital public services for citizens	67.2	72.1	7.2%	79.4	3.1%	100	100
Digital public services for businesses	77.9	79.2	1.6%	85.4	2.0%	100	100
Access to e-Health records	42.0	66.3	57.8%	79.1	10.6%	100	100

[1] See the methodological note for the description of the indicators and other descriptive metrics
[2] Last measure used is for 2021

National Digital Decade strategic roadmap

With respect to **Slovakia's** contribution to the Digital Decade Policy Programme, its national roadmap demonstrates **a high ambition** while it intends to devote **significant effort** to achieve the Digital Decade objectives and targets.

Slovakia's roadmap, published in March 2024, presents a comprehensive overview of the country's digital strategic direction for development. The document provides insights into the state of play, challenges, and strengths across various sectors. In particular, the roadmap outlines numerous targets, most of them (nine targets on connectivity, businesses, and public services) in line with the EU target. It also mentions 113 measures, with a significant commitment to digital advancement, underscored by an estimated budget of EUR 2 270 million (1.8% of GDP).

Some areas are presented in less detail. For example, no detailed measures are mentioned for edge nodes, semiconductors, and quantum technologies. The roadmap partially aligns with key recommendations presented in the Slovak Digital Decade Country Report 2023, with an emphasis on action to improve access to information and knowledge sharing for businesses, including through European Digital Innovation Hubs and action to digitalise public services. However, more ambition is needed on connectivity and digital skills.

Recommendations for the roadmap

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

- **TARGETS:** (i) Propose national target values for FTTP and edge nodes. (ii) Recompute the VHCN trajectory using the correct values. (iii) Re-evaluate possible efforts on 5G coverage, basic digital skills and ICT specialists.
- **MEASURES:** (i) Reinforce measures aimed to contribute to digital skills development and to foster connectivity. (ii) Provide more information on the implementation of digital rights and principles (and Digital Decade general objectives), including what national measures contribute to it. (iii) Review the budget estimated for all presented measures, highlighting the different sources, including more detail on EU funds such as RRF.
- **CONSULTATION:** Provide further detail on the consultation process of the roadmap.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' provides key insights into Slovak perceptions of digital rights. 47% of Slovak respondents believe the EU protects their digital rights, a 5-point increase since last year. Confidence in digital privacy stands increased by 5 points to 52%, aligning with the EU average. Notable concerns include worries about online safety for children (57% of respondents, up 8 points), and about control over personal data (39%). Positive trends are evident in the high value placed on digital technologies for accessing public services (84%) and connecting with friends and family (89%), both 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[26].

A competitive, sovereign and resilient EU based on technological leadership

Despite a commitment to ensure equal access to affordable high-quality digital connectivity, with 69% of households currently covered by VHCN, challenges remain to ensure Gigabit coverage for all. Action to create opportunities through research, development and innovation is underway, although the share of the ICT sector in private R&D expenditure remains relatively low at 0.6%. Initiatives for collaboration undertaken between academia, industry, and government aim to drive innovation and develop capacities in areas like semiconductors and quantum. Infrastructure enhancements, such as the new international optical backbone route and development of the Slovak quantum communication infrastructure, help to further improve the resilience of Slovakia's digital ecosystem. Moreover, Slovakia has taken action to promote the uptake of digital technologies by businesses, with currently 42% of SMEs having at least a basic level of digital intensity, recognising their role in driving economic growth.

Recommendations – Slovakia should:

- **CONNECTIVITY INFRASTRUCTURE:** (i) Develop targeted initiatives to fill the investment gap and secure public and private funding in broadband coverage and uptake to address the identified gigabit and 5G connectivity challenges, especially in rural areas. (ii) Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-

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

consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.

- **SMEs:** Accelerate the diffusion of innovative technologies and solutions across the economy to improve digital adoption and competitiveness.
- **SEMICONDUCTORS/EDGENODES/QUANTUM:** Foster increased involvement at the European level to promote the adoption of semiconductors, edge nodes, and quantum technologies.
- **AI/CLOUD/DATA ANALYTICS:** (i) Support the development, roll out and take up, including support for capital investment in cloud computing, artificial intelligence, data analytics, and other cutting-edge technologies. (ii) Stimulate the adoption of next generation cloud infrastructure and services by companies of all sizes, including by liaising with the Cloud IPCEI Exploitation office and/or the coordinators and the Member States participating in the IPCEI-CIS.
- **UNICORNS:** Expand existing measures aimed at supporting the growth of scale-ups and startups that drive innovation and invest in emerging technologies.
- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

Protecting and empowering EU people and society

Slovakia is actively fostering a human-centred, inclusive, and transparent digital environment, in alignment with overarching EU objectives for the digital empowerment of its citizens. Measures such as the adoption of the Consumer Protection Act reflect efforts to empower individuals by ensuring a fair balance between consumer rights and obligations in the digital sphere. These legislative measures address emerging challenges in the digital realm and align with EU consumer legislation. Additionally, Slovakia's participation in the INHOPE network underscores the country's dedication to promoting digital inclusion and safeguarding online safety, particularly for vulnerable groups like children. However, Slovakia’s measures have not yet translated into better performance on digital skills. Actions in education at all levels still require improvement, with a decline in basic digital skills from 55% to 51% in the past year, below the EU average of 55%, possibly due to post-COVID-19 effects (i.e., lower usage of ICT tools). Special attention is needed for age groups 55 to 64 (38%) and 65 to 74 (19%). The national targets for 2030 are lower than the EU targets. With a national target of 70% for basic digital skills, and 6% for the population being ICT experts by 2030, more specific and broader measures are necessary and are crucial for strengthening digital skills in Slovakia, in alignment with existing national strategies.

The use of e-ID remains limited as only 8% of the population use e-ID for public services, compared to an EU average of 36%. To address this, Slovakia has launched the Digital Identity Testing and Deployment project, which will run until 2026, aiming to enable access to digital identity through mobile devices. In the realm of digital public services, Slovakia’s performance in services offered to citizens and businesses, although showing some improvement, continues to lag behind the EU average. Actions are underway to promote digitalization, including by streamlining public procurement processes, increasing electronic communication with public administration, and improving access to electronic health records. Awareness campaigns and the development of dedicated mobile applications are being considered to boost usage and accessibility of e-Health services, aligning with Slovakia's commitment to leveraging technology to improve healthcare provision.

Recommendations – Slovakia should:

- **BASIC DIGITAL SKILLS:** (i) Expedite the implementation of new curricula in primary and secondary schools, incorporating robust programs focused on informatics and digital skills. (ii) Implement a comprehensive upskilling program for schoolteachers to ensure that all educators possess adequate digital competencies.
- **ICT SPECIALISTS:** Foster the development of more flexible and diverse certified ICT studies at various levels and modalities within higher education.
- **DIGITAL PUBLIC SERVICES:** Strengthen the digital transformation of public services and actively encourage the adoption of electronic modalities by both workers and retired citizens.
- **E-HEALTH:** (i) Offer a mobile application for citizens to access their electronic health records, enhancing the authentication method for logging into the online access services with full accessibility compliance. (ii) Make the data type of medical images available to citizens through the online access service. (iii) Expand the coverage of the online access service to ensure that all citizens can access their electronic health data online.

Leveraging digital transformation for a smart greening

Slovakia can still capitalise on green transformation opportunities, fostering the development of green skills and advancing its digital and professional capabilities in line with its strategic objectives. Measures like the 'Analysis of the transition to green ICT in public administration' are underway to assess the impact of transitioning to sustainable communication infrastructures, green data centres, and energy-efficient ICT services. These initiatives prioritize digital rights and sustainability by integrating principles of data privacy, security, and ethical technology use, helping to achieve environmental sustainability and digital inclusion.

Recommendations – Slovakia should:

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

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

2.1 Building technological leadership: digital infrastructure and technologies

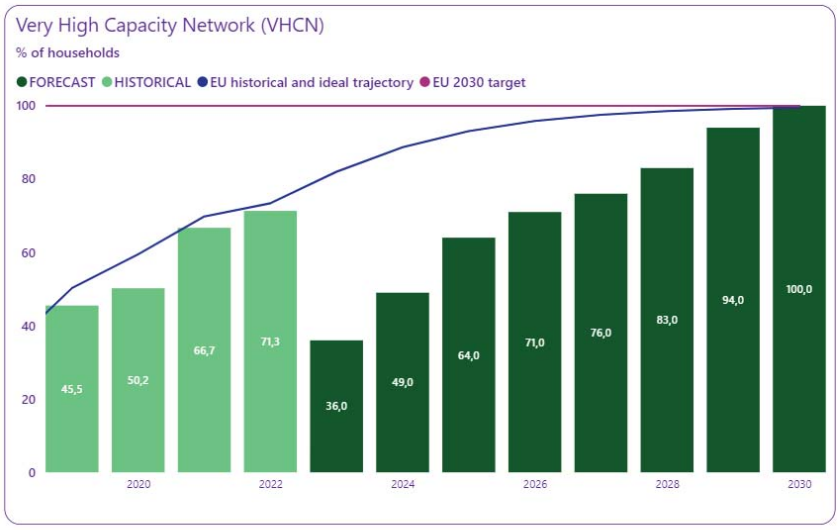
Slovakia is dedicated to promoting digital inclusion, including by ensuring that everyone has access to affordable and high-speed digital connectivity. While investment is a critical issue for the next years, initiatives are being implemented to ensure full geographical coverage, including rural areas, to provide equal opportunities for all citizens and businesses.

Slovakia is focused on promoting research and innovation to foster resilient and enduring digital infrastructure and technologies. Initiatives are being implemented to encourage collaboration between academia, industry, and government bodies to drive innovation, promote the take-up of technologies by enterprises and develop capacities in the areas of semiconductors, edge nodes and quantum, to address societal challenges while improving competitiveness.

2.1.a Connectivity infrastructure (Gigabit)

Slovakia has scope to improve its performance to contribute to the EU's Digital Decade target on Very High-Capacity Networks (VHCN), while demonstrating a very limited dynamic. With 69% of households currently covered by VHCN, a stable rate compared to the last reporting period, Slovakia has untapped potential to improve its performance, as it has a 10% gap compared to the EU-level of coverage. Rural coverage is also below average, as VCHN covers 35% of households in this area.

In its roadmap, Slovakia has adopted the EU-level target of achieving 100% coverage by 2030, while also adopting a lower-than-observed starting point for its trajectory. The Digital Decade Eurobarometer indicates that 88% of Slovakians consider the availability and affordability of a high-speed internet connection fairly or very significant.



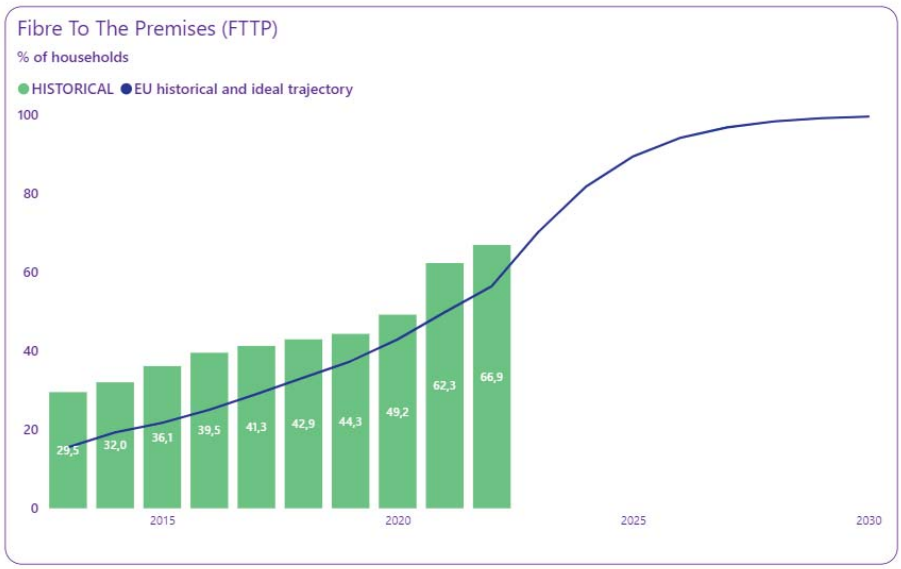
2023 state of play and recent progress

	Country level	EU level
FORECAST	36,0	82,0
DESI 2024	69,1	78,8
AVERAGE ANNUAL GROWTH %	-3,1	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

At 64%, **the country's coverage for FTTP connectivity is on a par with the EU average,** even though it shows a decrease compared to the last available data (67%). Slovakia has not provided a trajectory or target for this KPI in its roadmap.



2023 state of play and recent progress

	Country level	EU level
FORECAST		70,3
DESI 2024	64,2	64,0
AVERAGE ANNUAL GROWTH %	-4,0	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

Slovakia has continued implementing its **National Broadband Plan (NBP), approved in March 2021.** The NBP aims to ensure that all households have a connection speed of at least 100 Mbit/s with the possibility to increase it to 1Gbit/s, as well as to ensure that schools, institutions, and authorities have a connection speed of at least 1 Gbit/s.

The Broadband Competence Office supports various activities for the development and sustainability of broadband ensuring the achievement of the objectives set out in the NBP. To foster broadband deployment, several important activities were implemented in 2023, including the finalisation of the feasibility study of the NBP and Mapping 2022. The feasibility study focuses on the bottleneck – the 'last mile' of broadband connections – including the solution of regional (backhaul) networks. It elaborates in detail the rules, parameters, and requirements for the preparation of demand calls and for their implementation itself, analyses the ways of using the prioritisation of intervention areas, describes the technical, environmental, financial and geographical requirements for measures and describes the proposals for calls for action. As part of the coverage mapping completed in February 2023, 43 telecommunications operators provided data about current and planned coverage enabling a speed of 1Gbit/s speed. Based on this mapping, by the end of 2025 64% of address points would be covered by Gigabit speed with investment from the operators' own resources, in line with the expected trajectory for VHCN. Starting in 2024, mapping provided by operators will be georeferenced and transmitted to the Monitoring System for Regulation and State Supervision information system.

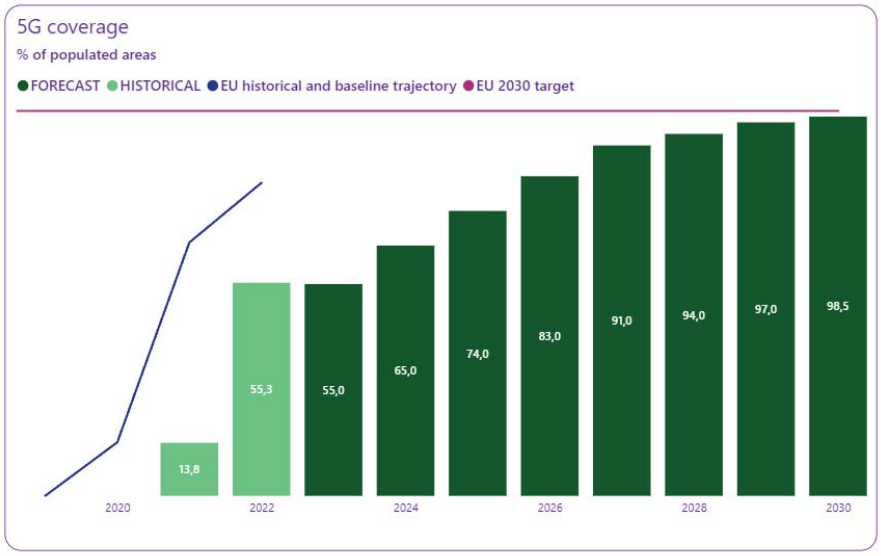
While Programme Slovakia, with the help of EU funds, can cover EUR 112 million of the investment gap, additional investment will be needed to meet the 2030 targets. The NBP includes a calculation of the investment gap, to fully achieve the EU targets and to reach the expected uncovered addresses. This gap has been estimated at around EUR 925 million, including EUR 625 million from public funds. Cities in general, and suburban areas with higher population density, have already been covered to a greater extent by the telecommunications market with local telecommunications infrastructure capable of achieving gigabit speeds. The situation is different in areas with lower population density and/or greater geographical dispersion.

To increase take-up, Slovakia has been preparing a project on social vouchers, a measure to promote the deployment of digital infrastructure in less economically viable areas. The eligible services will be fixed connectivity services offering at least 50 Mbps download speeds under usual peak time conditions. The

vouchers can be used to subscribe to a new broadband service or to retain broadband services. The voucher will be granted to eligible end-users for a total amount of EUR 440 to be spread over 24 monthly instalments.

2.1.b Connectivity Infrastructure (5G)

With a coverage of 79%, compared to an EU average of above 89%, Slovakia has scope to improve its performance to help achieve to the EU 5G target, while showing a very strong dynamic. Nevertheless, Slovakia's latest 5G coverage rate shows substantial progress from the previous year (55%). At 98.5%, the 5G coverage target for 2030, is slightly below the EU target (100%) but, at the current growth rate, it can be achieved before 2030.



2023 state of play and recent progress

	Country level	EU level
FORECAST	55,0	
DESI 2024	79,0	89,3
AVERAGE ANNUAL GROWTH %	42,8	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

In 2022, out of a total private investment of EUR 382 million, EUR 181 million was invested in mobile networks, with EUR 56 million going specifically to 5G. While the Broadband Competence Office monitors the number of investments for all registered operators providing electronic communication services on a yearly basis[27], monitoring anticipated future investments can provide a better analysis to reach coverage targets. As part of the 2020 5G auction, the Slovak national regulatory authority-imposed obligations to ensure that at least 95% of the population of each regional capital of Slovakia is covered by a 5G network by the end of 2025 and that at least 90% of the population living outside regional cities is covered by 5G by the end of 2027. In 2023, Slovak mobile operators continued to intensively build the 5G network. By the end of 2023, the three largest mobile operators have achieved a 5G coverage ranging from 52% to 70% of the population.

In 2023, the government of Slovakia approved the 'National policy for electronic communications to 2030', identifying instruments for state intervention in view of **technological trends and market developments.** One of the measures is an inventory of the spectrum in Slovakia in internationally coordinated bands for the deployment of 5G and prospectively 6G networks. As part of the preparation of the tender procedure for the allocation of frequencies in the 900 MHz and 2100 MHz frequency bands, a public consultation was held in 2023. The selection procedure will take place in 2024, complying with the principles of technological neutrality and service neutrality.

[27] Data for the previous year is provided in July.

2.1.c Semiconductors

Slovakia is taking necessary steps to actively participate in the semiconductor ecosystem. The Research and Innovation Authority (VAIA) made a call to support projects that are part of an important project of common European interest (IPCEI) in the field of microelectronics (and communication technologies, IPCEI-ME/CT). The aim and purpose of the call is to improve the synergies of research, development, and innovation measures between the national and EU levels by supporting the R&D and innovation phase and the first industrial deployment phase of projects (or part of these phases). The call supported four projects with an allocation of EUR 20 million coming from EU Recovery and Resilience Facility funds (RRF), with three companies coming from the Bratislava Self-Governing Region and one from Vrbové. A second call with a total allocation of EUR 52.7 million will award grants to quality fundamental and industrial research projects at TRL 1-3 levels (i.e., basic principles observed¸ technology concept formulated, and experimental proof of concept) for the transition to a digital economy. The call supports knowledge creation in research performing organisations as well as cooperation between all sectors.

Slovakia is also developing stronger cooperation in the fields of semiconductors with Taiwan. The working group on semiconductors of the Slovakia-Taiwan intergovernmental commission for economic cooperation developed agreements between the Slovak Academy of Sciences (SAV), the Faculty of Electrical Engineering and Computer Science of the Slovak University of Technology (FEI STU) and the Taiwan Industrial Technology Research Institute (ITRI). Through cooperation, they aim to set up laboratories, transfer know-how and carry out joint research projects. This will help ensure the development of technological capacities for semiconductor assembly in Slovakia as a seed for possible future production of back-end products, electromobility products and R&D in the field of compound semiconductors and power modules. The value of the projects is close to EUR 20 million.

2.1.d Edge nodes

Slovakia is aware of the full benefits of edge computing is present, for example in the automotive industry, but it will take some years to scale up. On edge nodes, the Edge Observatory for the Digital Decade estimates the deployment of 8 units in 2023. The figure could also indicate the need for increased funding, public-private partnerships, or incentives for technology adoption among businesses[28].

2.1.e Quantum technologies

On quantum technology, the Action plan for the digital transformation of Slovakia has the specific strategic objective of making the national quantum internet network operational by 2026, with prototype devices expected by 2025. The quantum communication network is currently being constructed with funds from the Digital Europe Programme (under the EuroQCI initiative) and the national Recovery and Resilience Plan. The network will connect in the first phase up to 12 academic institutions from Bratislava to Košice and create the prerequisites for interconnection with neighbouring countries. Measures include implementing scholarships and training programmes, supporting software solutions, setting up cross-border communication lines and creating a satellite quantum communication node. Within the project, the International training and education centre for Quantum Technologies will be established in order to disseminate the potential of quantum technologies among targeted public, state and industrial communities.

[28] EC (2023) Edge Observatory for Digital Decade Edge Computing Nodes: Characterisation, Deployment Monitoring and Trajectories No. *2022/012* under Framework Contract SMART 2019/0024, Lot 1.

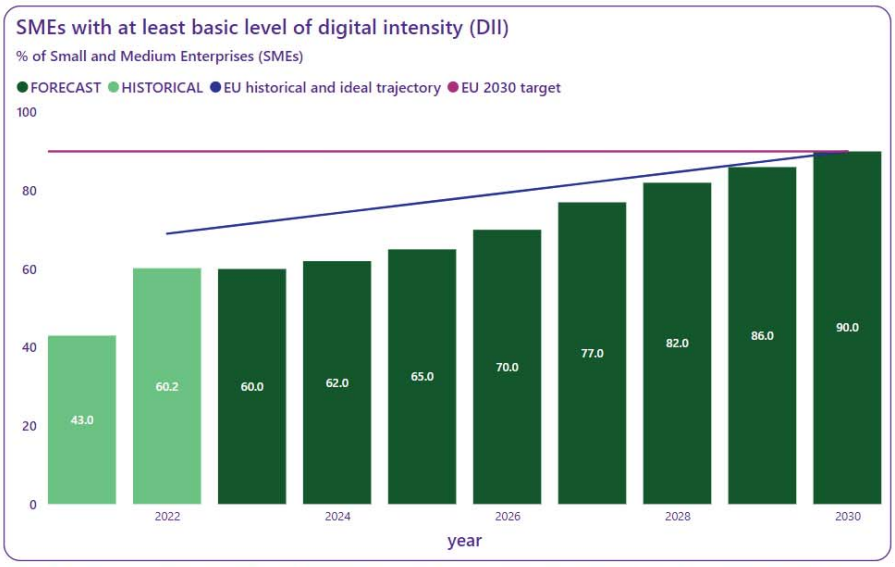
2.2 Supporting EU-wide digital ecosystems and scaling up innovative enterprises

Current initiatives in Slovakia are focused on creating opportunities through research, development, and innovation, to foster the start-up ecosystem, and achieve a high level of digital intensity in enterprises, especially SMEs. In view of improving this performance, measures include strengthening synergies between private and public investments and are supported by both EU and national funds. Their aim is to ensure that advanced digital technologies such as high-performance and quantum computing, edge and cloud services, artificial intelligence, and data analytics are taken up and integrated into industries, particularly by SMEs. In line with the EU's objectives, Slovakia is committed to ensuring the EU's digital sovereignty. This includes actions to strengthen cybersecurity measures.

Slovakia also participates as an observer in the Alliance for Language Technologies European Digital Infrastructure Consortium (ALT EDIC) and in working groups concerning a number of prospective EDICs, which are relevant for the country's contribution to the digital innovation and digitalisation of business goals: IMPACTS-EDIC EUROPEUM-EDIC, Vehicle of the future, Mobility Data Space and Digital Commons.

2.2.a SME with at least basic digital intensity

Slovakia has untapped potential to contribute to the EU's Digital Decade target for the digitalisation of SMEs, while demonstrating a very limited dynamic. Currently, Slovakia performs below the EU average with 42% of SMEs having at least a basic level of digital intensity (EU average: 58%), which represents a very limited dynamic from the last comparable measurement and is still far from the 90% target presented in the country's roadmap. The growth rate will have to drastically increase to achieve the ambitious national target of 90% of SMEs having at least a basic level of digital intensity expected by 2030.



2023 state of play and recent progress

	Country level	EU level
FORECAST	60.0	71.6
DESI 2024	42.2	57.7
AVERAGE ANNUAL GROWTH %	-0.9	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

In 2022, public investment in research and innovation in Slovakia remained relatively modest at 0.98% of GDP, compared to an EU average of 2.22% of GDP. As part of the action plan of the National Research & Development & Innovation Strategy 2030, EUR 6.98 million was allocated in 2023 to supporting SMEs in implementing innovation through vouchers, mini-grants or financial instruments to increase their competitiveness and promote the dual transformation (i.e., digitalization and decarbonisation).

The Slovak Business Agency provides SMEs with a voucher for an audit of their business, which is aimed at checking the state of digitization of business processes. Although some steps were taken to improve the

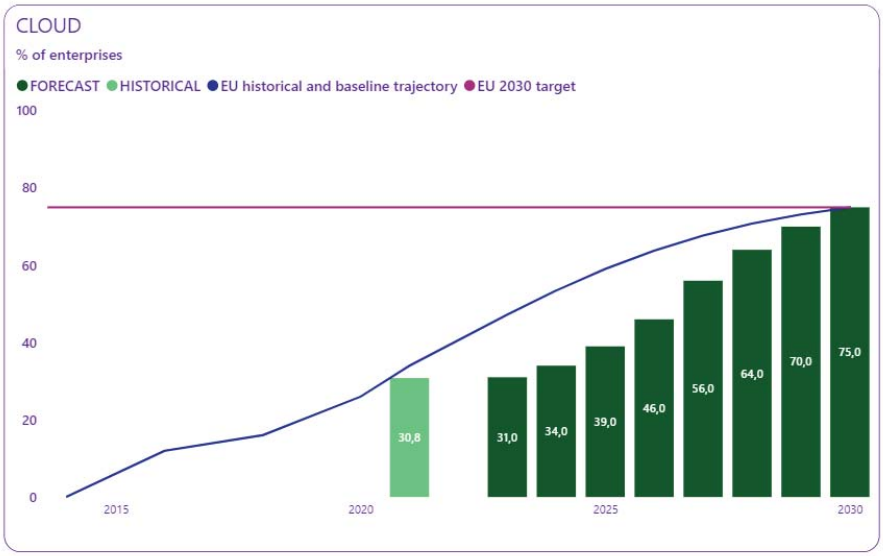
situation, expanding the development and diffusion of innovative technologies and solutions across the economy, to SMEs, is of crucial importance for improving the competitiveness of Slovak businesses.

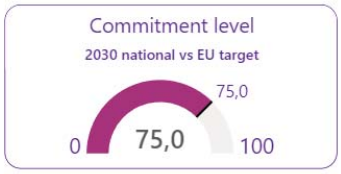
2.2.b Take up of cloud/AI/data analytics

- **Cloud**

Slovakia has scope to improve its performance to contribute to the EU's Digital Decade target for cloud adoption and demonstrates a very limited dynamic. The take-up of cloud solutions by Slovak enterprises (at 30% in 2023) is relatively below the EU average (39%) and substantially unchanged compared to 2021 (31%) while the EU is globally improving (+7% annually since 2021).

Slovakia presented in its roadmap a level of ambition equal to the 2030 target for the EU, of 75% of enterprises adopting Cloud. However, measures undertaken to reach this target, which include a cloud popularisation campaign and leveraging cloud computing in the public sector, indicate that important additional effort is required to match this goal.





2023 state of play and recent progress

	Country level	EU level
FORECAST	31,0	47,3
DESI 2024	30,2	38,9
AVERAGE ANNUAL GROWTH %	-1,0	7,0

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

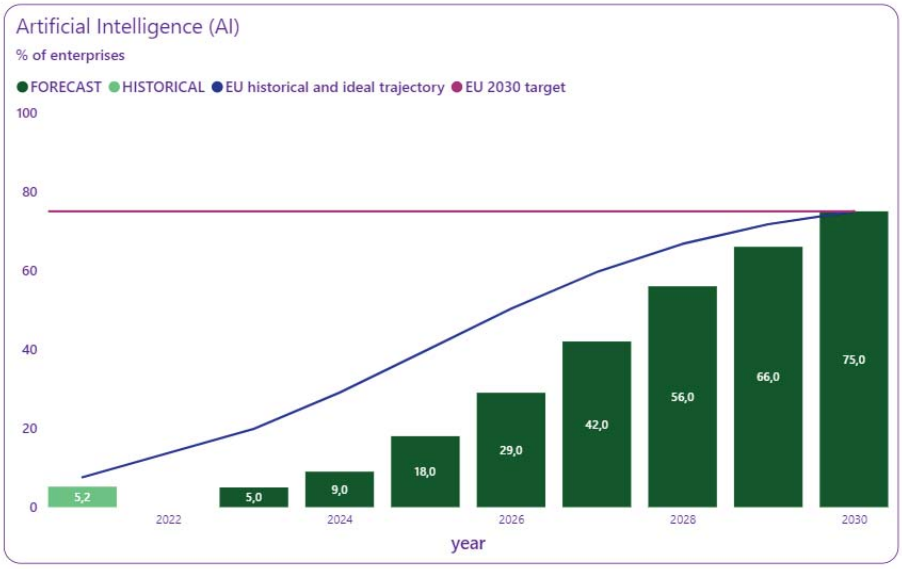
Note: The source of national forecast values is the 2023 country roadmap

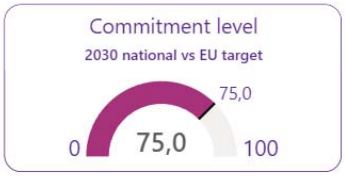
- **Artificial Intelligence (AI)**

Slovakia has untapped potential to contribute to the EU's Digital Decade target for AI adoption and demonstrates very limited dynamic. Slovak businesses are still few to adopt AI solutions with a share of 7% in 2023, an increase from a rate of 5% in 2021 and just below the EU average of 8%. Slovakia sets a 2030 target of 75%, in line with the EU target. Venture Capital (VC) investment in AI, USD 36 million in 2023, remains low compared to the aggregated VC investment for EU-27 (USD 7,9 billion)[29].

There is a growth of activities within business associations and platforms (e.g., AIslovakIA) with public participation, which begin to focus specifically on the activities to promote the use of Artificial Intelligence) and raise awareness. Slovakia has one project on AI funded by the European Innovation Council (EIC) Accelerator, to develop an application for more accurate heart attack diagnosis. However, based on the current rate of progression, and in absence of an intensification of efforts over the coming years, Slovakia's attainment of the AI EU target may be compromised.

[29] OECD.AI (2024), visualisations powered by JSI using data from Preqin, accessed on 28/3/2024, www.oecd.ai





2023 state of play and recent progress

	Country level	EU level
FORECAST	5,0	19,9
DESI 2024	7,0	8,0
AVERAGE ANNUAL GROWTH %	16,0	2,6

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

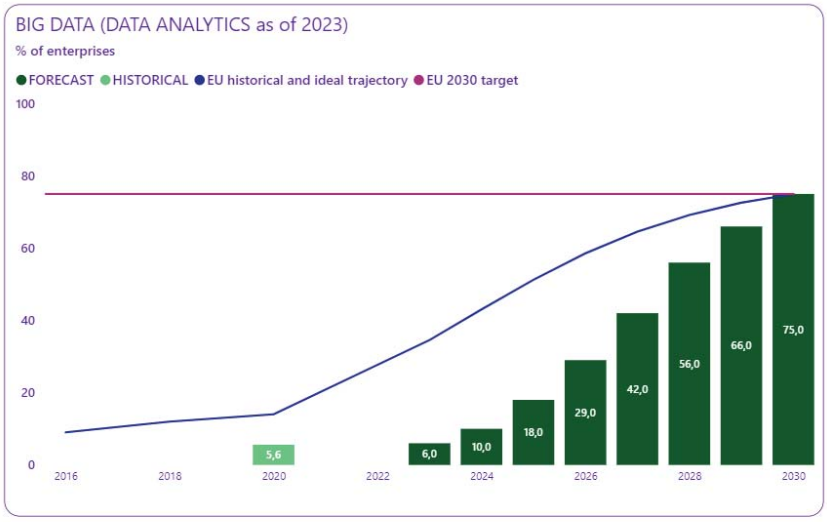
Note 1: at the end of 2023 ESTAT revised backward the values of AI. The revised value for 2021 at the EU level is 7.6 % (from 7.9 %).

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

- **Data Analytics (Big Data)[30]**

Concerning the use of data analytics by enterprises, Slovakia has untapped potential to contribute to this EU's Digital Decade target. The situation of Slovakia, with 30% of enterprises using data analytics, is slightly below the EU average of 33%. Progress through time cannot be assessed since the indicator's definition evolved.

In its roadmap, Slovakia presented a level of ambition (75%) equal to the 2030 target for the EU of 75% of enterprises adopting data analytics. However, more efforts are needed to reach this target. The roadmap of Slovakia mentions Big Data popularisation campaign as the mail specific measure to be taken for data analytics, in addition to other with a broader technological span. A higher level of effort appears necessary to reinforce the trajectory set up in the national roadmap.



2023 state of play and recent progress

	Country level	EU level
FORECAST	6,0	34,6
DESI 2024	30,2	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

[30] 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.

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

Taking the three technologies together (adoption of either AI, or Cloud, or Data analytics), Slovakia stands at 46%, significantly below the EU average of 55%. This performance is the consequence of the low adoption of cloud and data analytics. There is significant room for improvement on take-up of new technologies. Cross-technology efforts are already taking place. It is the case for the provision of digital vouchers of up to EUR 15 000 to stimulate the digitization of services and processes in companies through cooperation with suppliers of such services, which began to be provided by Slovak Innovation and Energy Agency (SIEA) in 2023. SIEA announced a call for innovative and digital vouchers in 2023, with a planned allocation of EUR 14,6 million, among other measures mentioned in the national roadmap.

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

The percentage of the ICT sector in its GDP was 4.66% for the latest available data (2020), while for EU27 it was 5.23%. Moreover, the share of the ICT sector in private R&D expenditure was relatively low at 0.6% in 2020. ***Venture capital investment for seed and start-ups represents 2% of Slovakia's GDP, while in other countries like the Netherlands, Denmark, Finland, or Sweden this share is higher than 5%***. *Alt*hough during the last year Slovakia did not count with a 'unicorn', *defined as* a *privately held startup company with a value of over USD 1 billion, its ambition, as stated in its roadmap, is to have at least three unicorns by 2030.*

Access to finance for the innovative business has been one of the main axes for latest support, through the reform of the taxation of income from capital assets of domestic firms and the increase of venture capital in the economy, through the Slovak Investment Holding and the support of business angels. In 2023, the joint effect of these measures is estimated at EUR 22 million, with a planned target of EUR 32 million for 2024.

2.3 Strengthening cybersecurity & resilience

Slovakia's ICT infrastructure reveals that 16% of enterprises are vulnerable to disruptions from cyberattacks and 15% are vulnerable to system failures. Data corruption is affecting 6.1% of enterprises and breaches of confidential data are impacting 1.7%. Although these numbers are relatively low, there might still be a need for infrastructure enhancements[31].

Since 2012, the Office for the Regulation of Electronic Communications and Postal Services has been regularly monitoring the situation in the area of security and integrity of networks and services as well as Cybersecurity in the networks of Slovakian operators and registered companies with the aim of evaluating reported significant security incidents informing of the European Commission agency ENISA in accordance with the adopted Act on Electronic Communications. In 2023, the Digital Europe Programme provided grants to three security operations centres in Slovakia and four projects in the area of taking up cybersolutions. **Various initiatives were undertaken to support the resilience of Slovakian digital ecosystem.** In 2023, new international optical backbone route between Slovakia and Poland was supported from the CEF Digital programme. Furthermore, the Slovak Quantum Communication Infrastructure (initial terrestrial network) has begun to be developed with EU funds. In addition, from the newly emerged network of five European Digital Innovation Hubs (EDIHs), four received support from Digital Europe Programme and RRF sources, and one was awarded with the Seal of Excellence. Slovak EDIHs, that provide SMEs with services which include the testing of innovative technologies (digitalisation and automatization), adult learning, support in attempts to secure funding, and organising networking opportunities, became fully operational and providing support to enterprises in their digital transition.

[31] EC (2013) Edge nodes.

3 Protecting and empowering EU people and society

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

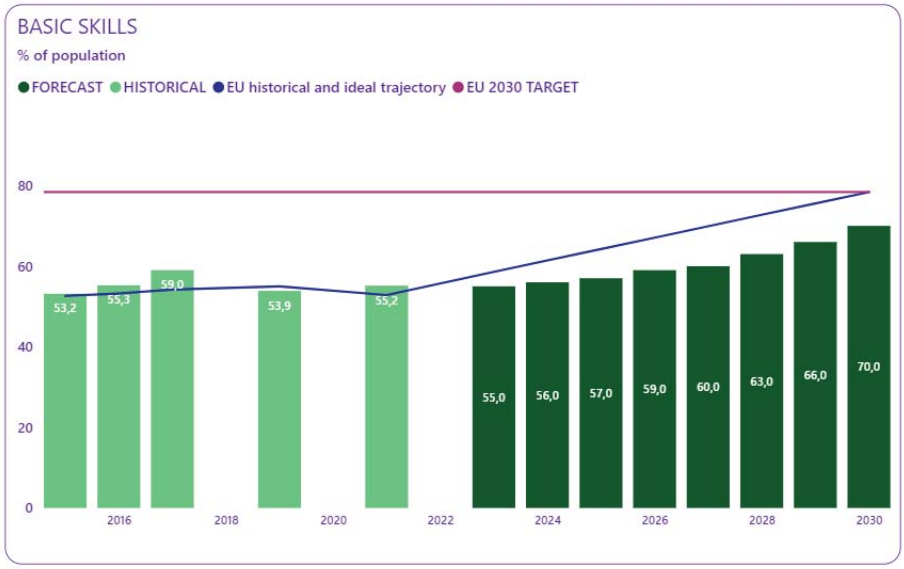
In Slovakia, the overarching objectives outlined in their proposed measures aligns closely with the commitment to advancing digital rights and principles. Initiatives such as the enactment of the Consumer Protection Act and amendments to the Civil Code reflect efforts to empower individuals by ensuring a fair balance between consumer rights and obligations in the digital sphere. Moreover, Slovakia's participation in the INHOPE network and the establishment of a Safe Internet Centre underscore the nation's dedication to promoting digital inclusion and safeguarding online safety, particularly for vulnerable groups like children. Slovakia's digital roadmap further emphasizes the importance of human-centred digital rights, with measures aimed at coordinating government efforts to mitigate the impacts of digital transformation on mental health and ensuring access to trusted information sources. By prioritising digital literacy and fostering advanced digital skills and more ICT human resources, Slovakia is striving to empower individuals, bridging digital divides, and enhancing public services accessibility, thereby contributing to a more equitable and resilient digital future for all.

3.1.1 Equipping people with digital skills

3.1.1.a Basic digital skills

Slovakia has untapped potential to contribute to the EU's digital decade target on basic digital skills while demonstrating very limited dynamic. Slovakia's performance in the at least basic digital skills indicator requires improvement. Since 2021, the country has experienced a decline from 55% to 51% of citizens with at least basic digital skills, contrasting with the current EU average of 55%. Special attention is needed for the basic digital skills for people aged 55 to 64 (38%) and 65 to 74 (19%).

Slovakia has set a national value of 70% for this target, below the level of the EU target of 80%. The national roadmap presents a comprehensive list of efforts to meet this national target. In 2023, Slovakia has for example continued working on its project of digital courses 'Improving Digital Skills of Seniors and Disadvantaged Groups in Public Administration', which has delivered more than 500 training courses to more than 13 000 seniors, who have learned how to work effectively with a computer or smartphone. In 2023 Slovakia also successfully launched, implemented, and completed the national pilot project Digital Pupil Allowance. More than 130 000 Slovak pupils have a new digital device at home, which can be dedicated to education and the development of digital skills. A similar project focused on refugees from Ukraine (Ukrainian Pupil Allowance) has delivered more than 9 300 devices to students currently residing in Slovakia. Slovakia also runs a popular IT FITNESS Test (V4 + UA and EN language versions) established in 2009 that has already involved more than 550 000 participants.



2023 state of play and recent progress

	Country level	EU level
FORECAST	55,0	59,8
DESI 2024	51,3	55,6
AVERAGE ANNUAL GROWTH %	-3,6	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

Slovakia has also set a target of 30% of its population with above basic digital skills until 2030. The current rate is at 22%, while the EU level is at 27%[32]. As the low performance in digital skills impacts the rate at which businesses can modernise their production processes and service provision, there is need for more structural digital reforms to engage teachers and the student population.

Measures dedicated to promoting STEM programs and ICT careers to women have been introduced in the National Digital Skills Strategy of the Slovak Republic and its Action Plan for 2023-2026.

3.1.1.b ICT specialists

Slovakia has scope to improve its performance to contribute to the EU's Digital Decade target on ICT specialists while demonstrating limited dynamic. Slovakia rate of ICT specialists remains stable at 4.2% of total employment in the country. Slovakia has set a target of 6% of its population being ICT specialists by 2030. This target is well below the EU target for 2030, (20 million employed ICT specialists, corresponding to around 10% of the total employment in the EU).

Several projects are included in the national roadmap to help achieving this target. For example, two Slovak institutions participate in the multi-country project EAGLE, supported by Digital Europe Programme. The main objective of EAGLE project, that started beginning of 2023, is to design and deliver six high-quality specialized training courses, reflecting the latest developments in key capacity areas (Cybersecurity, Big Data, Robotics, Blockchain and Smart Energy), supporting the development of advanced digital skills of people in the labour force, with a focus on SMEs. There is also the EURIDICE project on inclusive education. This type of initiatives is in line with the Research and Innovation Strategy for Smart Specialisation of the Slovak Republic 2021-2027, the National Digital Skills Strategy of the Slovak Republic and the Action Plan for 2023-2026. However, more concrete efforts are necessary to achieve the targets, already below the EU level. Increase of training offer for digital upskilling of teachers and increase the offer of IT studies, including at bachelor and technical level, can enhance the actual levels of digital skills.

[32] Two levels of skills, "basic" and "above basic", are computed for each of the following areas: Information and data literacy, Communication and collaboration, Digital content creation, Safety, and Problem solving.

2023 state of play and recent progress

	Country level	EU level
FORECAST	4,0	5,4
DESI 2024	4,2	4,8
AVERAGE ANNUAL GROWTH %	-2,3	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

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

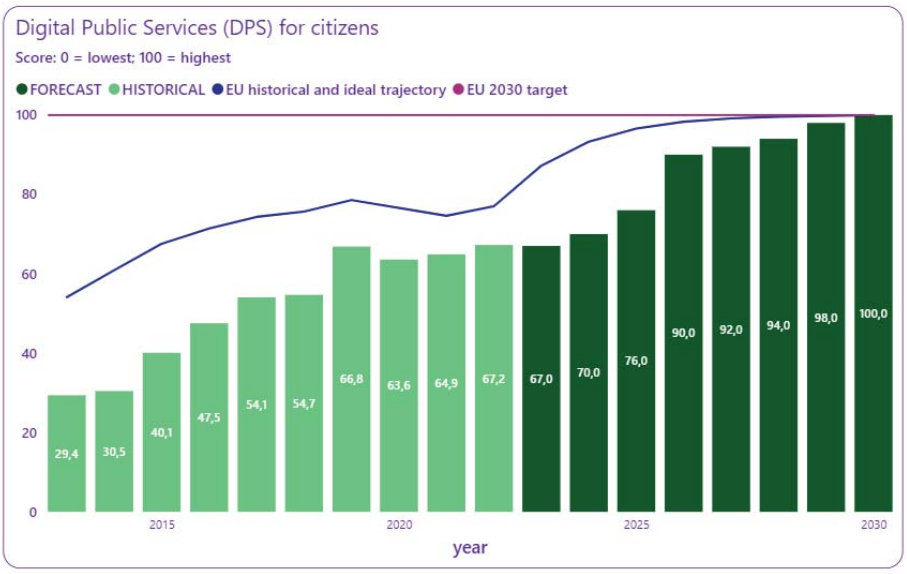
3.1.2.a e-ID

Slovakia notified the European Commission of an electronic identification scheme in 2019 (High level of assurance). Slovakia has an announced e-ID scheme available to over 72% of the population. **However, use of e-ID to access online services for private purpose, provided by public services or the business sector, remains low**. 8% of citizens have used their e-ID to access services provided by public services in the last 12 months, compared to 36% as average for the EU 27 countries (Eurostat).

In this domain, Slovakia was involved in the Digital Identity Testing and Deployment project, to allow citizens and businesses access to digital identity through a digital wallet in a mobile device until 2026.

3.1.2.b Digitalisation of public services for citizens and businesses

Slovakia has scope to improve its performance to contribute to the EU's Digital Decade target on digital public services for citizens, while showing a very strong dynamic. Slovakia's score of 72 out of 100, compared to an EU score of 79/100, has increased in comparison to the previous score (an annual increase of 7%).



2023 state of play and recent progress

	Country level	EU level
FORECAST	67,0	87,2
DESI 2024	72,1	79,4
AVERAGE ANNUAL GROWTH %	7,2	3,1

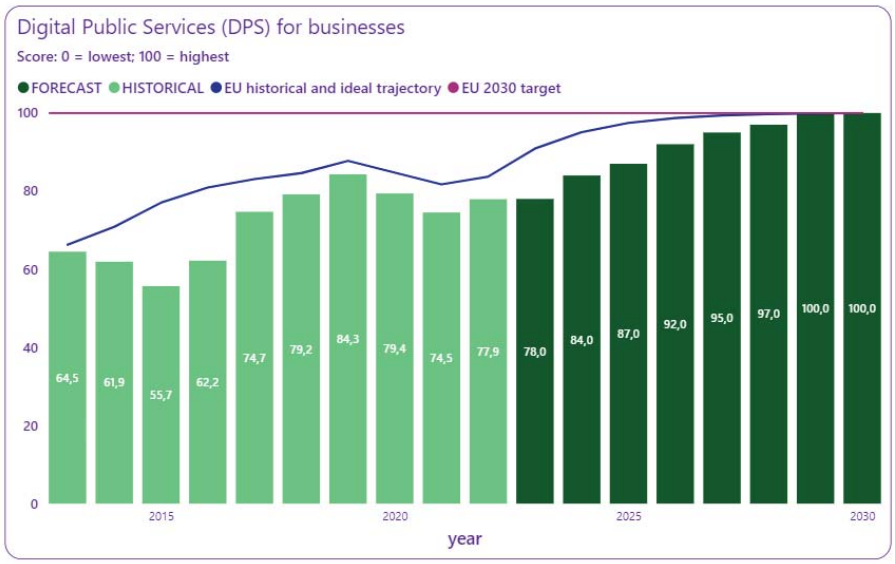
Average, annual growth is computed between the two most recent available data points

Note 1: Data break-in-series in 2020

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

On the digital public services for businesses, Slovakia has untapped potential to contribute to the EU's Digital Decade target, while showing positive dynamic. Slovakia has a score of 79 out of 100, practically stable since the previous year, while the current EU-level score is 85/100. A comprehensive approach to implementation is important to catch up with e-governance trend-setters in the EU.

Specific measures have been taken to further digitalise public services, including the digitalisation of public procurement processes tested and fully operational, through the development of a single electronic platform for public procurement. Other projects expected in the following months include increasing the share of electronic communication with public administration, the openness and transparency of public administration data and the satisfaction and trust of persons and public administration entities with electronic services; reducing the personal interactions and complexity in the use of public administration services, and streamlining the implementation of the state's IT service architecture by leveraging cloud native services.



2023 state of play and recent progress

	Country level	EU level
FORECAST	78,0	90,9
DESI 2024	79,2	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

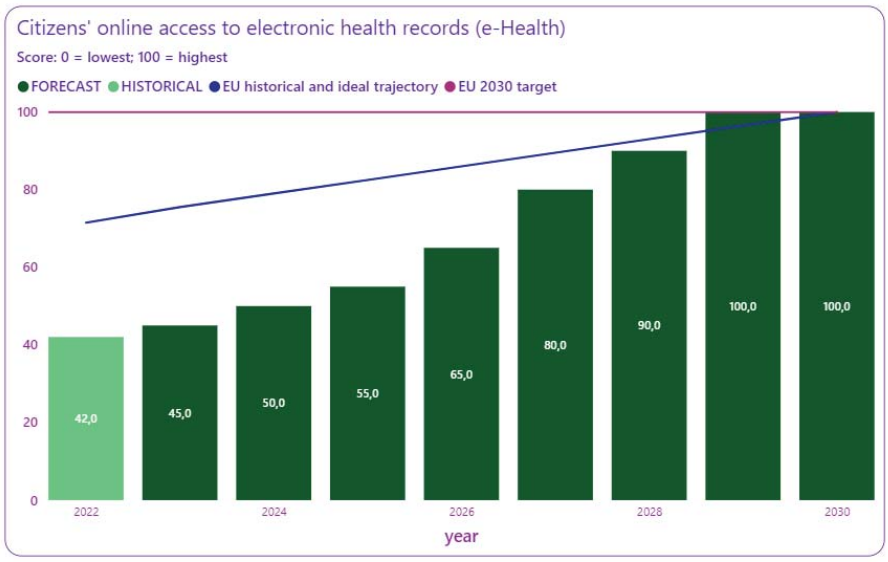
Note 2: The source of national forecast values is the 2023 country roadmap

3.1.2.c e-Health

Slovakia has scope to improve its performance to contribute to the EU's digital decade target on e-Health while showing a very strong dynamic. The overall maturity score on e-Health for Slovakia is 66, below the EU average of 79. However, the country's score has greatly improved during the last year (+58%).

In Slovakia, every citizen with an activated chip ID card has access to electronic health records via the National Health Portal. However, as there is limited awareness of this option, with only about 2% of the population estimated to have accessed their electronic health records, it is necessary to raise awareness about the potential use of this service, as well as other eHealth services. Creating a dedicated mobile application can also facilitate access to selected electronic health records for citizens.

Slovakia's roadmap shows that measures are being taken to ensure access to electronic health documentation for healthcare professionals. 60% of doctors record patient examinations in the electronic health record system, information campaigns are planned to positively motivate doctors to document electronic health records. Sharing health documentation will contribute to improving the quality of healthcare provided. The National Health Information Centre, which is responsible for implementing e-Health initiatives in the form of services, products and tools, is committed to leveraging information and communication technologies to enhance healthcare provision in Slovakia.



2023 state of play and recent progress

	Country level	EU level
FORECAST	45,0	75,5
DESI 2024	66,3	79,1
AVERAGE ANNUAL GROWTH %	57,8	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

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

In 2023, Slovakia enacted a new Consumer Protection Act, representing a significant step towards achieving a better balance between the rights and obligations of consumers and traders. This legislative measure aimed to address emerging challenges in the digital realm by establishing requirements for the compatibility and interoperability of digital content and services. Moreover, amendments to the Civil Code introduced clear definitions for digital content, digital services, and items incorporating digital elements, reflecting evolving market dynamics, and aligning with European consumer legislation.

Furthermore, Slovakia has demonstrated a commitment to upholding digital rights and principles, particularly in consumer protection and online safety. Hate speech online is a problem in Slovakia, with 48.8% of the population exposed to hostile or degrading online messages, as per the last Eurostat survey data, significantly above the EU average of 33.5%. The Council for media services has been actively monitoring the enforcement of regulations on online platforms for media sharing, ensuring adherence to prescribed rules. Notably, between August 2022 and June 2023, the council escalated over 1,300 posts deemed potentially in violation of platform guidelines, underscoring the country's dedication to maintaining a safe online environment.

In the realm of online child protection, Slovakia has taken proactive steps to combat Child Sexual Abuse Material (CSAM) through its participation in the INHOPE network. By joining this international initiative, Slovakia has bolstered efforts to combat online exploitation and ensure the safety of children in the digital sphere. Moreover, the will to establish a Safe Internet Centre in Slovakia is a testament to the nation's commitment to providing support and resources to children, parents, educators, and caregivers, addressing digital challenges, and combating online child sexual abuse effectively.

In addition to these initiatives, Slovakia's digital roadmap highlights various measures aimed at promoting human-centred digital transformation and an inclusive, and transparent digital environment, in alignment with respective overarching European objectives. These efforts include coordinating activities among government entities to mitigate the impacts of digital transformation, particularly on mental health. Notably, the proposed measure to create a digital platform aggregating validated sources of information related to mental health underscores Slovakia's commitment to addressing the multifaceted challenges posed by the digital age and prioritizing the well-being of its population. The Digital Decade Eurobarometer

shows that 75% of Slovakians find fairly or very important that public authorities shape the development of Artificial Intelligence and other digital technologies to ensure they respect our rights and values.

Best practice: *The Digital Pupil project*

The aim of the project was to deliver help to families with children of primary, secondary, and secondary vocational schools, increasing the accessibility of digital devices among pupils coming specially from social groups of the population in material need, households with low and below-average incomes and pupils with special educational needs.

The budget for this project was of EUR 65 million. More than 130 000 devices were purchased with the help of the grant, enabling pupils to have a new digital device at home dedicated to education and the development of digital skills. Thousands of primary and secondary schools, seven thousand teachers and school digital coordinators, hundreds of community centres and terrain workers across Slovakia were actively involved in the implementation of the project, as well as more than 500 stores.

The Digital Pupil is so far the only project of its kind, in which a voucher scheme has delivered targeted assistance directly into the hands of individual pupils. Enormous interest from students and families has shown that investing in equipping students with digital devices is essential and serves to improve children's digital skills. The project was in line with the country-specific recommendations for Slovakia, which proposed the adoption of measures to improve the quality of education at all levels. The project was also in line with the Digital Education Action Plan 2021-2027. It achieved its intended outcomes and proved to be an example of an effective cooperation between different private and public actors.

4 Leveraging digital transformation for a smart greening

The National Concept for the Informatization of Public Administration of Slovakia prioritizes digital rights and principles, particularly in terms of sustainability. It outlines strategies and principles for the sustainable and responsible use of digital technologies in public administration, ensuring alignment with environmental, social, and economic sustainability goals. Through this integration, the National Concept contributes to the fulfilment of digital rights and principles relevant to sustainability, such as environmental protection.

In Slovakia, there is a notable commitment to energy efficiency among businesses, with 48% implementing measures affecting the energy consumption of ICT equipment. Moreover, a significant proportion (66%) of enterprises consider the environmental impact of ICT services or equipment before selection, indicating a prevalent environmental consciousness in procurement practices. However, among enterprises with a high digital intensity index, only 17% have considered the environmental impact of their ICT choices, suggesting room for improvement in environmental considerations alongside digital advancements[33].

Capitalizing on the opportunities presented by the Programme Slovakia and the EDIHs, the Ministry of Investments, Regional Development and Informatization, in collaboration with the Digital Coalition, has developed the national project 'Digital Skills for the Green Future of Slovakia'. This initiative, slated for implementation from 2024 to 2027, aims to raise awareness of the necessity for digital and green transformation while supporting the development of managerial competencies in navigating these transformations. The national project will contribute to increasing the level of digital and green skills linked to the SK RIS3 2021+ domains, in particular to Domain 1 (Innovative Industry for the 21st Century) and Domain 3 (Digital Transformation of Slovakia). Notably, top managers in Slovakia have shown resistance towards digital transformation, highlighting the need for targeted education and support to foster readiness for transformative changes. The project targets top managers in the business sector, public administration, and municipal management, recognizing their pivotal role in driving successful green and digital transformation across processes and human resources.

A key measure underpinning this transformation is the 'Analysis of the transition to green ICT in public administration', which seeks to assess the impact of transitioning to sustainable communication infrastructures, green data centres, and more energy-efficient ICT services in public administration. This measure aims to drive the gradual adoption of green data centres, cloud services, and overall energy-efficient ICT services by public administration entities. Green transformation in Slovakia not only presents opportunities for clean technology markets but also supports the development of green skills essential for emerging green jobs. Therefore, the 'Digital Skills for a Green Future of Slovakia' project targets increasing digital and professional skills relevant to Research and Innovation Strategy for Smart Specialization 2021-2027, particularly focusing on areas such as innovative industry and digital transformation.

Slovakia's RRP includes investments for the digitalisation of transmission system and regional distribution systems, to allow for a better integration of renewable energy sources into the grid.

[33] EC (2013) Edge nodes.

Annex I – National roadmap analysis

Slovakia's National Digital Decade Strategic Roadmap

Slovakia submitted its National Digital Decade Strategic Roadmap, published in March 2024[34], in accordance with Article 7 of the Digital Decade Policy Programme Decision. It offers a detailed overview of the nation's digital landscape and its planned trajectory for development, covering various dimensions of digitalization. While all sections of the roadmap are presented, some areas remain less thoroughly completed. The document effectively outlines the state of play, challenges, and strengths across different dimensions, providing valuable insights into Slovakia's digital journey. Notably, most information on targets is provided, although details on edge nodes, semiconductors, and quantum technologies are notably absent. Targets on basic digital skills and ICT specialists are below the EU level.

The roadmap encompasses 117 measures, of which 44 are new measures, indicating a substantial commitment to digital advancement, with an estimated budget of EUR 2.270 million. Budget is attributed to almost all measures. Existing measures are referenced appropriately, aligning with Slovakia's national digital strategies and the objectives of the Digital Decade Programme and the European Declaration on Digital Rights and Principles.

The following table reflects a best effort attempt to estimate and categorise the number of measures and their relative budgets contributing to the targets, made by the Commission:

Target	Budget (EUR million)	Number of Measures
Connectivity Gigabit	124.9	3
Connectivity 5G	-	-
Semiconductors	-	-
Edge nodes	-	-
Quantum computing	-	-
SME take up	86.9	5
Cloud/AI/Big Data uptake	277.1	11
Cloud only uptake	25.2	1
AI only uptake	-	-
Big data uptake	25.2	1
Unicorns	303.8	11
Basic Digital Skills	447.5	27
ICT Specialists	357.0	21
eID	0.0	1
Key Public Services	439.6	8
e-Health	0.7	2
Objectives	81.7	22
Total	**2 169.6**	**113**

The roadmap demonstrates Slovakia's engagement in EU-level cooperation through participation in multi-

[34] English version: https://mirri.gov.sk/wp-content/uploads/2024/03/National-Digital-Decade-Strategic-Roadmap-of-the-Slovak-Republic.pdf ; Slovak version: https://mirri.gov.sk/wp-content/uploads/2024/03/Vnutrostatny-plan-Digitalnej-dekady-za-Slovensku-republiku.pdf

country projects, European Digital Innovation Hubs (EDIHs), and other initiatives. Additionally, the document includes a thorough explanation of stakeholder consultation processes, highlighting the importance of collaboration in shaping digital policies and strategies. However, certain elements necessary for comprehensive analysis, such as the expected impact and concrete expected outputs of the measures, are lacking.

Despite these gaps, the roadmap largely reflects the recommended actions identified in the Slovak Digital Decade Report 2023. Key priorities include accelerating efforts in digital skills development, adopting a positive trend in ICT specialist availability, and advancing the rollout of 5G and gigabit connectivity. Moreover, there is a concerted focus on digitalizing businesses and public services, aligning with broader EU objectives for digital transformation.

The document provides a broad overview of Slovakia's digital strengths, challenges, and areas for improvement, organized across four dimensions. However, certain aspects, such as Cloud/AI/Big data, unicorns, eID, and e-Health, require further development. While targets are generally aligned with EU objectives, specific trajectories are lacking for critical areas like edge nodes, semiconductors, and quantum technologies. Moving forward, **there is a need for increased budget allocation for connectivity initiatives and the development of more concrete measures to address skills shortages and foster digital innovation**. Nonetheless, the roadmap represents a commendable effort towards advancing Slovakia's digital agenda and aligning with broader European digitalisation goals.

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

MCP and EDICs

Slovakia participates as a member in the already established Local Digital Twins towards the CitiVERSE – EDIC, and in the established Alliance for Language Technologies EDIC (which addresses the scarcity of European language data needed for AI solutions) as an observer.

Slovakia is a founding member in the IPCEI-ME/CT.

It is a member of the working group of possible future IMPACTS-EDIC, Mobility and Logistics Data EDIC, Digital Commons EDIC and a member of working groups exploring other possible areas to set up EDICs.

EU funding for digital policies in Slovakia

EU funds support the digitalisation efforts in Slovakia. Slovakia's Recovery and Resilience Plan was updated in July 2023 to also introduce reforms and investments that address REPowerEU objectives. **20.5%** of the RRP foster the **digital transition and, more specifically EUR 1.1 billion are related to the Digital Decade objectives and targets. T**he plan aims at providing better services for citizens and businesses by introducing user-friendly e-government solutions with an investment of EUR 509 million. An investment of around EUR 83 million will help **businesses with their digitalisation** through a network of digital innovation hubs to assist them in digitalising business processes and provide trainings in digital skills. **Digitalisation of education** is supported through EUR **164 million** to finance digital equipment, including for children from socially disadvantaged backgrounds, to enhance digital skills and create a new learning ecosystem.

State of the Digital Decade 2024

Slovenia

1 Executive Summary

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

In 2023, Slovenia made notable progress in e-government, through the notification of its national e-ID scheme and a high overall eHealth maturity, and in 5G coverage, including in the 3.4-3.8 GHz bands. However, despite ongoing efforts, **challenges persist** in improving basic digital skills of the population, while Slovenian enterprises, especially SMEs, lag behind in the adoption of advanced technologies like data analytics.

According to the Special Eurobarometer 'Digital Decade 2024'[35], 74% of Slovenia's population considers the digitalisation of daily public and private services to be making their lives easier (just above the EU average of 73%).

Slovenia is actively laying the foundation for its digital transformation by developing complementary strategic orientations and action plans, including strategies on semiconductors and quantum technology. The long awaited Digital Public Services Strategy 2030 was published in 2023 and Slovenia's participation in EDICs underlines its commitment to advancing digital initiatives.

Slovenia is a member of several **EDICs**, including the **Alliance for Language Technologies** (ALT), **Local Digital Twins towards the CitiVERSE** and **EUROPEUM** (all already set up). It is also developing the Statute and other relevant documents of the possible future **Cybersecurity Skills Academy** EDIC and is engaging in discussions on the setup of the possible future **Digital Commons** EDIC, within informal Working Groups.[36] However, Slovenia does not participate in the IPCEI CIS.

Even though some implementation activities have taken place, broader scale progress and transformational effects have yet to materialise.

The Slovenian **Recovery and Resilience Plan (RRP) allocates 20% (EUR 0.5 billion) to digital[37] policy measures.** Priority is given to digitising public services and e-Health as well as participation in digital multi-country projects for example on cloud and semiconductors. Additionally, 9% (EUR 0.3 billion) of Slovenia's total Cohesion Policy funding is dedicated to digital transformation[38].

[35] Special Eurobarometer 551 on 'the Digital Decade' 2024: https://digital-strategy.ec.europa.eu/en/news-redirect/833351
[36] Information updated on 31 May 2024.
[37] The share of financial allocations that contribute to digital objectives has been calculated using Annex VII to the Recovery and Resilience Facility Regulation.
[38] 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]	Slovenia			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	SI	EU
Fixed Very High Capacity Network (VHCN) coverage	75.5%	78.5%	4.0%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	75.5%	78.5%	4.0%	64.0%	13.5%	100%	-
Overall 5G coverage	63.9%	82.1%	28.5%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		5		1 186		200	10 000
SMEs with at least a basic level of digital intensity	55.2%	50.4%	-4.4%	57.7%	2.6%	90%	90%
Cloud	37.6%	36.0%	-2.2%	38.9%	7.0%	75%	75%
Artificial Intelligence	11.7%	11.4%	-1.3%	8.0%	2.6%	75%	75%
Data analytics	NA	19.1%	NA	33.2%	NA	75%	75%
AI or Cloud or Data analytics	NA	44.7%	NA	54.6%	NA		75%
Unicorns		0		263		7	500
At least basic digital skills	49.7%	46.7%	-3.0%	55.6%	1.5%	80%	80%
ICT specialists	4.5%	3.8%	-15.6%	4.8%	4.3%	10%	~10%
eID scheme notification		Yes					
Digital public services for citizens	71.4	77.0	7.9%	79.4	3.1%	100	100
Digital public services for businesses	82.7	84.0	1.5%	85.4	2.0%	100	100
Access to e-Health records	80.4	87.6	8.9%	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 **Slovenia's** contribution to the Digital Decade reflected in its roadmap, it is demonstrating a **very high ambition** and, based on this document, intends to allocate **very significant effort** to achieve the Digital Decade objectives and targets. However, **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.**

Slovenia's roadmap is very ambitious and coherent, addressing all Digital Decade objectives through a comprehensive range of **99 measures**. Its 2030 targets for the key performance indicators (KPI) are aligned with those of the EU and it introduces additional targets such us the uptake of e-ID. It also includes quantitative estimations of how it expects to help achieve the edge node and semiconductor targets.

The total budget for the measures outlined in the roadmap **is estimated to be EUR 1 billion** (approximately 1.7% of GDP), with the priorities being basic digital skills, digital public services, gigabit connectivity, and the uptake of AI / cloud / data analytics (especially AI). However, more comprehensive action is required to address limitations (e.g., ICT specialists) and bring forward targeted initiatives (i.e., for the digitalisation of SMEs). Additionally, the roadmap would benefit from a more detailed description of the planned strategies and activities for semiconductors, quantum and AI, including the planned competence centre.

Recommendations for the roadmap

In addition to horizontal recommendations provided to all Member States (MS) regarding their national roadmaps, Slovenia should consider the following adjustments to its roadmap (Article 8(3) of the DDPP Decision):

- **MEASURES:** (i) Bring forward additional measures for the digitalisation of SMEs and the uptake of advanced technologies, particularly data analytics, along with upskilling the population, focusing on ICT specialists and women in ICT, and emphasising semiconductors, quantum and AI; (ii) Revise the budget description to ensure overall consistency and complement the information on expected impact on measure-level; (iii) Provide more information on the implementation of digital rights and principles (and Digital Decade general objectives), including what national measures contribute to it.

Digital rights and principles

The Digital Decade Eurobarometer shows that 46% of Slovenians feel the EU protects their digital rights, a 5-point drop from last year, just below the EU average of 47%. Rising concerns include 62% worried about children's online safety (up 11 points) and 47% about their control over personal data. However, 62% trust in online freedom of assembly and 57% in safe and privacy-friendly technologies, both 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[39].

A competitive, sovereign and resilient EU based on technological leadership

To underpin its technological leadership and competitiveness, Slovenia is taking considerable action to develop cutting-edge technologies, but further measures are required to boost the digital transformation and uptake of advanced technologies in businesses, especially SMEs.

On connectivity, Slovenia performs fairly well, with the exception of fixed and mobile connectivity in rural areas. This long-standing issue, which is partially structural (i.e., topography-related), is being addressed through measures such as the ongoing construction of broadband networks of at least 100 Mbps in white areas, co-funded by public and private stakeholders. Furthermore, Slovenia is taking action to prepare for the next generation of electronic communication networks, including with the auctioning of private 5G networks in March 2024, and preparing to auction bands for machine-to-machine communication networks, including Internet of Things.

Slovenia falls below the EU average in the digitalisation of businesses. Despite the strong digitalisation of large enterprises (including the high uptake of AI) and the country's participation in initiatives (including at EU level) to develop cutting-edge technologies (i.e., cloud, semiconductors, quantum – with a focus on research – and blockchain), the uptake of digital technologies remains a persisting challenge. Slovenian SMEs, in particular, have the lowest scores in the EU in basic digital intensity, cloud computing adoption, and data analytics uptake. This is being addressed by action to boost the uptake of advanced technologies among large companies and SMEs, unprecedented investments via the Technology Innovation Fund (part of the Slovene Enterprise Fund), and structural framework improvements, particularly regarding the

[39] 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.

employment of non-EU nationals (although some of these programmes are currently on hold). European Digital Innovation Hubs are also making their services available to Slovenian SMEs. Moreover, Slovenia is taking action to improve its cybersecurity with projects to set up cybersecurity schools and a national cybersecurity coordination centre, but not yet on a broad scale.

Recommendations – Slovenia should:

- **CONNECTIVITY INFRASTRUCTURE:** (i) Continue and supplement measures to tackle 5G connectivity challenges, especially in rural areas. (ii) Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.
- **SEMICONDUCTORS:** Sustain activities on semiconductors and quickly implement them on the ground.
- **SMEs:** Accelerate policies to increase the uptake of digital technologies by SMEs. In particular by quickly implementing, maintaining and complementing the efforts to provide supportive framework conditions, including a highly skilled workforce, in a continuous manner and by paying particular attention to the specificities of industries.
- **AI/CLOUD/DATA ANALYTICS:** (i) Accelerate policies to increase and speed up the uptake of advanced technologies. In particular by stepping up actions on data analytics, and by speeding up and further targeting preparation and implementation of measures on AI. (ii) Support broad uptake of the next generation of cloud infrastructure and services under development in the IPCEI-CIS by companies of all sizes, including by liaising with the direct participants to develop a country-specific dissemination strategy reaching beyond the participating organisations.
- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

Protecting and empowering EU people and society

Slovenia is committed to achieving an inclusive digital transformation, yet significant and continuous action is needed to ensure people have the necessary digital skills and can access user-friendly digital public services, and to address the shortage of ICT specialists to help boost economic competitiveness.

The country's performance on basic digital skills is below the EU average (including a further decrease since last year, possibly due to post-COVID-19 effects, i.e., lower use of ICT tools), with ongoing measures targeting various groups (i.e., young people, adults, and vulnerable populations). Slovenia also aims to tackle challenges in recruiting ICT specialists through reforms in higher education curricula (which are ongoing) and (a small number of) specific training programmes, including initiatives to promote the presence of women in the ICT field. Action is under way to gain an understanding of the need for ICT specialists through the 'Skills Forecasting and Labour Market Platform'.

In the area of digital public services, e-health and e-ID, Slovenia performs close to the EU average, but there is also a gap between the services offered and their utilisation. Improving digital literacy could help bridge this gap, particularly as a significant number of people do not interact with public authorities online due to a lack of skills and knowledge. The Digital Public Services Strategy 2030 is expected to put such measures in practice.

Recommendations – Slovenia should:

- **BASIC DIGITAL SKILLS:** Accelerate efforts in the area of basic digital skills. In particular, by increasing the level of these skills to allow its population and economy to make full use of the potential of digital transformation. This can be done through an increased and intensified offer and collaboration between public and private actors.
- **ICT SPECIALISTS:** Strengthen the early identification of labour market needs and further complement them for a swift reaction, especially in the area of digital upskilling and reskilling, adapt the (higher) education curricula to the latest digital needs and addressing the gender gap. Strengthened collaboration between industries, (higher) education institutions, public administration and relevant stakeholders can increase the effectiveness of those measures.
- **e-HEALTH:** Make the data types of medical imaging reports and medical images available to citizens through the online access service and build on existing legal provisions as well as technical solutions, for authorised persons to access electronic health data on behalf of others.
- **DIGITAL PUBLIC SERVICES:** Continue efforts to digitalise public services. Slovenia should continue to pay particular attention to the participatory development and user-friendliness of these services.

Leveraging digital transformation for a smart greening

Slovenia has started to make use of digital technologies to support the green transition, with a particular focus on increasing energy efficiency. An example of the latter is a pilot project prepared by the Ministry of Digital Transformation using the Internet of Things to collect data on energy consumption in buildings managed by the Ministry of Public Administration. The promotion of sustainable, circular business models starts to fall under the scope of public support measures on digital. Furthermore, Slovenia is developing a green budgeting framework.

Recommendations – Slovenia should:

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

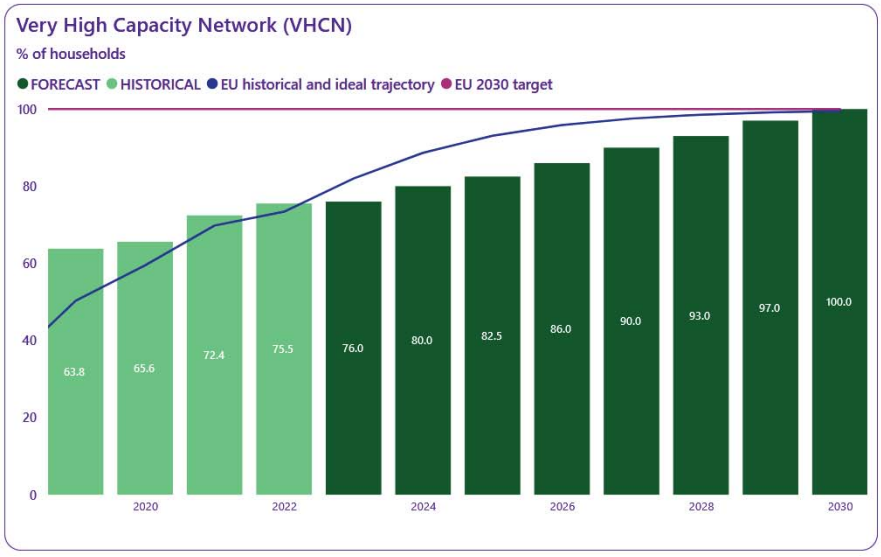
2 Technological leadership for a competitive, sovereign and resilient EU

A high ICT-intensity along with the digitalisation of global value chains, were identified as key factors making companies more resilient to disruptive shocks. Evidence gathered from firm-level data during the COVID-19 pandemic in Slovenia suggests that companies with higher ICT intensity experienced a less pronounced decline in their labour productivity growth compared to less ICT-intensive companies.

2.1 Building technological leadership: digital infrastructure and technologies

2.1.a Connectivity infrastructure (gigabit)

Slovenia has untapped potential to contribute to the EU's Digital Decade target on Very High-Capacity Networks (VHCN) while showing a positive dynamic. Slovenia's VHCN coverage (78.5%) is on a par with the EU average (78.8%). Its fibre-to-the-premises coverage (FTTP) remains[40] well above the EU average (78.5% vs. 64%). The gap between urban and rural connectivity persists, and the progress in VHCN for rural areas (56.8% compared to 51% in the last reporting period) is more limited than at EU level, where rural connectivity increased from 44.2% to 55.6%. The share of households with broadband subscription of at least 1 Gbps (gigabits per second) continued to increase considerably to 9.5% compared to 4.5% from the last reporting period but is still well below the EU average of 18.5%. The Digital Decade Eurobarometer indicates that Slovenia considers nationwide connectivity as a relevant facilitating factor for the use of digital technologies. More respondents than at EU level consider the availability and affordability of a high-speed internet connection very important or fairly important to facilitate the daily use of digital technologies (84% vs 80%).



2023 state of play and recent progress

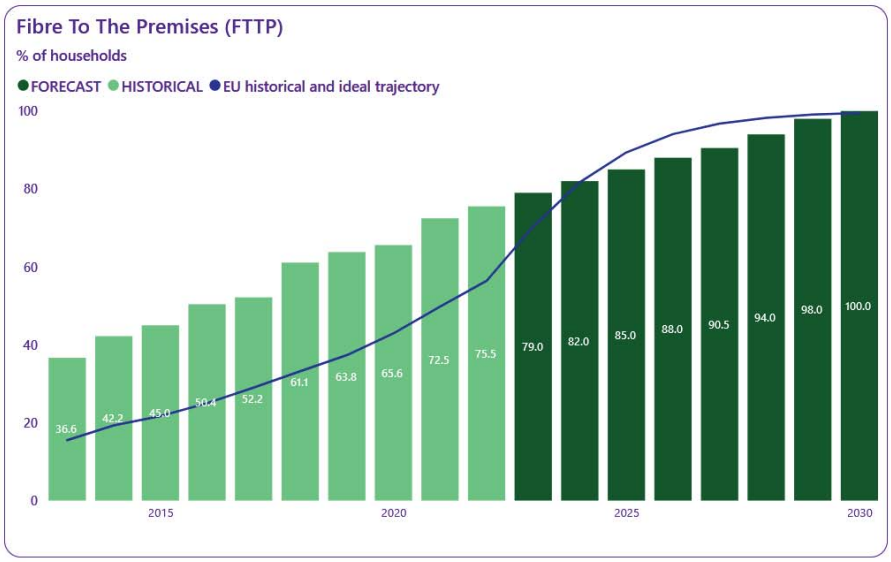
	Country level	EU level
FORECAST	76.0	82.0
DESI 2024	78.5	78.8
AVERAGE ANNUAL GROWTH %	4.0	7.4

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

The country aims to reach 100% of VHCN coverage by 2030, in line with the EU target and linked to a fair starting point. For FTTP, Slovenia aims to achieve 100% coverage by 2030 as well, which is linked to a strong starting point. If Slovenia maintains the current pace of progress, the country will bring a very significant contribution to this target.

[40] The VHCN coverage is defined as the combination of FTTP and DOCSIS 3.1 coverage. As Slovenia has not upgraded its DOCSIS 3.0 infrastructure to DOCSIS 3.1, the VHCN coverage equals the FTTP coverage.



2023 state of play and recent progress

	Country level	EU level
FORECAST	79.0	70.3
DESI 2024	78.5	64.0
AVERAGE ANNUAL GROWTH %	4.0	13.5

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

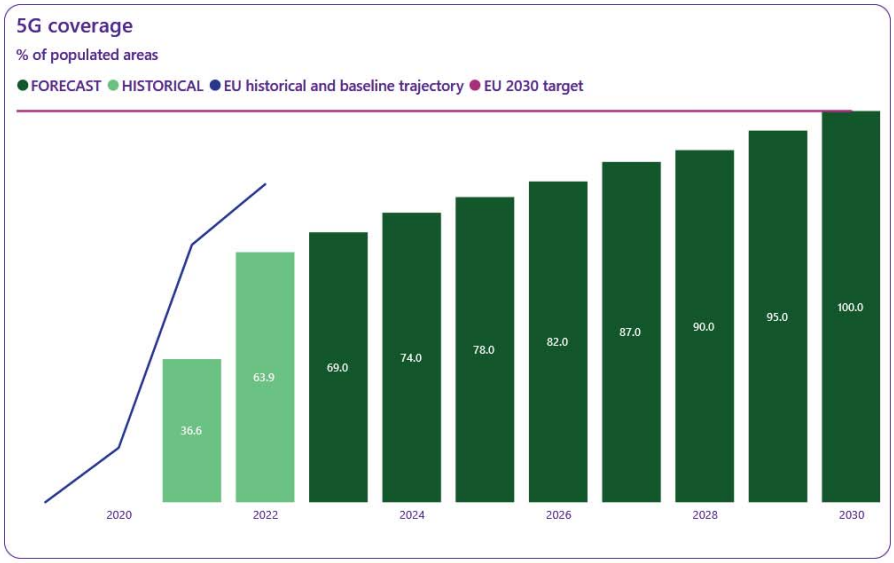
Note: The source of national forecast values is the 2023 country roadmap

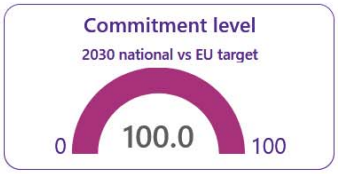
Almost all gigabit connectivity measures in the Slovenian roadmap focus on white areas, taking into account the persisting key challenge of connectivity in rural areas which was also reflected in the recommendation of the 2023 State of the Digital Decade report. Around one-fifth of the total budget is allocated to the gigabit connectivity target, making it the largest allocation for a single target in the Slovenian roadmap. However, it must be noted that a large part of this funding for connectivity stems from the period 2014-2020, which is already implemented. Moreover, it includes private investments, which have not been reported for any other target, and contribute to around half of Gigabit connectivity's high budget share. These private investments aim to contribute to the publicly co-funded construction of broadband networks of at least 100 Mbps in white areas. At the same time, the increase in rural connectivity might be slowed down by the need to reconstruct network infrastructure damaged by the floods of August 2023, at the expense of new deployment. To support rapid reconstruction, AKOS, the national regulatory authority for telecommunications, organises targeted workshops for local communities to inform them about legal obligations and benefits of joint infrastructure construction. It remains to be seen whether these activities will be sufficient to address the long-standing and partially structural, i.e. topography-related, rural connectivity challenges.

2.1.b Connectivity infrastructure (5G)

Slovenia has untapped potential to help achieve the EU's Digital Decade target on 5G in all populated areas, while showing a very strong dynamic. The country continues to considerably improve its 5G coverage, most recently from 63.9% to 82.1%, and starts getting closer to the EU average of 89.3%. Equally, rural 5G coverage is picking up strongly (from 14.1% to 45.6%), but it is still below the EU average of 73.7% (51.1% in the previous reporting period). Mobile broadband take-up (89.2%) is around the EU average (89.9%) and the specific take-up of 5G by the population is also close to the EU average – 23.4% of the population has a 5G SIM card (EU average: 24.6%).

At 100%, the country's target for 5G coverage is in line with the EU target value. The value is linked to a fair starting point. Moreover, based on the current rate of progress, and assuming that Slovenia maintains this rate, the country will bring a very significant contribution to this EU target.





2023 state of play and recent progress

	Country level	EU level
FORECAST	69.0	
DESI 2024	82.1	89.3
AVERAGE ANNUAL GROWTH %	28.5	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

Since 98% of the spectrum was already assigned in 2021, Slovenia is currently making preparations for a transparent spectrum management and for upcoming technological developments. As set out in the Slovenian national roadmap, this process will entail the preparation of a radio spectrum development strategy for 2024-2026 and first reflections on the timely provision of sufficient radio spectrum for the deployment of state-of-the-art technologies, including 6G.

AKOS is preparing the ground to help businesses reap the benefits of 5G and develop and implement the latest digital technologies. AKOS has auctioned spectrum for private 5G networks in three blocks in the 2.3 GHz band and the 3.6 GHz band. The results of the public tender were published in March 2024 – businesses, municipalities and operators have obtained frequencies. Slovenia is also preparing a tender to auction 700 MHz bands for machine-to-machine communication networks, including Internet of Things. The roadmap also envisages the co-financing of the construction of open passive base stations.

2.1.c Semiconductors

In its roadmap, Slovenia states that it plans to contribute to the semiconductor target, projecting that 10 R&D companies with a focus on semiconductors and 25 manufacturing companies will be involved. The country currently reports having two R&D enterprises and eight active manufacturing companies in the semiconductor sector.

In line with the 2023 State of the Digital Decade recommendation, Slovenia is helping to achieve the semiconductor target, including via multi-country and bilateral collaboration with other Member States. As part of its Recovery and Resilience Plan (RRP), Slovenia presented a list of six potential project participants and, together with two companies as associated participants, it is now involved in a multi country project on microelectronics and communication technologies. The project, which is also included in the Slovenian roadmap, aims to increase and strengthen the country's capabilities for designing and increasing the resilience of semiconductor value chains. The two Slovenian companies involved focus on microelectronic systems and on fast, secure and reliable transmission of information. Furthermore, the Ministry of Economy has launched a call for proposals for a multi-country project on 'Low-Power Processors and Semiconductor Chips', aiming to strengthen the country's capabilities for designing and increasing the resilience of EU and Slovenian semiconductor value chains, connecting national and EU processes, and strengthening the microelectronics value chain. Slovenia also continues its bilateral collaboration activities with other Member States, for example through a memorandum of understanding, signed between the

Ministry of Digital Transformation of Slovenia and the Federal Ministry of Finance of Austria on digitalisation and innovative technologies, including on cutting-edge semiconductors.

In its national roadmap and in line with the implementation of the Chips Act, Slovenia sets out two additional initiatives to strengthen the semiconductor ecosystem, with a time horizon to 2030. The first one is an interdepartmental chips and semiconductor strategy. The second initiative, as one of the first specific measures of this strategy, is the creation of the semiconductor competence centre 'Chips.SI'. Both initiatives are still in the preparatory phase and essential aspects, including financial resources and a timeline for the strategy, still need to be determined. In May 2023, 18 partners, including universities, research institutes and companies, committed themselves to working on setting up the competence centre. R&D, prototyping, chip sensor systems, integrated photonics, and optoelectronics are expected to be in the remit of the centre, with an earmarked budget of EUR 1.2 million in 2024. Quick conceptualisation and implementation on the ground will be key to support Slovenia's advancement on semiconductors and its contribution to this Digital Decade target.

2.1.d Edge nodes

The latest studies **estimate that there are five edge nodes in Slovenia.** In its roadmap, Slovenia assumes to contribute to this target with 200 companies deploying edge nodes. The country declares to currently have around 20 companies, in particular cloud services providers, that are working on the deployment of edge nodes. While the largest telecommunications providers and the postal service already operate edge nodes in the country, there are also numerous specialised companies offering cloud services for various business processes and purposes. A total of approximately 3 000 companies are expected to be involved in edge node deployment. These companies will be recorded and measured through a new methodology designed to assess the integration of digital technologies into businesses.

Slovenia's main activity to help achieve the edge node target is its participation in the multi-country project on common data infrastructure and services, which will support the development of software and data processing capabilities for the exploitation of edge nodes (for more details, see the cloud-specific section of the part on the AI / cloud / data analytics target). This project is expected to encourage 12 additional companies to work on the deployment of edge nodes.

In relation to this, Slovenia could consider additional funding to balance its action on research, development and innovation with the deployment of mature edge nodes.

2.1.e Quantum technologies

In line with the 2023 State of the Digital Decade recommendation, Slovenia continues its participation in EU-level initiatives for quantum technologies and envisages to strengthen this participation with a national framework.

In 2023, with several other Member States, Slovenia signed the European Declaration on Quantum Technologies, to promote collaboration on the development of a strong European quantum ecosystem. As envisaged in its roadmap, the country has set aside EUR 1 million to support the participation of Slovenian researchers in the European High Performance Computing Joint Undertaking (EuroHPC JU), and the purchase of relevant equipment. One related example is Slovenia's participation in the Leonardo Consortium, which aims to provide technical and engineering support to the pre-exascale supercomputer Leonardo. Furthermore, Slovenia continues to develop and maintain its Vega supercomputer, located in Maribor, and intends, based on its roadmap, to set aside around EUR 1 million per year for this. The government is now considering a successor to the Vega high-performance computer. The project documentation is being prepared and the necessary national funding is being sought to submit the project to the EuroHPC JU call for proposals in time.

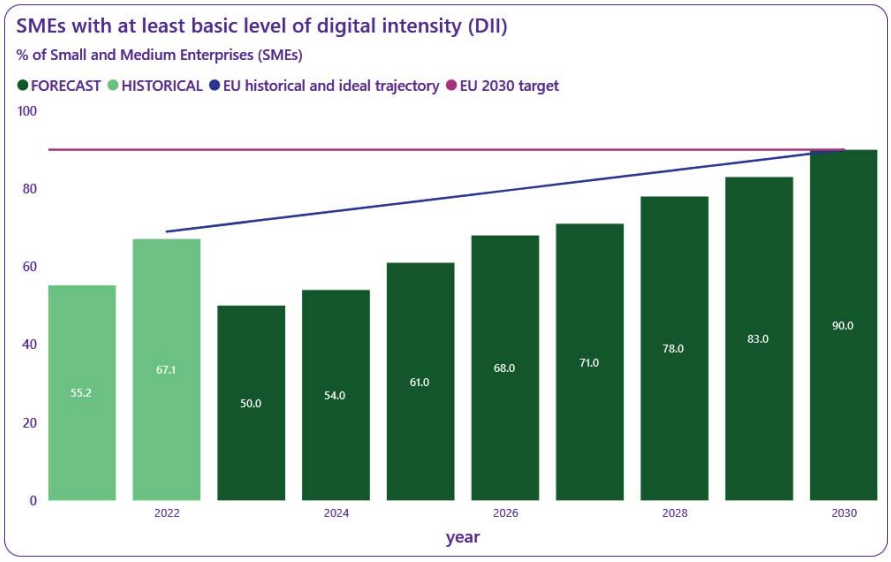
At national level, Slovenia is preparing a strategy for the development of quantum technologies. To inform its decision on the scope of this strategy, the government sent a questionnaire to 19 stakeholders, mainly from academia and research organisations as well as some industry representatives. Unsurprisingly, since this technology is still in the early development stage, one questionnaire result is that Slovenia is much more active in research than in commercialisation in this field (see also scholarships for PhDs in quantum technologies in the part on the target on ICT specialists). The strategy, which covers quantum computing chips, among other things, is currently being finalised and will be published after its adoption by the government. Moreover, Slovenia participates in the European Quantum Communication Infrastructure (EuroQCI) with the Slovenian Quantum Communication Infrastructure Demonstration (SiQUID) project. The SiQUID project, running from 2023 to 2025, aims to create quantum key distribution links and a test quantum network in Slovenia for advanced communication protocols, with a focus on cost-effective solutions and cross-border collaboration for a future full-scale quantum communication network.

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

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

Slovenia has untapped potential to achieve the EU's Digital Decade target for the digitalisation of small and medium-sized enterprises (SMEs) and demonstrates a very limited dynamic. With 50% of its SMEs having at least a basic level of digital intensity, Slovenia performs below the EU average (57.7%). The indicator performance decreased compared to 2021 (the last comparable year for measuring the digital intensity of enterprises) by 4.4% on average, while the EU saw a 2.6% annual increase on annual average. Since it is very unlikely that Slovenian SMEs stepped backwards in their digitalisation process, this decrease is likely due to a change in the index, which replaced 'Internet of Things' with 'Data Analytics', an area where Slovenia scores considerably below the EU average (see section below).

While the **gap in the level of digitalisation between larger enterprises and SMEs is particularly pronounced**, the country ranks among the top five EU countries where enterprises with 250 employees or more, have at least a basic level of digital intensity (96.6% compared to 91% at EU average). Furthermore, while Slovenia ranks second among the Member States in terms of large enterprises sharing electronic information between different functional areas (e.g., accounting and production) via an enterprise resource planning software package, SMEs score below the EU average with 35.4% vs. 42%. Considering the substantial funding dedicated to the digital transformation of SMEs (EUR 30 million of RE-ACT funds) and large companies (EUR 44 million of RRF funds), Slovenia expects the gap between the two to decrease and the level of digital intensity of both to grow. As ongoing investments and projects take effect, the government anticipates an improvement in these results for the 2024 reporting period.



2023 state of play and recent progress

	Country level	EU level
FORECAST	50.0	71.6
DESI 2024	50.4	57.7
AVERAGE ANNUAL GROWTH %	-4.4	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 a target of 90% of SMEs having at least a basic level of digital intensity, Slovenia's national roadmap presents a level of ambition that is in line with the EU target for 2030. This effort is considered ambitious, especially when taking into account the country's starting point. Moreover, given the current rate of progress, reaching the target by 2030 would imply an intensification of efforts.

In 2023, European Digital Innovation Hubs (EDIHs) were key to broadening and accelerating SME support activities. **In 2023, Slovenia's EDIHs progressed well in providing their services to SMEs, however, only a limited number of measures support SMEs' digital transformation**. They developed a broad digital skills development, investment support and test-before-invest offer. While the Digital Emergency Response for Slovenia (EDIH DIGI-SI) focuses on SMEs in manufacturing, agri-food, health and the tourism sector, the EDIH Smart, resilient and sustainable communities (SRC-EDIH) supports manufacturing companies and public organisations. In addition, the EDIH Public, Private, People, Partnership Digital Innovation Hub (4PDIH), which received a Seal of Excellence, focuses on agricultural biotechnology and food biotechnology, community-led local development, education and smart cities. Based on Slovenia's roadmap, by 2025, the EDIHs aim to provide their services to 700 SMEs, which amounts to approximately 10% of the country's SMEs.[41] By March 2024, the two EDIHs funded under the Digital Europe programme had already provided or had been requested to provide 476 services, of which 421 for SMEs and 55 for public services. This is the third-highest number of EDIH services provided of all Member States (in total, 59 EDIHs have provided or have been requested to provide 3 709 services so far).

Providing financial and consultancy support, the measures for the digitalisation of SMEs in the Slovenian roadmap combine a relaunch of previously existing but currently paused programmes with new impulses. The country intends to continue the Slovene Enterprise Fund voucher system, which is currently paused, and disburse EUR 5 million worth of digital vouchers to 1 000 additional SME projects by 2029.[42] Equally, the measure 'incentives for digital transformation', which combines a grant with a loan, is planned to be relaunched to support (in)tangible investments and related external experts' advice in approximately 150

[41] In 2022, there were around 8 200 SMEs (10-249 employees), SMEs in Slovenia 2022, by size | Statista.

[42] The system was launched in 2021 and disbursed more than EUR 20 million to 4 100 projects until the end of 2022. In the past, by far the largest part of the vouchers was used to start to implement digital marketing.

SMEs.[43] The new impulses will focus on combining the green transition and the digital transformation as well as on providing consultancy services to SMEs and start-ups. EUR 13.4 million will help support the companies involved in using digital technologies to apply circular economy principles to their processes, services and products. The measure, which is also expected to help achieve the objectives linked to the green transition, puts a particular focus on the transformation of business models in manufacturing companies, which represent a major economic sector in Slovenia.[44] Furthermore, consultancy points will be funded to provide support services to SMEs and start-ups, including mentoring, advice and provision of information on adopting digital technologies in companies. This is in line with the 2023 State of the Digital Decade report, which recommended to provide supportive framework conditions. The measures outlined in the roadmap prioritise the uptake of digital technologies, with development-oriented activities receiving less emphasis. While these measures appear to address the identified needs and challenges, a comparison with key developments of 2023 suggests that the roadmap may not fully align with the high level of ambition set in the trajectories, in terms of both intensity and scope.

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

- **Cloud**

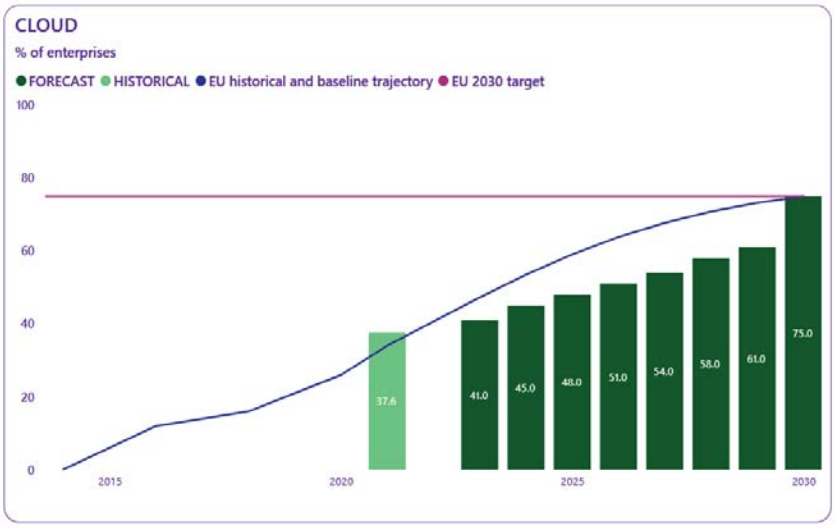
Considering cloud computing services individually, Slovenia has untapped potential to help achieve the EU's ambition on the share of enterprises using cloud computing services, and demonstrates a very limited dynamic. The take-up of cloud computing services by enterprises is slightly below the EU average (36% vs 38.9%), while in 2021, when the previous data collection took place, Slovenia scored slightly above the EU average (37.6% vs 34%).

With a target of 75% of enterprises using cloud computing services, Slovenia's roadmap presented a level of ambition in line with the EU target. The value is high compared to Slovenia's starting point. Moreover, taking into account the current rate of progress, reaching the target by 2030 would imply an intensification of efforts.

Slovenia's participation in the multi-country project on common data infrastructure and services is key to increasing the uptake of cloud computing services in Slovenia. Slovenia's contribution to the development and deployment of the next generation of advanced, distributed, secure, sustainable and innovative cloud-to-edge capabilities is part of its RRP and is also taken into account in its roadmap. Slovenia's involvement in this multi-country project via 11 indirect partners is expected to support advanced cloud uptake among Slovenian enterprises as well as overall action to help achieve the Digital Decade target on cloud computing services uptake and edge nodes.

[43] With an allocation of EUR 15 million from 2021-2027 European Regional Development Fund and additional resources from the Slovene Enterprise Fund for the credit part. Indicative implementation period: 2024-2027.

[44] The manufacturing sector accounts for more than 20% of Slovenian GDP (Manufacturing, value added (% of GDP) - Slovenia | Data (worldbank.org), Slovenia - share of economic sectors in the gross domestic product 2022 | Statista).



2023 state of play and recent progress

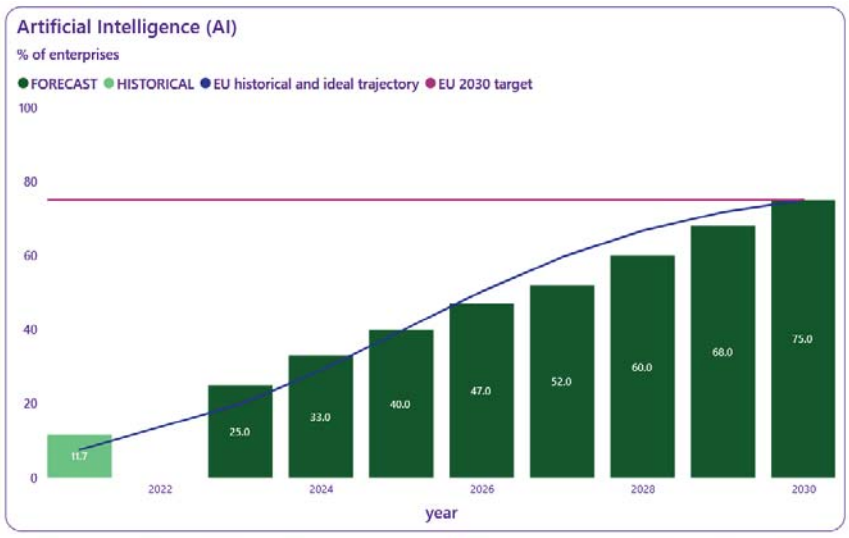
	Country level	EU level
FORECAST	41.0	47.3
DESI 2024	36.0	38.9
AVERAGE ANNUAL GROWTH %	-2.2	7.0

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

- **Artificial Intelligence**

Considering artificial intelligence (AI) individually, Slovenia brings a positive contribution to the EU's ambition on the share of enterprises using AI, although with a very limited dynamic. Similar to the EU-level trend, the take-up of AI services by Slovenian enterprises (11.4% in 2023) was rather stable compared to 2021 (11.7%), remaining above the EU average (7.6% in 2021 and 8% in 2023). This slight dip could be attributed to a rise in less-digitised companies; according to the Slovenian government, there were 8 576 new companies created in 2023, marking a 5% increase from the previous year and 11% from 2021. Notably, the manufacturing sector saw a 12% rise and the service sector a 10% increase in the number of companies since 2021.



2023 state of play and recent progress

	Country level	EU level
FORECAST	25.0	19.9
DESI 2024	11.4	8.0
AVERAGE ANNUAL GROWTH %	-1.3	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

With a target of 75% of enterprises adopting AI, Slovenia presented in its roadmap a level of ambition in line with the EU's ambition. Moreover, taking into account the current rate of progress, reaching the target by 2030 would imply an intensification of efforts.

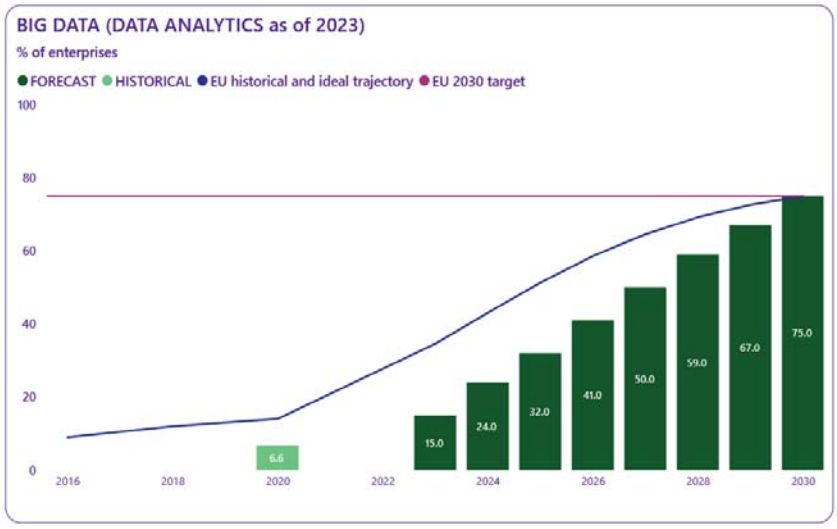
With a target of 75% of enterprises adopting AI, Slovenia's roadmap presented a level of ambition in line with the EU target. However, taking into account the current rate of progress, reaching the target by 2030 would imply an intensification of efforts.

Slovenia is quite active in supporting the development of AI and is preparing some measures in this regard. One of the key measures, which is also part of its roadmap, is the creation of the Competence Centre for AI, which is currently being prepared. Over the last year, Slovenia has consulted stakeholders, at meetings in and 2023, to get their views on the remit of this Centre. The current plan is for the Centre to foster and further develop Slovenia's AI ecosystem. Over the last year, Slovenia has discussed with stakeholders, in meetings in July and October 2023, to get views on the scope of this Centre that is currently being prepared. This initiative is designed to advance AI technology proficiency and empower economic and research innovation within the country. The centre will act as a hub for cutting-edge AI knowledge, technologies, services, and expertise, improving visibility, accessibility, and practical application for a wide range of Slovenian users. It will promote AI adoption, skill development, and infrastructure creation, thereby enhancing the value chain and competitiveness of local stakeholders. Additionally, the centre seeks to strengthen international collaborations and raise Slovenia's global standing in AI. After the broad consultation and conceptualisation phase, it will now be key to transform these objectives into a clear-cut, targeted concept and to draw up an implementation plan with a solid structure and specific activities. Furthermore, existing initiatives and projects, including private initiatives like the Ai4si initiative, led by the ICT Association of Slovenia, continue promoting the uptake of AI among companies, e.g. through workshops and seminars. Ai4si has recently started to extend its exchanges to cover cross-border activities, including with Croatian and German companies, public authorities and organisations.

The Slovenian roadmap presents a number of measures expected to support the uptake of AI in enterprises from different angles in the upcoming years. The planned measures range from training and awareness raising for managers and their employees ('Support for vocational training programmes in the field of AI'), over AI R&D transfer to new products and services in different domains, including smart factories and environment ('Support for interdisciplinary AI innovation projects'), to the use of AI to facilitate processes in businesses ('Support to reference implementation projects for the deployment of information management systems to support business operations'). These projects are a solid starting point, but it remains to be seen if they will be sufficient to support the uptake of AI in enterprises in a substantial manner. This will depend, among other things, on a quick and targeted implementation.

Moreover, Slovenia has taken steps in collaborating with international bodies and initiatives to advance AI policy and research. Through the AI Laboratory of the Jožef Stefan Institute, Slovenia is actively collaborating with the OECD AI Policy Observatory, which is continually updated with new data and analyses on AI policy globally.

- **Data analytics (Big Data)[45]**



2023 state of play and recent progress

	Country level	EU level
FORECAST	15.0	34.6
DESI 2024	19.1	33.2
AVERAGE ANNUAL GROWTH %		

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

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

Considering data analytics individually, Slovenia has scope to improve its performance to help achieve the EU's ambition on the share of enterprises using data analytics. The use of technologies, techniques or software tools to analyse data to extract patterns, trends and insights to make better predictions and decisions is considerably lower than the EU average (19.1% vs 33.2%) and the lowest of all EU Member States. Progress cannot be assessed since the indicator's definition has changed. Data analysis is a relevant basis for several other advanced technologies. Therefore, this low performance could be one possible explanation for the observation of the Institute of Macroeconomic Analysis and Development of Slovenia that the use of several digital technologies and tools (e.g. customer relationship management systems) remains challenging for Slovenian enterprises, especially for SMEs. The OECD has also highlighted the relevance of data collection and analysis for a more comprehensive digital transformation and broader use of advanced technologies in Slovenia.

With a target of 75% of enterprises using big data, Slovenia's roadmap presented a level of ambition in line with the EU target. However, this target value has become irrelevant since the indicator's definition has changed.

Slovenia's participation in the common European data spaces is one of its main specific activities to increase the uptake of data analytics. European data spaces support data pooling and sharing in strategic economic sectors. This will also enable businesses to get access to a broader range of data. Slovenia is particularly involved in the areas of agriculture, tourism, smart cities and communities and skills. Furthermore, some of the measures supporting the digitalisation of businesses in broader terms, e.g. the 'Industrial/business digital transformation programme' or the EDIHs, are expected to support the uptake of data analytics as well. The Ministry of Digital Transformation is a member of the Stakeholder Strategic Forum at the Data Space Support Centre[46], focusing on establishing a network of data stewards. This network has initially been established within public administration and aims to expand its reach to include enterprises as well.

The Slovenian roadmap does not contain any measures that specifically focus on the uptake of data analytics While broader measures such as the Industrial/Business Digital Transformation programme'[47] and

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

[46] https://dssc.eu/space/DC/28049509/Strategic+Stakeholder+Forum

[47] https://commission.europa.eu/projects/industrialbusiness-digital-transformation-programme_en

the EDIHs[48](e.g. the SRC-EDIH and the EDIH DIGI-SI) may indirectly support the uptake of data analytics, these measures do not seem to match the high ambition expressed in the roadmap's trajectories when assessed alongside the key developments of 2023, in terms of both intensity and scope.

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

Slovenia has scope to improve its performance to help achieve the EU's target of 75% of enterprises using at least one of the following three technologies: cloud computing services, AI or data analytics. With 45%, it scores below the EU average of 55%[49].

The 'Industrial/business digital transformation programme' is a key measure for the uptake of digital innovation in businesses, with a strong focus on the adoption of advanced technologies. Via this RRP measure, which is also included in the roadmap and is expected to be implemented by mid-2024, 23 consortia, comprising 42 large companies and 87 SMEs, receive funding. So far, the consortia have assessed their level of digital maturity and, on this basis, have prepared tailored digital strategies and implementation plans to progress in the areas identified as relevant to their digital transformation, e.g., to extend the use of advanced technologies or transfer digital competences.

With around EUR 173 million, the measures presented as contributing to the cloud / AI / data analytics target have the third-highest budget of all targets in the Slovenian roadmap. They cover a broad range of aspects, from strengthening ecosystems and enabling framework conditions to support the development of capabilities for these technologies, to fostering the development of viable industrial solutions in the market.

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

Slovenia is one of the six EU Member States without a unicorn company[50] and there is also no potential future unicorn company in the country[51]. The ICT sector in Slovenia is among the smallest in the EU (accounting for 4% of GDP, compared with an EU average of 5.2%) and there is room for improvement in the expenditure on R&D in the ICT sector (0.8% of total R&D expenditure). Surveys suggest that low business investment is related to the lack of skilled labour[52].

Slovenia set the very ambitious target of having seven unicorn companies by 2030. This aim represents around 1.5% of the EU target value, which is 500 unicorn companies by 2030, while Slovenia's GDP amounts to around 0.4% of the EU's GDP. The value is also very high compared to Slovenia's starting point, and reaching the target by 2030 would imply a considerable intensification of efforts.

Access to finance, in particular equity, remains a challenge for start-ups and scale-ups. Slovenian companies rely more on bank funding and less on capital market funding than competitors in other EU countries. Venture capital investment in Slovenia's ICT sector amounted to 0.01% of the country's GDP in

[48] https://digital-strategy.ec.europa.eu/en/activities/edihs

[49] 2023 was the first year in which Eurostat simultaneously collected data on the take-up of cloud computing services, data analytics and artificial intelligence. As these indicator data were not available at the time when the roadmaps were submitted, Member States have not provided their respective aggregate trajectories, but only technology-specific trajectories.

[50] Based on data from Dealroom (extracted on xx.xx.2024). A unicorn is a company founded after 31 December 1990 that has been valued at over USD 1 billion in an initial public offering or trade sale or a company that has been valued at over USD 1 billion in its last private venture funding round, including where the valuation has not been confirmed in a secondary transaction. In its roadmap, Slovenia reports one unicorn, which was acquired in 2017 by a non-Slovene company.

[51] Based on data from Dealroom (extracted on xx.xx.2024). A potential future unicorn is a start-up with a market valuation between EUR 100 million and EUR 1 billion.

[52] See European Investment Bank Investment Survey 2023, EIB Investment Survey 2023: European Union overview.

2022, and remains low compared to other EU Member States[53]. This investment has a strong focus on the start-up stage and other early investment stages. Additionally, the Capital Markets Strategy is rolling out innovative pilot schemes, like the DLT pilot regime[54], to enhance financing options for SMEs and startups. Concurrently, a novel corporate entity is being developed within Slovenian corporate legislation to establish a streamlined version of the joint stock company.

Slovenia is taking action to address these challenges. In addition to the reforms related to capital market access and R&D governance that it carried out in 2022, the country plans to invest considerably in development and innovation in companies. As part of the Slovene Enterprise Fund, in 2024, Slovenia will set up a Technology Innovation Fund to invest an unprecedented amount of EUR 125 million in innovative enterprises over the next 5 years, with a focus on companies in the very early development stage. For 2024, a first tranche of EUR 25 million in equity funding will be available to support around 70 projects of innovative deep-tech start-ups and scale-ups. This measure, representing the most significant effort for a target in the Slovenian roadmap in terms of national funding, is expected to help create and further develop start-ups. Moreover, Slovenian ministries started to exchange with industry representatives to explore how framework conditions – including the taxation system, access to a highly skilled workforce and capital, and the legal structure of businesses – could be improved to facilitate the creation and growth of start-ups. On access to a highly skilled labour force, the Slovenian authorities have adopted measures to facilitate the employment of non-EU nationals. Slovenia is currently preparing amendments to the Employment, Self-employment, and Work of Foreigners Act and to the Foreigners Act to simplify, to a certain extent, the procedures for employing foreign workers. On these amendments, a public consultation has taken place.

2.3 Strengthening cybersecurity & resilience

As companies rely increasingly on digital technologies, their risk of exposure to cybersecurity incidents is increasing, as is their need for preparedness in this area. In 2022, 2.2% of enterprises in Slovenia reported ICT service outage due to cyberattacks (e.g., ransomware attacks, denial of service attacks). In the same year, 27% of enterprises reported having developed or reviewed their ICT security policy in the previous 12 months. Slovenian enterprises have scope for improvement when it comes to being prepared as only 8% of enterprises reported being insured against ICT security incidents and 86.7% reported using ICT security measures (against an EU average of 91.8%).

Slovenia is taking action to increase its cybersecurity, but not yet on a broad scale. In 2023, Slovenia started to implement a project on quantum cryptographic key distribution as part of its involvement in the EU initiative EuroQCI. Its roadmap includes the creation of cybersecurity schools and of a national cybersecurity coordination centre.

Best practice: 'DigiVzornik' (digital role model) award

As part of the Digital Slovenia 2030 initiative and the EU Digital Decade, the Ministry of Digital Transformation awarded the title 'DigiVzornik' (digital role model) to 10 institutions. This recognition aims to celebrate and inspire digital excellence and innovation. Among the awardees are the Internet Institute, with its private 5G system, offering advanced solutions for industrial processes, and the University of Ljubljana's Faculty of Electrical Engineering, with its CyberLab, an open platform for cybersecurity monitoring that uses digital twins and AI integration to improve

[53] OECD Going Digital Toolkit, Venture capital investment in the ICT sector as a share of GDP | Innovation Indicators (oecd.org).

[54] For the DLT or Distributed Ledger Technology pilot regime, see here: https://www.esma.europa.eu/esmas-activities/digital-finance-and-innovation/dlt-pilot-regime

security and resilience in society. The initiative aims to encourage institutions, organisations, and individuals to share successful digitalisation experiences and practices contributing to Digital Decade targets

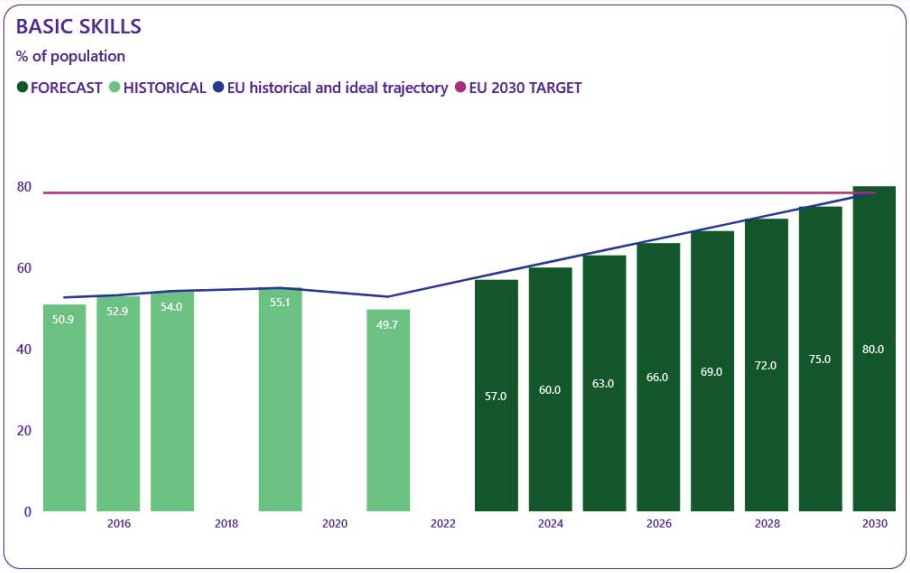
3 A new digital deal for people

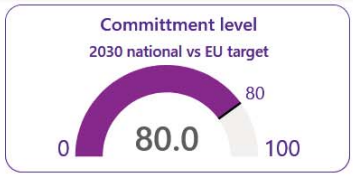
3.1 Empowering people and bringing the digital transformation closer to their needs

Compared to other countries, the potential risk of job automation has increased further in Slovenia, also due to the impact of AI. Slovenia ranks sixth among EU Member States in this regard- with 31 % of jobs potentially at high risk of automation.

3.1.1 Equipping people with digital skill

3.1.1.a Basic digital skills





2023 state of play and recent progress

	Country level	EU level
FORECAST	57.0	59.8
DESI 2024	46.7	55.6
AVERAGE ANNUAL GROWTH %	-3.0	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

Slovenia has scope to improve its performance to help achieve the EU's Digital Decade target on basic digital skills and demonstrates a very limited dynamic. In 2023, 46.7% of the Slovenian population aged 16-74 had at least basic digital skills, which is below the EU average (55.6%). The country's indicator performance decreased slightly from 2021 by 3% on average, while the EU progressed slightly, by 1.5% on average, over the same period. Looking at different age groups, only the youngest section of the population, those aged 16-24, scores slightly above the EU average (73% vs 70%). All other age groups score below the EU average. The gap is high especially large for the unemployed (27.5% in Slovenia and 46.5% at EU level). The scores for men and women are almost the same – 47% for men and 46.5% for women. Similar overall developments can be observed for above-basic digital skills, where Slovenia scores below the EU average (18.9% compared to 27.3%). Compared to 2021, the Slovenian score for above-basic digital skills has decreased (from 19.7%), while the EU average has increased (from 26.5%). The decrease could be explained by post-COVID-19 effects, with a decreased digital activity of the population, e.g., with less telework or online purchases. Looking at some indicators focused on one specific activity, e.g., use of cloud services, internet use, use of ICT at work and doing financial activities online, Slovenia mainly scores around the EU average. Slovenians are very aware of the positive effects of digital skills on the use of digital technologies: 77% of respondents to the Digital Decade Eurobarometer consider the participation in education and training to develop skills required to use digital services very or fairly important (72% at EU level).

In its roadmap, the country presents a level of ambition that is aligned with the EU target of 80% of the population aged 16-74 having at least basic digital skills by 2030. This value is linked to a modest starting

point. Moreover, based on the current rate of progress, in absence of an intensification of efforts over the coming years, Slovenia's contribution to this target will remain limited.

Slovenia implements a broad number of measures to support basic digital skills, targeting young people as well as adults, older people, and vulnerable groups. In total, at least 35 000 people were trained in digital inclusion-related programmes in 2023. Moreover, digital literacy training for around 29 000 adults took place. Moreover, the initiation of the Digital Teacher project marks a significant step forward. This initiative targets the upskilling of a minimum of 20,000 educational professionals and managers, focusing on enhancing digital skills, sustainability competences, and financial literacy. Additionally, Slovenia is in the process of setting a comprehensive strategic goal to advance digital education. To increase the particularly low share of unemployed people with at least basic digital skills, Slovenia launched basic and higher-level digital skills training programmes in February 2024. The programmes are part of the 2021-2027 cohesion policy programme and aim to train around 1 300 unemployed people by the end of this year and around 7 600 by 2028.

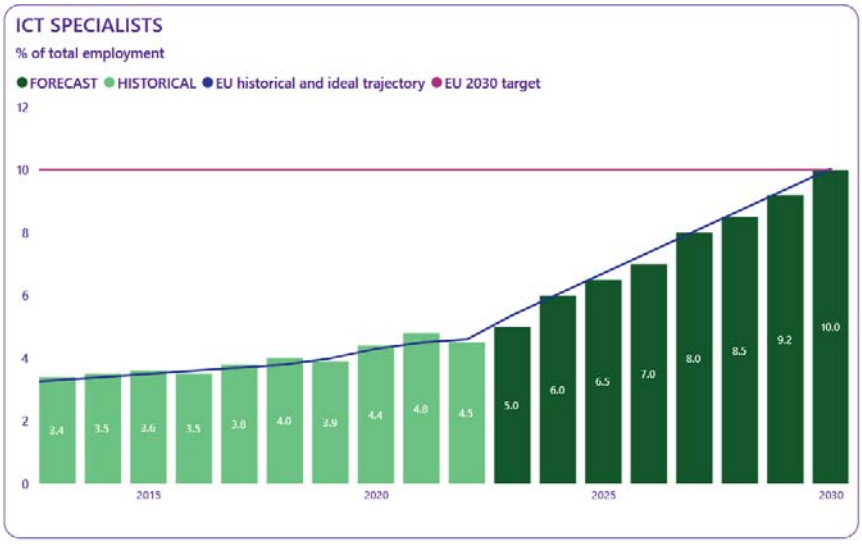
Another important milestone was the adoption of the adapted Promotion of Digital Inclusion Act. After a long amendment process, the updated Act, which now specifically focuses on the most vulnerable groups, was adopted by the National Assembly in March 2024. A call aiming to help deliver the objectives of this Act was published in April 2024. It will enable around 13 000 beneficiaries from the most vulnerable groups to rent a laptop.

In its roadmap, Slovenia combines the need for considerable action, in particular to train around 30% of its population (around 450 000 inhabitants), with a large number of targeted and complementary measures. Together with key public services, basic digital skills are the target with the highest number of measures and the second-highest budget, with a comparatively strong focus on national sources. Activities of the roadmap focus on formal education and digital inclusion. Upskilling of people in employment – including employees of organisations, companies, and public administration bodies – will also be supported in a targeted manner, but with a smaller number of measures.

In line with the 2023 State of the Digital Decade report, which recommended to increase the level of basic digital skills, Slovenia is very active in addressing its lack of basic digital skills. However, when assessed together with the key developments of 2023, the measures reported in the Slovenian roadmap do not seem to be in line with the high level of ambition of the trajectories reported in the roadmap, in terms of both intensity and scope.

3.1.1.b ICT specialists

Slovenia has scope to improve its performance to help achieve to the EU's Digital Decade target on ICT specialists and demonstrates a very limited dynamic. The share of ICT specialists in total employment decreased from 4.5% to 3.8% compared to the previous reporting period, while at EU level, it increased from 4.6% to 4.8%. The share of female ICT specialists also remains below the EU level (17.1% compared to 19.4%). Furthermore, Slovenia is in very strong need of additional ICT specialists: 78% of Slovenian enterprises reported difficulties in recruiting ICT specialists, which is the highest share in the EU (EU average: 63%).



2023 state of play and recent progress

	Country level	EU level
FORECAST	5.0	5.4
DESI 2024	3.8	4.8
AVERAGE ANNUAL GROWTH %	-15.6	4.3

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

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

With an equivalent of 10% of its working population employed as ICT specialists[55], Slovenia's ambition is in line with the EU target value. The value is linked to a modest starting point. Moreover, based on the current rate of progress, in the absence of an intensification of efforts over the coming years, Slovenia's contribution to this EU target will remain limited. Based on an analysis of 58 university programmes, the Chamber of Commerce and Industry of Slovenia estimates that on top of the around 1 400 ICT specialists trained every year, an additional 3 000-4 000 ICT specialists per year would be needed to reach the Digital Decade target. **In the roadmap, the ICT specialists target is one of the targets with the fewest measures and the smallest budget.** Given their very focused scope, the few measures seem to be suitable to provide very targeted support for a small number of technology areas, in particular cybersecurity training in interested schools and scholarships for PhDs in quantum. While being important initiatives, they do not seem to be sufficient to meet Slovenia's demand for ICT specialists.

Slovenia is implementing a higher education curricula reform and offers a small number of very specific training courses to increase the number of ICT specialists. In the area of reforms and as part of its RRP, the country carries out pilot projects aiming to integrate digital skills into higher education curricula, and a curriculum analysis. Afterwards, it will take stock to enable knowledge exchange between pilot projects and monitoring per thematic cluster, including digital. Slovenia has created dedicated training courses for women in cybersecurity, data analysis, IT support, IT project management, planning and designing user experience as well as AI. As a result, more than 500 women were trained and, based on the information provided by the Ministry of Digital Transformation, several participants decided to pursue ICT careers after the training. As part of its roadmap, Slovenia will continue this measure and 2 270 additional participants are expected by 2030.

Furthermore, Slovenia is taking action to gain a better overview of the ICT specialist needs and expected job market developments. In June 2023, Slovenia finalised the Skills Forecasting Platform, co-funded by the European Social Fund, which aims to predict skills needs and identify skills gaps in the job market in the short, medium and long term. The needs of the Slovenian job market until 2037 were presented at a conference in June 2023. It is estimated that between 2023 and 2027, a yearly average of approximately 1 200 vacancies for ICT specialists with a university degree or PhD will not be filled by a suitable candidate –

[55] Statistics | Eurostat (europa.eu)

the third-highest number of unfilled vacancies included in the forecast[56]. This work will also feed into a follow-up project, the Labour Market Platform, which is again co-funded by the European Social Fund and the Slovenian national budget. The project, with a total budget of EUR 6 million, started in July 2023 and is expected to run until October 2028. This follow-up project aims to provide real-time data on job market trends, forecasts, and gaps and, on this basis, to propose the integration of relevant skills into existing and potential new education/training programmes.

This is in line with the 2023 State of the Digital Decade report, which recommended that Slovenia strengthen the early identification of job market needs, provide a more powerful and quicker response, especially in the area of digital upskilling and reskilling, and adapt the (higher) education curricula to the latest digital needs. To what extent planned measures and measures that are currently being implemented will be sufficient remains to be seen, especially in the area of digital upskilling and reskilling. At this stage, the measures reported in the Slovenian roadmap do not seem to be in line with the high level of ambition of the trajectories reported in the roadmap, in terms of both intensity and scope.

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

3.1.2.a e-ID

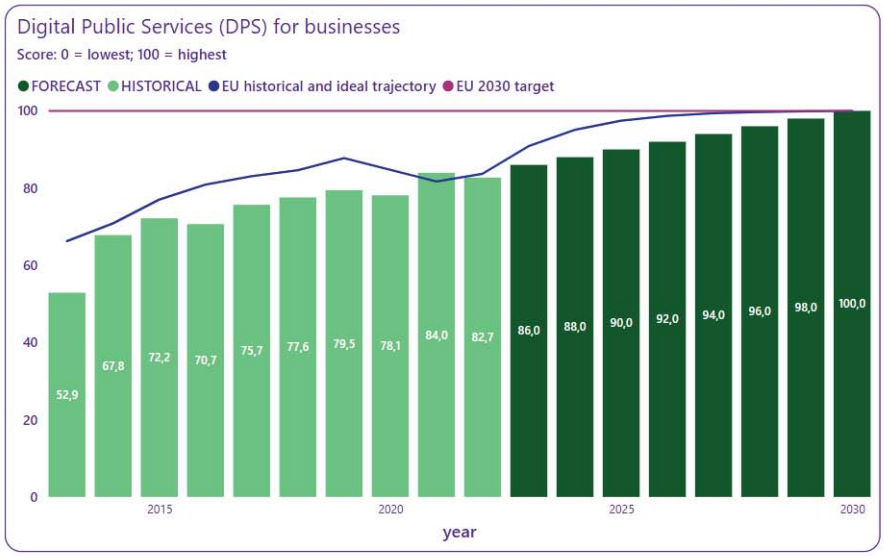
Slovenia has notified a national e-ID scheme to the Commission in accordance with the eIDAS Regulation[57] in May 2023 as part of its RRP (implementation was part of the second disbursement of December 2023). Furthermore, Slovenia supports the development of the European digital identity wallet, in particular via its **participation in the European Consortium** POTENTIAL (PilOTs for EuropeaN digiTal Identity wALlet-p), **which prepares, develops and tests pilots for integration into the European digital identity wallet.** Slovenia is mainly active in three use cases: (i) 'bank account opening', to use the wallet to open current and savings accounts; (ii) 'qualified electronic signature', to sign documents remotely; and (iii) 'e-government services', to prove your identity quickly and securely. **Slovenia is also involved in** DC4EU**, which aims to apply the EU's eIDAS trust framework, with a focus on education and social security**. DC4EU will investigate the issuance of educational credentials and professional qualifications in the education sector, and the issuance of a portable A1 form and European Health Insurance Card in the social security sector.

Slovenia has set itself the target of at least 80% of people using their e-ID for public services. In 2023, the share of the population who reported having used their e-ID to access online services in the last 12 months was below the EU average (35.7% vs 41.1%). For services provided by Slovenian public authorities or public services, Slovenia scores below the EU average again (21.8% vs 36.1%). However, it performs above the EU average for services provided by the business sector (24% vs 16.4%). This can be linked to the characteristics of these services, which may be used more frequently. Furthermore, it can also stem from activities to promote the use of e-ID for services provided by the private sector. For example, several meetings with the Slovenian Bank Associations took place to encourage the financial sector to enable identification via e-ID. Based on all these measures that have been or are being implemented, it is expected that the use of e-ID will increase.

[56] https://www.gov.si/assets/ministrstva/MDDSZ/Potrebe-trga-dela-do-2037.pdf, p. 44. It remains to be seen to what extent some of this mismatch can be addressed by candidates who have completed vocational training or technical higher education. Based on the forecast, there will be more such candidates than vacancies.

[57] Regulation (EU) No 910/2014 on electronic identification (the 'eIDAS Regulation').

3.1.2.b Digitalisation of public services for citizens and businesses



2023 state of play and recent progress

	Country level	EU level
FORECAST	86,0	90,9
DESI 2024	84,0	85,4
AVERAGE ANNUAL GROWTH %	1,5	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

Slovenia has untapped potential to help achieve the EU's Digital Decade target on the digitalisation of public services, while demonstrating a very strong dynamic for services for people and a positive dynamic for services for businesses. In the area of digital public services for people, with a score of 77.0, Slovenia is coming closer to catching up with the EU average of 79.4 (compared to 71.4 for Slovenia and 77 for the EU in 2022). In the area of digital public services for businesses, Slovenia continues to remain very close to the EU average (84 vs 85.4). Moreover, Slovenia performs fairly on indicators that have an impact on the quality of public services. On the one hand, the country continues to provide a comparatively high amount of pre-filled data in online forms of public services (a score of 73.9 for Slovenia vs 70.8 at EU level) and, based on the degree to which users are involved in the design of services and able to manage their personal data, service processes are relatively transparent compared to the EU average (70 vs 67). User support (score of 84.9 vs 86.4) as well as a mobile-friendly interface (score of 94.4 vs 95.3) are well developed, but slightly below EU average as well as a mobile-friendly interface (94.4 vs 95.3) are well developed, but slightly below the EU average. However, looking at the demand side, the percentage of e-government users – measuring the number of people who report having used websites or apps to interact with public authorities in the last 12 months – decreased from 81.3% to 78.4% though it is still above the EU average of 75%. A similar discrepancy between the offer and the demand side for services also exists for e-health and e-ID. Based on the reasons people provided in 2022 for not submitting completed forms to public authorities' websites, the most common reasons specified were a lack of skills or knowledge (4.7% for Slovenia vs 2.7% at EU level) and a lack of an electronic signature (highest score of all EU Member States that provided data, but it is to be noted that since then, an e-ID scheme has been notified that can be used for qualified electronic signatures – see the part on e-ID)[58].

[58] There might be other reasons – Slovenia scores high on 'other reasons' for not submitting completed forms, which are not further specified (7.4% for Slovenia vs 4% for the EU on average).

Note 1: Data break-in-series in 2020

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

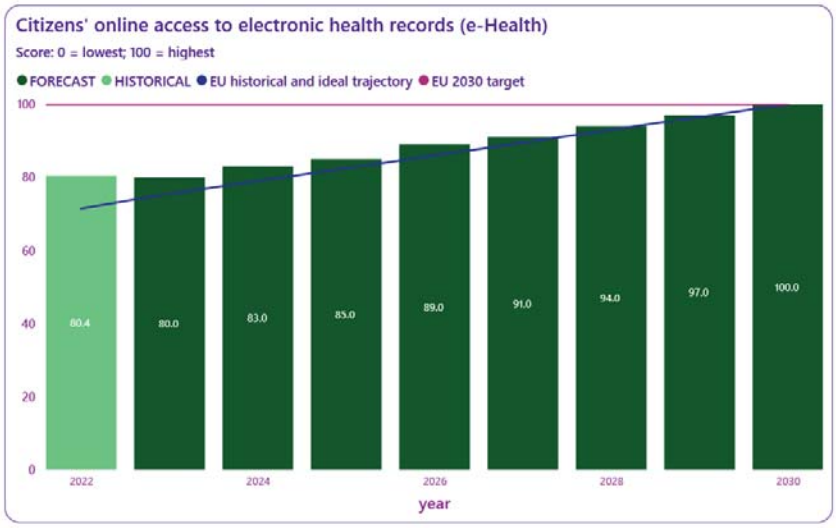
At 100% for digital public services for people and businesses, the country's target is in line with the EU target value. For businesses, Slovenia assumes to reach 100% already in 2027. Based on the current rate of progress, Slovenia's contribution to this target will be very significant.

In its roadmap, Slovenia presents a large number of very specific measures to improve and expand its digital public services in the next 2-3 years, unlike other targets, where measures often have a time horizon to 2030. Together with basic digital skills, the digitalisation of public services is the target with the highest number of measures. Several measures are part of the long-awaited action plan of the Digital Public Services Strategy 2030, which was published in August 2023. It puts into practice the Digital Public Services Strategy, which was adopted in December 2022. In alignment with the observed performance, the planned measures mainly focus on people, and cover life events such as studying, health and career. Some measures, including 'developing dynamic e-services' and 'smart digital public services', are expected to take into account user-friendliness and user experience. Furthermore, the RRP reform 'Modernising administrative processes for successful digital transformation', whose implementation was part of the second disbursement of December 2023, aims to remove obstacles to the provision of digital public services and processes, including by enlarging the scope of electronic procedures in administrative processes. A survey conducted by the Association of Municipalities and Towns of Slovenia showed that 89% of respondents had not yet implemented any AI-based solution or process and 55% of respondents did not have any specific plan to implement AI soon[59].

This is in line with the 2023 State of the Digital Decade report, which recommended that Slovenia translate – in a participatory manner – the strategic orientations into ambitious and specific measures to provide efficient and user-friendly digital online services. The total budget presented is comparatively low (around EUR 14 million) because of the nature of the measures and because of the fact that for several measures, the budget has not been determined yet. Against the background of the discrepancy between the offer of and the demand for digital public services, the participatory development (e.g., including user feedback) and user-friendliness of digital public services seem to remain relevant.

[59] Uporaba umetne inteligence (UI) v poslovanju občin in javnih zavodov – Skupnost občin Slovenije (skupnostobcin.si). 59 employees of municipalities and public institutions answered to the survey questions.

3.1.2.c e-Health



2023 state of play and recent progress

	Country level	EU level
FORECAST	80.0	75.5
DESI 2024	87.6	79.1
AVERAGE ANNUAL GROWTH %	8.9	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

Slovenia's overall eHealth maturity increased from 80 in 2022 to 88 in 2023), surpassing the EU average of 79. With a centralized access service, 80-100% of the population can use e-ID to access eHealth records via desktop and mobile applications. Slovenia provides 87% of health data types (EU average: 74%), excluding medical devices/implants and medical images. All healthcare providers, except private and mental health facilities, contribute data to online access service; 9 of 10 applicable categories supply relevant information.

Despite high eHealth infrastructure scores, only 51.4% of Slovenians declare to seek health information online (EU average: 56.3%), possibly due to the relatively low level of basic digital skills (see above). Slovenia's 75% compliance with the Web Content Accessibility Guidelines (EU average:77% of EU average) may hinder citizens with reduced accessibility. Slovenia's efforts in providing improved access opportunities and the introduction of functionalities for authorised persons to access electronic health records on behalf of others, building on existing legal provisions disadvantaged group assistance, can further enhance the situation.

In 2023, Slovenia focused on improving and extending the functionalities of existing services in the area of e-health. One notable initiative is allowing patients to authorize a close person, who may not be digitally savvy, to access their data on the repository on their behalf. This authorization, done in person at any healthcare provider, encompasses all functionalities on the patient portal zVem. A strategic decision was made to enable access to the data and services provided by the National Health Insurance Fund through the zVem portal, aiming to make it a one-stop health portal with full implementation expected in 2025. The unification of patient experience will be improved by enabling zVem to communicate with any healthcare provider in a safe and reliable manner. This mandatory use of the channel for any healthcare provider in the public network will ensure a high uptake of the service. In 2024, patient contact data (telephone, email) will be stored centrally and verified by the patient, making it accessible to all healthcare providers for necessary contact. Furthermore, additional new initiatives are anticipated: RRF-funded projects will continue to gather patient data in a structured format in a national register, paving the way for successful Health Data Space regulation. Telemedicine functionalities will also be made available to zVem users.

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

Based on a Eurostat survey, hate speech is relatively widespread in Slovenia: 43.8% of the population reported having been exposed to hostile or degrading messages online in the previous 3 months, which is significantly above the EU average of 33.5%. The awareness of this issue also seems to be higher than in the

EU on average: in the Digital Decade Eurobarometer, people identified hate speech as the harmful behaviour with the biggest impact on them (28% vs 22%).

Slovenia is taking very specific action to better understand and counter online hate speech and disinformation. The Ministry of Digital Transformation and AKOS, the national regulatory authority for telecommunications, are raising awareness through campaigns, workshops and web portals. For example, in 2023, Slovenia set up a strategic council for preventing hate speech. In April 2024, the Ministry of Digital Transformation organised round tables in various municipalities to discuss with relevant interlocutors (e.g., teachers, social work centres, non-governmental organisations) how to better protect young people and empower them to react against hate speech online.

AKOS has set up the dedicated portal 'MiPi' to raise awareness. Furthermore, AKOS is promoting media and information literacy in cooperation with organisations, and plans to further develop this work as part of its strategic plan for 2024-2026, which it is currently preparing. Furthermore, in October 2023, the Peace Institute launched a project to analyse online hate speech and disinformation and to develop a proposal for action. The project aims to develop and use indicators or other means to monitor online hate speech and disinformation and, on this basis, develop, test and afterwards refine proposals for suitable measures by March 2025.

According to the Digital Decade Eurobarometer, human support in accessing and using digital technologies and services is considered very significant or fairly significant by more respondents in Slovenia (80%) than in the EU on average (74%). Public authorities are considered very important or fairly important to ensure this by an equal share of respondents in Slovenia and at EU level (88%).

Slovenia has set up the International Research Centre on Artificial Intelligence **(IRCAI) under the auspices of UNESCO,** aiming to serve as a coordination point, funding route, and accelerator for AI approaches relevant to the Sustainable Development Goals (SDGs). IRCAI is committed to providing professional support for systemic and strategic solutions in AI deployment across various sectors. It also helps generate relevant statistics on AI and associated technological innovations while addressing legal, ethical and social implications.

Slovenia is very active in supporting human-centric AI and developing ethical and legal frameworks, both in the EU and at global level. For example, Slovenia chaired the ad hoc Committee on AI at the Council of Europe, which prepared the work of the AI Committee, drafting the Council of Europe's Framework Convention on Artificial Intelligence and Human Rights.

Best practice: Civil society to help with monitoring roadmap implementation
The "Co-creating digital policies in Slovenia Phase II - (CODIS 2[60])" project, aims to monitor and enhance the implementation of the digital decade strategic roadmap in Slovenia. This initiative led by the Institute for Electronic Participation focuses on inclusive digital transformation, engaging citizens in informed civic dialogue, providing recommendations for updating the roadmap, and raising awareness through project outreach and dissemination. Scheduled to commence in spring 2024, the project will use an open source "on-line visualisation dashboard" to monitor the progress of digital inclusion measures, including basic digital skills, gigabit network coverage, and EU-level cooperation. Engaging citizens, civil society organizations, experts, media, local municipalities, and policymakers will be a key aspect of the project,

[60] The project is funded by the European Citizen Action Service (ECAS) regranting scheme in the framework of the European Citizenship Accelerator (EURECA) project, co-funded by the Citizenship, Equality, Rights and Values programme of the European Union. Available at www.inepa.si/tag/codis/.

facilitating informed civic dialogue, providing recommendations for roadmap updates, and addressing diversity, equity, inclusion, and accessibility (DEIA) issues within the national strategic plan. Additionally, the project seeks to expand its methodology to other member states, with an emphasis on advocating for compliance with EC guidelines by civil society.

4 Synergies between the green and digital transformaions

Slovenian enterprises and people are generally sensitive to the green transition of the digital sector. Some 40.6% of enterprises in Slovenia considered the environmental impact of ICT services, or ICT equipment, before selecting them, and applied some measures, affecting the paper or energy consumption of their ICT equipment. This rate is below the EU average of 48.7%. Recycling is more present than in the other EU Member States, with 11.7% of the population recycling mobile phones, 9.5% recycling laptops and tablets, and 15.9% recycling desktop computers (compared with an EU average of 10.4%, 9.7% and 12.8%, respectively). According to the Digital Decade Eurobarometer, the share of respondents in Slovenia who consider that ensuring that digital technologies serve the green transition should be a very important or fairly important action for public authorities is around the EU average. However, the proportion of respondents in Slovenia who consider digital technologies to be fairly or very important for helping to fight climate change is below the EU average (67% vs 74%).

Slovenia has started to make use of digital technologies to support the green transition, with a particular focus on increasing energy efficiency. The country monitors and manages public buildings with Internet of Things systems – at federal as well as municipality level. Three Slovenian cities are in the EU Mission among 100 Climate-Neutral and Smart Cities. Another important angle, also reflected in the 2023 European Semester country-specific recommendations for Slovenia, is to strengthen and better manage electricity distribution networks, including by digitalisation them. For this purpose, Slovenia included a measure in the REPowerEU chapter of its RRP that aims to install new control systems and sensor technologies to enable interactive and intelligent monitoring and management of the energy generation, distribution or consumption within the network. Furthermore, the country's 2021-2027 cohesion policy programme allocates EUR 54 million to smart energy systems, including smart grids, to improve the efficiency and resilience of the electricity distribution network.

Public support measures in the area of digitalisation are starting to cover the promotion of sustainable, circular business models. As part of its RRP, Slovenia aims to set up a programme to support at least 200 start-ups and SMEs in their transition to a circular, low-carbon and sustainable economy. Under this programme, several calls for tender have taken place already. Furthermore, programmes combining the green and digital transitions are planned, for example programmes supporting companies in using digital technologies to apply circular economy principles to their processes (see the part on basic digital intensity of SMEs).

Slovenia is developing a green budgeting framework. A methodology was adopted in 2023 and is being implemented in 2024. This reform is expected to support: (i) the monitoring of green budget expenditure; (ii) the assessment of environmental and climate impacts on fiscal policy; and (iii) the consistency of budgetary and fiscal policies with climate objectives.

Annex I – National roadmap analysis

Slovenia's national Digital Decade strategic roadmap

Slovenia submitted its national Digital Decade strategic roadmap on 21 December 2023, in accordance with Article 7 of the Digital Decade Policy Programme Decision and after a public consultation (including a 14-day consultation period and an online event on 8 September 2023). Afterwards, it was adopted by the government and published[61]. In parallel, the Slovenian national network of non-governmental organisation set up a project, led by the Institute for Electronic Participation, to accompany this process in a structured manner.

The Slovenian roadmap includes national target values, in line with the definitions of the key performance indicators, and trajectories including yearly data points for all 12 targets of the Digital Decade Policy Programme. All national target values provided are in line with the EU targets. The roadmap even provides an additional target value for e-ID uptake. Furthermore, Slovenia provided quantitative estimations of how it expects to help to achieve the edge node and semiconductor target, where no observed baseline value existed at the time of submission of the roadmap[62]. Slovenia expects to reach the target on digital public services for businesses in 2027 already.

The roadmap presents a comprehensive and ambitious overview of the planned measures and the measures that are currently being implemented in the country. It covers a broad range and number of policies and measures supporting the targets and groups of objectives, including several multi-country projects and European Digital Infrastructure Consortia**.** The total budget amounts to EUR 1 billion for 98 measures, quite balanced between EU sources (around 50%) and national sources (around 40%)[63]. A budget has been allocated to almost all measures, but not always consistently at measure and aggregated target level.

Basic digital skills and digital public services are the targets with the highest number of measures. In terms of budget, the highest shares are allocated to Gigabit connectivity (with a high share of private investment[64]), basic digital skills, and AI / cloud / data analytics uptake (especially AI). Furthermore, the roadmap presents unprecedented amounts of funding for start-ups / unicorn companies. However, measures specifically supporting edge nodes and data analytics are not included**.** Many measures have a time horizon to 2030.

Digital Decade target/objective	Budget (EUR million)	Number of measures
Connectivity Gigabit/FTTP	237	5
Connectivity 5G	3.9	4
Semiconductors	3.7	3
Edge nodes	-	-

[61] The draft roadmap was published on 31 August 2023 and the consultation ran until 19 September 2023 (the draft roadmap is available here: draft roadmap feedback collected during the online event is available here: Odgovori-na-pripombe-iz-javne-obravnave.pdf). After its adoption by the government, the roadmap was submitted to the Commission on 21 December 2023. Available here: Nacionalni strateški načrt za digitalno desetletje 2030 (1231 KB)

[62] For e-ID, Slovenia provided an additional uptake target value of at least 80% of the population using their e-ID for public services. By 2030, the number of enterprises performing R&D in the area of semiconductors is estimated to amount to 8, the number of enterprises manufacturing semiconductors is estimated to amount to 25, and the number of enterprises deploying edge nodes is estimated to amount to 200.

[63] The remaining 10% stems from private funding (see the part on Gigabit connectivity).

[64] Only target for which private investments were reported. All these investments stem from the 2014-2020 period.

Quantum computing	7.0	1
SME take-up	52.3	6
Cloud / AI / big data uptake	44.0	4
Cloud-only uptake	5.0	1
AI-only uptake	123.5	6
Big data uptake	-	-
Unicorn companies	135.8	3
Basic digital skills	179.3	16
ICT specialists	4.3	5
e-ID	0.6	1
Key public services	6.3	17
e-Health	133.0	4
Objectives	124.4	22
Total	**1 060**	**98**

The roadmap is overall consistent with action on all aspects of digitalisation, and takes into account several new impulses (e.g., unicorn companies) and persisting challenges (e.g., rural connectivity). However, this does not apply to all targets – some aspects might require more action. In particular, the digitalisation of small to medium-sized enterprises (SMEs) and the uptake of advanced technologies, especially data analytics, could benefit from additional, targeted action to address Slovenia's persisting challenges in the digital transformation and the uptake of advanced technologies in businesses, especially in SMEs. Furthermore, the skills aspect, in particular the high unmet demand for ICT specialists, would require additional and more comprehensive action. Some parts of the roadmap, e.g., on semiconductors, quantum and AI, could benefit from a more detailed description of the planned activities (e.g., scope and specific measures to implement strategies / the centre).

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

MCP and EDICs

In its roadmap, Slovenia reported participating in the **multi-country projects** on Common Data Infrastructure and Services, on Microelectronics and Communication Technologies, on European High Performance Computing Joint Undertaking, European Digital Innovation Hubs (see more information in respective sections above) as well as Slovenia's Common Language Resources and Technology Infrastructure (CLARIN.SI)[65].

Slovenia participates in five EDICs already set-up or in the making. It is a member of the **Alliance for Language Technologies (ALT) EDIC** to address the scarcity of European language data available for AI, the **Local Digital Twins towards the CitiVERSE EDIC** to connect local digital twins across Europe and the **EUROPEUM EDIC** to develop the existing ecosystem of the European Blockchain Services Infrastructure (all three EDICs already set up)**.** Furthermore, Slovenia is also developing the Statute and other relevant documents of the possible future **Cybersecurity Skills Academy EDIC**, within an informal Working Group and is engaging in discussions on the setup of the possible future **Digital Commons EDIC**, within an informal Working Group.

EU funding for digital policies in Slovenia

The Slovenian Recovery and Resilience Plan devotes EUR 0.5 billion (20% of the total) to the digital transformation, of which 0.4 billion are expected to directly contribute to achieve Digital Decade targets, according to a JRC mapping study[66]. The largest amounts are dedicated to digitalisation of key public services, including to remove obstacles to support the provision of digital public services and processes (e.g. enlarge the scope of electronic procedures in administrative processes), and e-Health, including to integrate new digital services into healthcare and to implement telemedicine. The second payment request was disbursed to Slovenia in December 2023. So far, the country received EUR 841 million in RRF grants and loans.

The Cohesion Policy Programme 2021-2027 devotes EUR 0.3 billion (9% of the country's total Cohesion Policy funding) to the digital transformation, of which EUR 0.2 billion is expected to directly contribute to achieve Digital Decade targets. The largest amounts are dedicated to key public services, followed by the digital transformation of businesses, including the development of ICT infrastructure for businesses.

[65] https://www.clarin.si/info/about/

[66] 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

Spain

1 Executive summary

Spain 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, Spain made notable progress** on increasing basic digital skills and in the use of artificial intelligence by enterprises. Spain has an excellent FTTP coverage and has taken significant action in the area of semiconductors. However, important **challenges persist** regarding the lack of ICT specialists and some indicators related to the digitalization of business, including the take up of cloud.

The Digital Spain Agenda is the country's digital transformation strategy aiming to leverage new technologies to drive intensive economic growth, placing people at the centre, and reaching all territories. The agenda is structured around ten strategic axes and two cross-cutting axes, which are framed by three dimensions reflecting the Digital Decade Policy Programme: (i) infrastructure and technology; (ii) economy; and (iii) people. It was approved in 2020 and updated in 2022 under the name 'Digital Spain 2026'. According to the special Eurobarometer on 'the Digital Decade' 2024[67], **73% of Spanish citizens consider that the digitalisation of daily public and private services is making their lives easier**. This percentage aligns with the EU average and reflects the success of Spanish authorities in the inclusive implementation of the Digital Agenda.

Spain is a member and the host of the **European Digital Infrastructure Consortium** of the Local Digital Twins towards the **CitiVERSE – EDIC** (already set up) and has recently joined the Alliance for Language Technologies EDIC (**ALT-EDIC**, already set up), which addresses the scarcity of European language data needed for AI solutions. Spain is also developing the Statutes and other relevant documents of the possible future Genome EDIC and the EDIC for Mobility and Logistics Data, within their informal working groups. In addition, the country is engaging in discussions on the setting up of the Cancer Image Europe (EUCAIM) and the Agri-Food EDICs, within their informal Working Groups[68]. Concerning the Important Projects of Common European Interest (IPCEIs), Spain takes part in the IPCEI on Next Generation Cloud Infrastructure and Services (IPCEI-CIS) and the **IPCEI on Microelectronics and Communication Technologies** (IPCEI-ME/CT). In addition, Spain takes part in the European High Performance Computing Joint Undertaking (EuroHPC) with the supercomputer MareNostrum 5 based in Barcelona.

The Spanish Recovery and Resilience Plan (RRP) allocates 26% of its budget to measures linked to the digital area[69]. The modified plan, updated in October 2023, has a stronger focus on the digital transition, devoting **EUR 40.4 billion to measures that support digital objectives** (up from EUR 19.7 billion in the original plan). Under the cohesion policy, an additional EUR 5.7 billion (16% of the country's total cohesion policy funding) is allocated to the country's digital transformation[70].

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

[68] Information last updated on 31 May 2024.

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

[70] 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]	Spain			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	ES	EU
Fixed Very High Capacity Network (VHCN) coverage	93.3%	96.3%	3.2%	78.8%	7.4%	100%	100%
Fibre to the Premises (FTTP) coverage	91.0%	95.2%	4.6%	64.0%	13.5%	100%	-
Overall 5G coverage	82.3%	92.3%	12.1%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		171		1 186		x	10 000
SMEs with at least a basic level of digital intensity	59.7%	60.5%	0.7%	57.7%	2.6%	90%	90%
Cloud	27.0%	27.2%	0.4%	38.9%	7.0%	75%	75%
Artificial Intelligence	7.7%	9.2%	9.3%	8.0%	2.6%	75%	75%
Data analytics	NA	38.0%	NA	33.2%	NA	75%	75%
AI or Cloud or Data analytics	NA	49.9%	NA	54.6%	NA		75%
Unicorns		11		263		24	500
At least basic digital skills	64.2%	66.2%	1.6%	55.6%	1.5%	85%	80%
ICT specialists	4.3%	4.4%	2.3%	4.8%	4.3%	8.6%	~10%
eID scheme notification		Yes					
Digital public services for citizens	86.2	84.2	-2.3%	79.4	3.1%	100	100
Digital public services for businesses	91.0	91.0	0.0%	85.4	2.0%	100	100
Access to e-Health records	83.2	84.6	1.7%	79.1	10.6%	100	100

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

National Digital Decade strategic roadmap

Regarding the **Spain's** contribution to the Digital Decade reflected in its roadmap, the country is demonstrating a **very high ambition** while intends to dedicate **significant effort** to achieve the Digital Decade objectives and targets.

The Spanish roadmap is ambitious, comprehensive, and coherent with the vision of Spain making a strong contribution to achieving the EU's Digital Decade targets. Building on the roadmap, Spanish authorities have paved the way for the digital transformation of the Spanish economy throughout the past years, with the document reflecting this vision and commitment. The roadmap presents targets and trajectories for all the Digital Decade targets, except for Edge-nodes. Overall, the targets are aligned with the EU values with the exception of the basic digital skills, which surpasses the EU target, and the ICT specialists, which stands slightly below the EU ambition level. **The roadmap contains up 67 measures with a total budget of EUR 33 750 million** (about 2.3% of its GDP), setting as key deliverables the growth of unicorns, innovative scale-up ecosystem, and the production of semiconductors.

Recommendations for the roadmap

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

- **TARGETS:** (i) Propose targets and develop trajectories for edge nodes; (ii) align with the EU level of ambition for ICT specialists.

- **MEASURES:** (i) Reinforce the roadmap with additional measures on ICT specialists, on the adoption of the advanced digital technologies, and on objectives; (ii) Provide more information on the implementation of digital rights and principles (and Digital Decade general objectives), including on contributing measures.
- **CONSULTATION:** Publish the roadmap to encourage open debate and engagement with the Digital objectives and receive future stakeholder feedback.

Digital rights and principles

The Special Eurobarometer on 'the Digital Decade' 2024 highlights that only 36% of Spaniards believe the EU protects their digital rights, a significant 9-point gap below the EU average (45%) and a 13-point increase in distrust since last year. Concerns are growing, notably with 61% alarmed about children's online safety—up 21 points, and 53% about control over personal data—up 17 points. Positively, 60% trust in affordable high-speed internet and 62% are satisfied with the level of digital skills. These findings underscore the urgency of enhancing digital rights and principles in Spain's roadmap and digital strategies. 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 to improve outcomes in the years to come[71].

A competitive, sovereign and resilient EU based on technological leadership

Spain performs exceptionally well in connectivity: FTTP stands at 95.2% and 5G coverage at 92.3%, much above the EU average and close to reaching the target. Concerning **semiconductor production**, the country set it up as a priority through the PERTE Chip. Although the roadmap does not present targets and trajectories for it, the country can be considered ambitious in Edge nodes given the public and private investments and its participation in IPCEI-CIS to accelerate the edge nodes deployment. The same approach applies to Quantum technology, given Spain's participation in the EuroHPC and the presentations in last December of the 'Quantum Pact' and the MareNostrum 5 supercomputer. While the country performs relatively well in the basic digital intensity of SMEs (60.5%), it is facing challenges although improving, in the advanced digitalisation of enterprises, such as the uptake of cloud, data analytics, and AI. The country is also **focused on supporting the innovative scale-up ecosystem**, planning, and implementing investments to support innovative enterprises.

Recommendations – Spain should:

- **CONNECTIVITY INFRASTRUCTURE:** Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.
- **DIGITALISATION OF SMEs/ AI, CLOUD and DATA ANALYTICS:** (i) Continue the efforts to support the digitalisation of enterprises, in particular to foster the adoption of advanced technologies; (ii) Ensure the broad uptake of the next generation of cloud infrastructure and services under development in the IPCEI-CIS by companies of all sizes, including by developing a country-specific dissemination strategy (complementing what has already been committed under IPCEI-CIS); contributing to the additional dissemination activities led by the Cloud IPCEI Exploitation Office.

[71] 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.

Protecting and empowering EU people and society

Spain is taking positive steps toward empowering people and promoting continuous opportunities for all individuals in the digital economy. To bridge gaps, digital technologies should be accessible to all, and that is what Spain is aiming for through all the activities related to its National Digital Skills Plan. The national target for basic digital skills of 85% of the population by 2030 is above the EU level of ambition, just as the current value is above the EU average (66.2% vs 55.6%). **On the other hand, more ambition could be envisaged for the ICT specialists as the roadmap sets a target that is lower than the EU expectations**. Concerning the **Digital Public Services, Spain brings a positive contribution to the EU's Digital Decade targets** on both public services for citizens (84) and businesses (91), ranking well above the EU average (79 and 85, respectively).

The country proceeded with the promotion of the **Charter of Digital Rights** approved in 2021 as well as the creation of a Digital Rights Observatory.

Recommendations – Spain should:

- **ICT SPECIALISTS:** Continue implementing its efforts to achieve a greater number of ICT specialists, designing incentives schemes to attract and retain them, and increasing the visibility and readability of training and reskilling options.
- **DIGITAL PUBLIC SERVICES:** Continue efforts to digitalise public services and further promote their use.
- **e-HEALTH:** (i) Make the data types of medical devices/implants, procedures/operations, and medical images available to citizens in all regions through the online access services; (ii) Increase the supply of health data by onboarding more categories of healthcare providers, especially in the private sector; (iii) Build on existing legal provisions and implement technical functionality for authorised persons to access electronic health data on behalf of others.

Leveraging digital transformation for a smart greening

Spain is harnessing digital technologies to enhance the green transition in key areas while implementing innovative programs to reduce the environmental impact of energy-intensive digital technologies. To develop environmentally friendly technologies guided by sustainability criteria, the National Green Algorithms Plan (PNAV) has been launched, with an investment of EUR 257 million from the European Next Generation EU funds.

Overall, Spain is committed to ensuring that all the measures included in the Digital Spain agenda adhere to the principle of not causing significant harm to the environment, which, combined with the relevant climate/environmental labelling, ensures that digitisation progresses in a sustainable manner.

Recommendations – Spain should:

- Continue developing and implementing a coherent approach to twinning the digital and green transitions, by leveraging advanced technologies and scaling up successful initiatives that improve the energy and material efficiency of digital infrastructures, in particular data

centres, and by proposing decarbonisation measures and supporting the take up of green technologies that reduce the carbon footprint in other sectors, such as energy, transport, buildings, and agriculture.

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

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

The Digital Spain Agenda has been successful in stimulating the development of infrastructure, continued growth, and digitalisation of the Spanish economy, bringing a very important contribution to the Digital Decade targets. The country performs exceptionally well in connectivity infrastructure, standing well above the EU average in several indicators. Spain continues to expand its digital industry. This will strengthen the EU's digital leadership and sovereignty, particularly in semiconductor production.

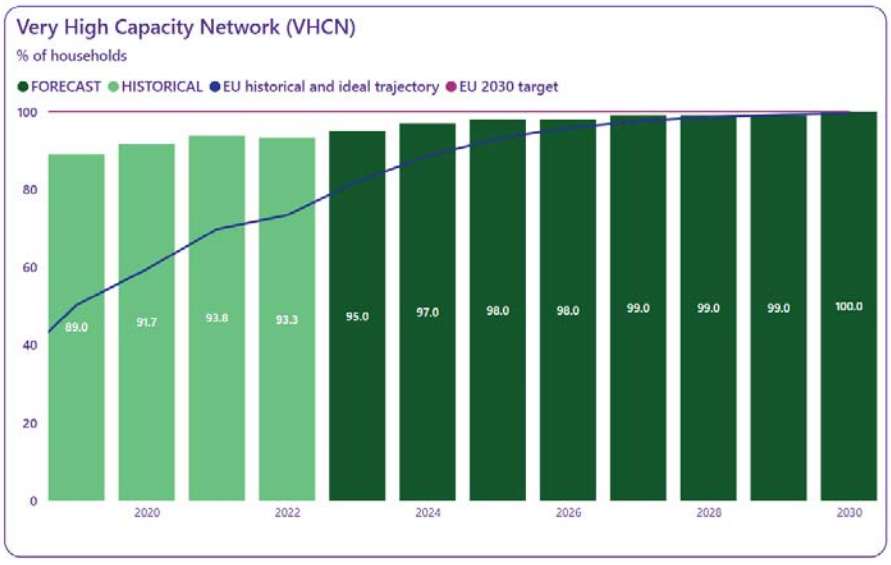
According to the 2024 Eurobarometer, **85% of Spanish people think that public authorities should support building efficient and secure digital infrastructures including connectivity and data processing facilities**. **83% think that the same should be done to ensure that European companies can grow and become European champions able to compete globally.**

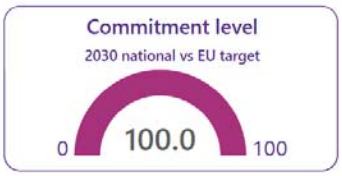
Of the 10 strategic axes of the Digital Spain agenda, those most relevant to the EU's technological leadership are: (i) digital connectivity, (ii) the impulse to 5G technology, and (iii) the digital transformation of enterprises and digital entrepreneurship.

2.1 Building technological leadership: digital infrastructure and technologies

As a result of its active deployment of connectivity infrastructures, Spain has nearly met the EU targets for VHCN, FTTP and 5G coverage.

2.1.a Connectivity infrastructure (Gigabit)[72]





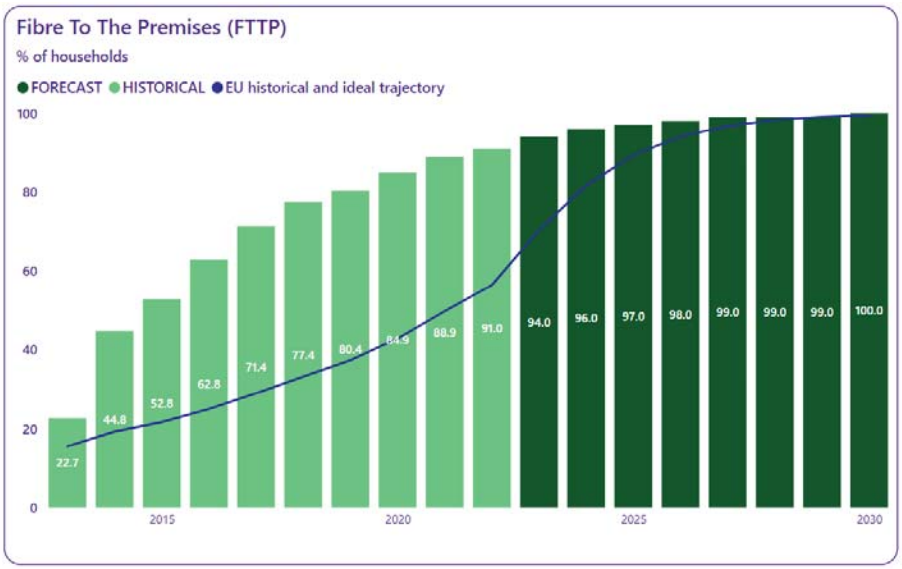
2023 state of play and recent progress

	Country level	EU level
FORECAST	95.0	82.0
DESI 2024	96.3	78.8
AVERAGE ANNUAL GROWTH %	3.2	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

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



2023 state of play and recent progress

	Country level	EU level
FORECAST	94.0	70.3
DESI 2024	95.2	64.0
AVERAGE ANNUAL GROWTH %	4.6	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

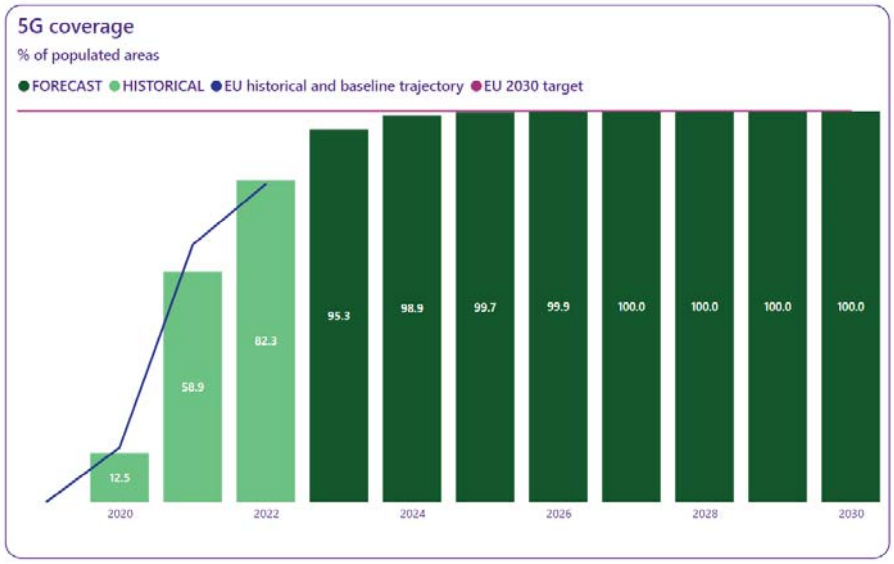
Spain makes a very strong contribution to the EU's digital decade VHCN target, showing a positive dynamic. In 2023, VHCN coverage stood at 96.3%, well above the EU average (78.8%). At 95.2%, FTTP coverage is also well above the EU average (64.0%). Spain is once again at the forefront of the roll-out of VHCN, up 3.2% from the previous year. For FTTP the growth is +4.6%. The progression is lower than in the EU but it can be explained by the fact that the last percentages of coverage are the most difficult to reach for advanced countries like Spain.

The Spanish roadmap includes five measures linked to the Gigabit infrastructure in order to reach the targets aligned with the EU objectives: achieving 100% coverage in VHCN and FTTP by 2030. Given the current rate of progress and focus on achieving the last 5% by 2030, the country is on track to reach these targets before the end of that year. By then, it expects all end users at a fixed location to be covered up to the termination point of a Gigabit network.

Spain continues to take a number of steps to improve these key performance indicators. In 2023, the Secretariat of State for Telecommunications and Digital Infrastructure launched the 2023 **UNICO Broadband programme**. This initiative promotes the deployment of broadband infrastructures capable of offering services of more than 300 Mbps symmetrical (scalable to 1Gbps), primarily in rural, isolated and remote areas not covered by private initiatives. The 2023 call, with a total awarded budget of EUR 134.36 million, complements the actions of the previous two years. Its aim is to cover nearly 360 000 premises. It is expected to provide Gigabit connectivity to the 1-2 % of the population that still lacks it or has no immediate coverage plans.

The private sector continues to invest in and to roll out VHCNs, primarily FTTH, as it has done in previous years. The main drivers of this high level of infrastructure-based competition include: (i) investment decisions and commercial co-investment agreements, where operators strive to compete as extensively as possible on the basis of their own FTTH networks; (ii) the regulatory framework derived from, among others things, the reviews of the various wholesale markets for broadband access that the Spanish National Markets and Competition Commission (the CNMC) performed in 2009, 2016 and 2021; and (iii) the availability of regulated access to Telefónica's civil engineering infrastructure.

2.1.b Connectivity infrastructure (5G)



2023 state of play and recent progress

	Country level	EU level
FORECAST	95.3	
DESI 2024	92.3	89.3
AVERAGE ANNUAL GROWTH %	12.1	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

Spain brings a positive contribution to the EU's Digital Decade 5G target, showing also a positive dynamic. At 92.3%, 5G coverage in Spain is above the EU average (89.3%). With annual growth of 12.1%, Spain is on track to achieve 100% coverage in populated areas by 2027 as planned. The national roadmap outlines six measures aimed at reaching complete 5G coverage by 2030.

Deployment of 5G was accelerated once the 3.6 GHz band was rearranged to provide operators with a contiguous block of spectrum, and the rest of the priority bands (especially the 700 MHz band was made available to operators). 5G in the 3.4-3.8 GHz band, an essential band for enabling advanced applications requiring large spectrum bandwidth, covers 52.3% of Spanish households in 2023, standing above EU average (50.6%). In 2023, to close the digital divide between urban and rural areas and in the frame of UNICO programmes, Spain launched two projects to accelerate 5G deployment in less populated areas and municipalities. The **UNICO 5G Networks – Backhaul Optical Fibre project** (total budget awarded: EUR 447 340 893) seeks to equip sites in municipalities of fewer than 5000 inhabitants with fibre optic backhaul connectivity to support future 5G network traffic and services. Meanwhile, the **UNICO 5G Networks – Active project** (call budget: EUR 543 879 531) aims to support deployment of equipment and infrastructure in less populated areas of Spain (with fewer than 10.000 inhabitants). The equipment and infrastructure will be used to roll out standalone 5G networks with minimum download and upload speeds of 100 Mbps and 5 Mbps, respectively, in peak time conditions and with advanced characteristics of edge computing and network slicing.

2.1.c Semiconductors

The Spanish roadmap does not set a target or trajectory for semiconductor production. However, as part of the Spanish Recovery Plan, Spain presents a dedicated Plan for Semiconductors called **PERTE Chip, which includes five measures to reinforce the value chain in the industry of semiconductors and microelectronics.** This overarching initiative will be able to tackle the different challenges Spain may face in its way of contributing to semiconductor production in the EU. It has an overall budget of EUR 12.25 billion and covers the whole value chain, including training, design, and production measures. Concerning its implementation, **a first mission PERTE Chip 2023 from the Centre for Innovation and Technological Development** was financed with EUR 47 million. It promotes R&D&I around cutting-edge microelectronic design, with a particular interest in the design of systems based on microprocessor cores of alternative architectures (such as RISC-V) so that progress is made in future generations of chips. In addition, the scope

of this mission not only refers to the design of the microprocessor core and its digital peripherals but also to the design of elements of another nature that complete a system-on-chip (SoC), which may include communication interfaces, sensors and actuators or power elements. Furthermore, **a call for 'the proof of concept' projects 2023 PERTE Chip** to fund projects that accelerate the transfer of knowledge and results generated in research was published in September 2023 with a budget of EUR 30.33 million, of which EUR 21.22 million have been awarded in May 2024.

In addition to the PERTE Chip, Spain participates along with 13 other Member States, in the **IPCEI on Microelectronics and Communication Technologies** (IPCEI-ME/CT). With a total budget of EUR 236 million, the project finances research and development activities covering microelectronics and communication technologies throughout the value chain, i.e., from materials and tools to chip design in advanced an open architectures and manufacturing processes associated.

A call for the '**Cátedras Chip' programme** to finance the creation of university chairs in microelectronics research, and boost talent in Spain associated with semiconductor design and manufacturing, was published in July 2023. In May 2024, EUR 45.74 million have been awarded to 17 universities.

In the private sector, the American chip maker **Broadcom** announced its plans to open a chip factory in Spain, attracting investment of EUR 920 million, and the world's leading independent nanoelectronics R & D hub, **IMEC**, based in Leuven (Belgium), announced the opening of an R & D centre in Andalusia.

2.1.d Edge nodes

The Spanish roadmap does not set a target or trajectory for deployment of edge nodes. However, it contains three measures with a total public investment of EUR 207 million to help to reach the target for at least 10 000 climate-neutral, highly secure edge nodes to be deployed in the EU by 2030. Spain is currently starting its deployment of edge nodes, which is to be carried out mainly by the private sector. The European edge nodes observatory estimates that Spain had deployed 171 edge nodes in 2023.

Spain is leveraging its participation in the **IPCEI Next Generation Cloud Infrastructure and Services (IPCEI-CIS)** to accelerate the deployment of edge nodes. The IPCEI-CIS includes the development and first industrial deployment of Cloud Edge nodes co-funded by public and private stakeholders to meet the specific needs of end-users located in EU Member States. These investments may cover all cloud edge categories, with a specific focus on supporting the development and initial deployment of cloud edge facilities. The IPCEI-CIS is expected to drive the research, development, and deployment of the next generation of cloud infrastructures, platforms, services, and applications in a in a centralised manner but with regional flexibility, leveraging existing national initiatives and resources where relevant. In December 2023, a first call awarded EUR 111 million to finance projects of Telefónica España, OpenNebula Systems and Arsys Internet.

To ensure Spain meets the EU-level edge nodes target, Spain is complementing this IPCEI programme with two national programmes: the **UNICO I+D Cloud** (EUR 40.8 million awarded in 2022) and the **FEDER Servicio Computacional** (scheduled for 2025), which focuses on facilitating deployment where there is a market failure.

As far as the **private sector activities** are concerned, in March 2023 **Meta** announced its plan to invest EUR 1 000 million to develop a data centre in Talavera de la Reina (Castilla-La Mancha). In July 2023, **IBM** announced the opening of its first multi zone cloud region (MZR) in Spain, designed to support the hybrid cloud and AI transformation journeys for Spanish and European enterprises. It will be comprised of three data centres located in Alcobendas, Las Rozas and Madrid City. In October 2023, **Microsoft** announced that it will build a data centre region in Aragon.

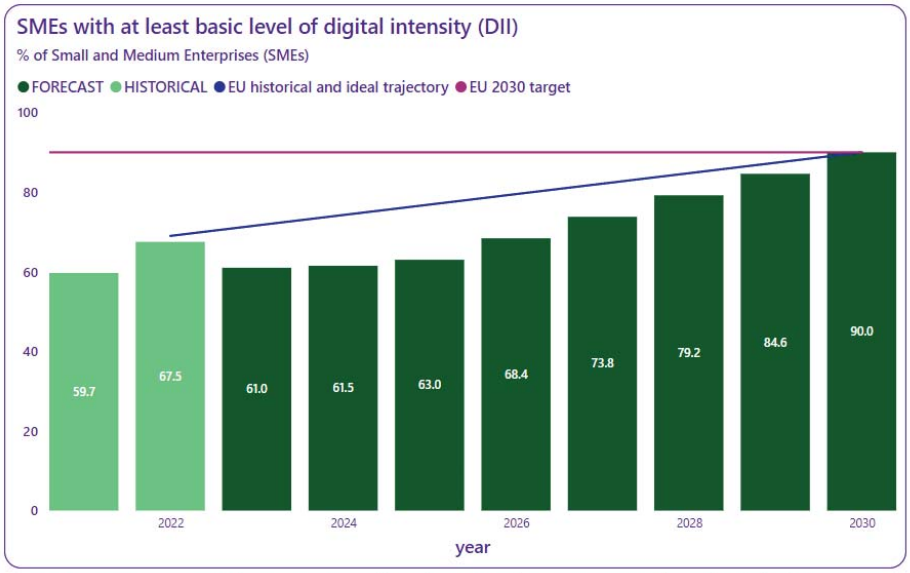
2.1.e Quantum technologies

The Spanish roadmap does not set a target or trajectory for high-performance computing and quantum technologies. However, the roadmap includes the Quantum Spain Programme, which promotes and strengthens the national quantum computing ecosystem, aiming at creating **the first quantum computing infrastructure in Spain**. In February 2023, the planned installation of the first quantum computer in southern Europe at the Barcelona Supercomputing Centre was announced. The project will be carried out by a group of Spanish companies, integrated into the Temporary Business Union (UTE) formed by the start-up Qilimanjaro Quantum Tech and the Spanish technology company GMV, which have won the public tender. The investment amounts to a total of EUR 12.5 million, 50% co-financed by the EU and the Government of Spain[73].

In December 2023, under the Spanish Presidency of the Council of the European Union, the government submitted the '**Quantum Pact**', which promotes collaboration both between countries themselves and between countries and the European Commission to develop and deploy of quantum technologies. The aim is for the EU to play a role within a growing international competitive landscape[74]. Also in December, the **MareNostrum 5** supercomputer was inaugurated in Barcelona. The aim is for it to be used by AI developers, making use of the most advanced accelerator chips. It is part of the Span's contribution to the **European High Performance Computing Joint Undertaking (EuroHPC)**.

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

2.2.a SME with at least basic digital intensity



2023 state of play and recent progress

	Country level	EU level
FORECAST	61.0	71.6
DESI 2024	60.5	57.7
AVERAGE ANNUAL GROWTH %	0.7	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

Spain brings a positive contribution to the EU's Digital Decade target on digitalisation of SMEs while demonstrating a limited dynamic. The country performs slightly above the EU average, with 60.5% of the SMEs having at least a basic level of digital intensity (EU average: 57.7%). This represents annual growth of 0.7% over the 2 years compared to 2021, which is the last comparable year when a similar methodology was used to measure the digital intensity of enterprises. This is below the average progress made in the EU

[73] https://portal.mineco.gob.es/RecursosNoticia/mineco/prensa/noticias/2023/20230227_ndp_quantum_spain.pdf
[74] https://espanadigital.gob.es/actualidad/presentado-bajo-la-presidencia-espanola-del-consejo-de-la-union-europea-el-quantum-pact

(2.6%). Other indicators show a positive trend in the digitalisation of Spanish enterprises as 40% of them use e-Invoices (slightly above the EU average of 39%) and 29.6% of SMEs are selling online (standing 10 percentage points above the EU average).

Spain's roadmap is in line with the 2030 target for the EU, aiming to digitalise 90% of SMEs. However, the current slow growth rate cannot ensure that the target would be reached for 2030, indicating the need for accelerated efforts. The 2023 State of the Digital Decade report recommended Spain to continue the digitalisation of businesses, particularly SMEs. The country's roadmap therefore includes seven measures targeted at these digital late adopters, accounting for EUR 3 922 million of public investment.

SMEs are particularly prominent in Spain's economy, where there are almost 2.9 million of them, accounting for around 65% of GDP and employing 11 million people in 2023[75]. The prominence and share of SMEs in the country's economy mean that reforms and investments to improve the scalability and digitalisation of SMEs not only have a direct effect on SMEs' basic and advanced digitalisation, but also have an indirect multiplier impact on other dimensions and targets and on the Spain's economy overall. To ensure the transformation of SMEs, Spain launched programmes in three dimensions: digitisation services to bring in new digital operations for SMEs, provide personalised advisory services and training for entrepreneurs and employees, and support for cooperation and innovation networks. In 2023 and 2024, Spain continued implementing different programmes, such as the 'Digital Kit' and 'Acelera Pyme' (which already has 160 offices around the country that provides assessment services to SMEs). Addressing the digital transformation of SMEs is also expected to foster the adoption of advanced technologies among SMEs. Following the recently approved Artificial Intelligence Strategy 2024[76], the 'Digital Kit' programme has been expanded with 350 million and the incorporation of new AI products. Additionally, for the development of AI in the private sector, a new 'Kit Consulting'[77] programme will be launched with 300 million euros so that smaller business projects can hire advisory services for the adoption of AI.

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

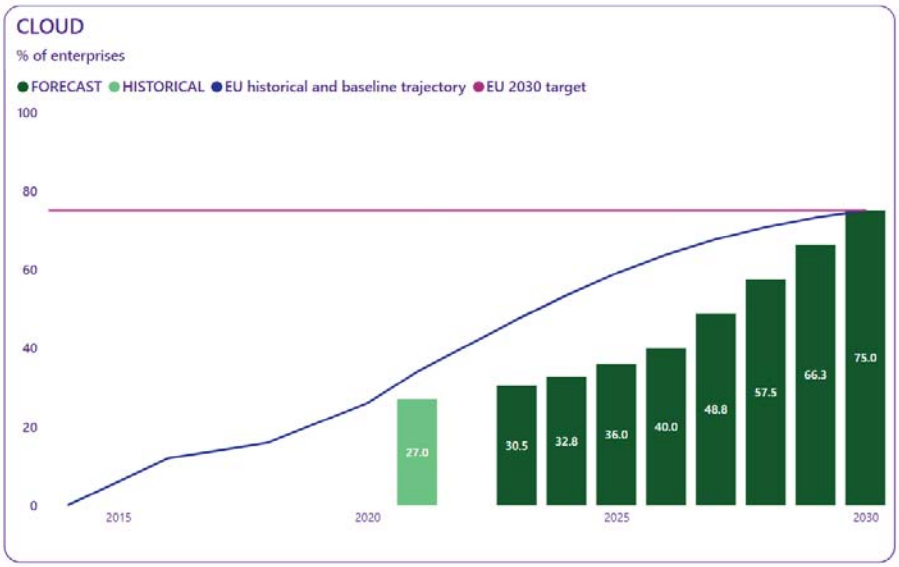
Spain faces challenges in the integration of advanced digital technologies by enterprises, which mainly affect SMEs. Consequently, many of the measures specifically support SMEs by encouraging them to adopt these technologies in value chains through various means (subsidy programmes, specialised consultancy, detection of needs, etc.). These measures mainly focus on promoting research and design innovation or identify use cases and tailored solutions for vital sectors of the Spanish economy, including creating sectoral data spaces to foster innovation by providing access to more data in a secure and trusted environment. The Spanish roadmap includes six measures to reach this target by 2030.

[75] https://industria.gob.es/es-es/estadisticas/Cifras_PYME/CifrasPYME-marzo2024.pdf

[76] https://www.lamoncloa.gob.es/serviciosdeprensa/notasprensa/transformacion-digital-y-funcion-publica/Paginas/2024/ia-inteligencia-artificial-estrategia-espana.aspx

[77] https://planderecuperacion.gob.es/noticias/conoce-programa-kit-consulting-servicios-asesoramiento-digital-prtr

- **Cloud**



2023 state of play and recent progress

	Country level	EU level
FORECAST	30.5	47.3
DESI 2024	27.2	38.9
AVERAGE ANNUAL GROWTH %	0.4	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

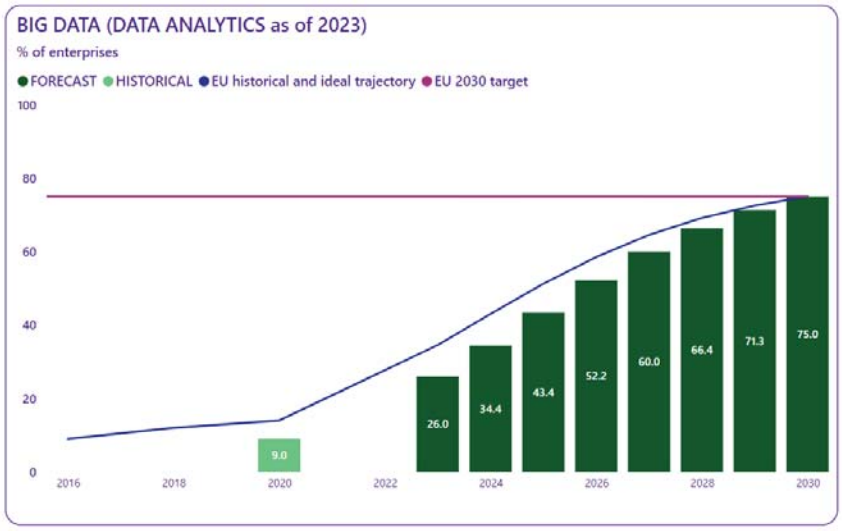
On the uptake of cloud services, Spain has room for improvement in its performance to contribute to EU's digital decade target of 75% of EU enterprises using cloud services by 2030; it shows a very limited dynamic in this regard. 27.2 % of Spanish enterprises use cloud services, which is well below the EU average of 38.9%. In addition, Spain's growth rate (0.4%) is below the EU rate (7%).

The Spanish roadmap sets a very ambitious a target of 75% uptake by 2030, which is in line with the EU target. Taking into account the starting point and the current uptake rate, reaching the target will be challenging and extra efforts will be needed.

A positive element is that Spain, as a direct participant of the **IPCEI on Next Generation Cloud Infrastructure and Services (IPCEI-CIS),** is at the forefront of developing and deploying cutting-edge cloud and edge capacities.

To ensure broad uptake of the future solutions by companies of all sizes, especially SMEs, it is important for Spain to develop an outreach strategy, including activities such as those led by the Cloud IPCEI Exploitation Office.

- **Data analytics (Big Data)[78]**



2023 state of play and recent progress

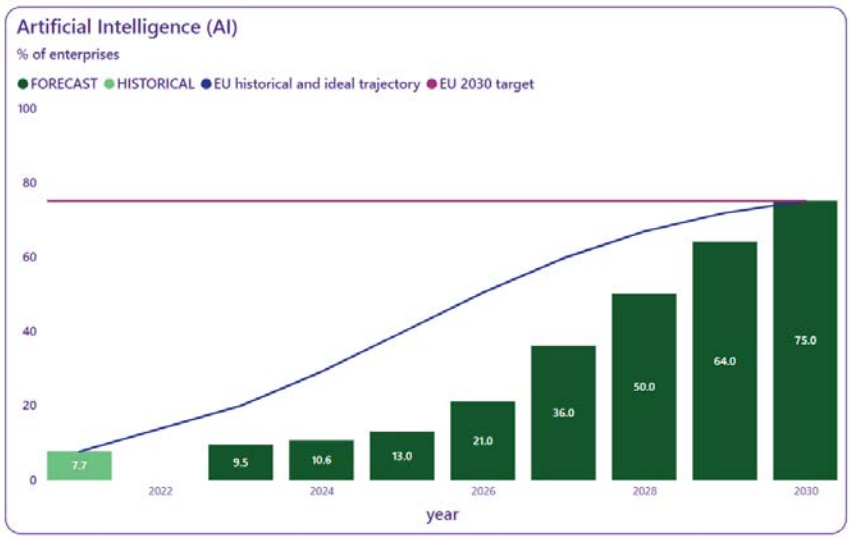
	Country level	EU level
FORECAST	26.0	34.6
DESI 2024	38.0	33.2
AVERAGE ANNUAL GROWTH %		

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

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

Spain brings a positive contribution to the EU's digital decade target, with 38% of its enterprises using Data analytics, which is above the EU average (33.2%). The Spanish roadmap sets an ambitious target of 75% uptake by 2030; this in line with the EU target.

- **Artificial Intelligence**



2023 state of play and recent progress

	Country level	EU level
FORECAST	9.5	19.9
DESI 2024	9.2	8.0
AVERAGE ANNUAL GROWTH %	9.3	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

On the uptake of Artificial Intelligence solutions, Spain brings a positive contribution to the EU's Digital Decade target, and shows a very strong dynamic. 9.2% of Spanish enterprises had adopted AI solutions in 2023, which is above the EU average of 8.0%. In addition, Spain's average annual growth (9.3%) is almost four times the EU average (2.6%), which is an indication of the good momentum in the sector. In addition, the Spanish roadmap sets a very ambitious target of 75% uptake by 2030, which is in line with the EU target.

[78] 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.

It includes four measures linked to AI uptake, such as the integration of AI in value chains, AI R & D missions and the Spanish Network of Excellence in AI.

Spain fully supports to the adoption of trustworthy sovereign AI-enabled solutions, facilitating the transition of AI solutions from research labs to testing environments to deployment, uptake, and commercial markets.

Spain is also joining forces with other Member States to jointly develop cutting-edge Europe-based AI models. In March 2023 it joined the **European Digital Infrastructure Consortium on the Alliance for Language Technologies (ALT-EDIC)**, to develop both a common infrastructure for natural language processing and to develop large multi-language models.

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

Combining the adoption of these three technologies together (AI, Cloud, and Data analytics), Spain's take-up stands at 49.9%. The country has untapped potential to contribute to the EU's digital decade target, as it is below the EU average of 54.6%.

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

Spain intends to make the best of its digital transformation and economic dynamism to make a significant contribution to the Digital Decade target that seeks to transform businesses and to grow innovative scale-ups and improve their access to funding. This will result in the number of unicorn companies in the EU at least doubling by 2030. Starting from 11 unicorns in 2023, the Spanish roadmap sets a target of 24 unicorn companies in Spain by 2030 and contains measures to contribute to achieve it, planning a total public investment of EUR 4 837 million and an estimated private investment of EUR 4 058 million.

Although Spain has a lower rate of entrepreneurial activity and business spending on R & D than the European Union, in recent years, the country has developed an emerging start-up ecosystem around two poles of attraction, such as Barcelona and Madrid. The Start-Up Law, approved in 2022, has started to improve the digital entrepreneurship ecosystem. Specific programmes are being deployed to support digital entrepreneurship through financing (e.g., Next-Tech), support for growth (e.g., Activa Start-ups), talent attraction and support for women's entrepreneurship (e.g., Emprendedoras Digitales, The Break). Other programmes are in place to support internationalisation (e.g., Desafia) and innovation (INNOVA, Neotec).

Concerning the development of the Start-up ecosystem, the South Summit 2023 Entrepreneurship Map highlighted that the Spanish entrepreneurial ecosystem has laid the path to maturity, due in part to the growing number of start-ups accumulating more years of market traction.

Although Artificial Intelligence was probably the predominant technology among start-ups and scale-ups in 2023, with the launch of the Miura 1 rocket by the Spanish start-up PLD Spain, Spain became the 10th country in the world with direct access to space. This could open the door to the development of a Spanish ecosystem of start-ups and scale-ups committed to the aerospace industry. In addition, through the PERTE Chip, Spain aims to make an international benchmark in the sector and to boost the sector in the coming years.

2.3 Strengthening cybersecurity & resilience

Cybersecurity is one of the strategic axes of Spain's digital agenda. With their growing reliance on digital technologies, companies face an increased risk of cybersecurity incidents and a greater need for protection. In 2022, 21.9% of enterprises in Spain reported ICT service outages due to cyberattacks. This was slightly below the EU average (25%). Most Spanish enterprises (87.7%) reported using ICT security measures slightly below the EU average of 91.8%. But only 21.9% reported being insured against ICT security incidents (EU average of 25.0%). Public administrations are also affected by cyberattacks and are among the entities most targeted by cybercriminals. According to the 2024 Eurobarometer, 81% of Spanish

people think that building efficient and secure digital infrastructures should be a priority for the public authorities.

To strengthen cybersecurity capabilities, multiple initiatives and measures are being developed across several lines of action: cybersecurity incident response services, training and capacity-building programmes, development of diagnostic tools for cyber risk prevention, and enhancement of the country's resilience to cyberattacks.

In Spain, most of the measures are coordinated by or involve the **National Institute for Cybersecurity (INCIBE)**, which implemented several programmes in 2023. For example, **the helpline 'Tu Ayuda en Ciberseguridad'**, which helps internet users, businesses, professionals and children and their teachers to deal with day-to-day cybersecurity issues, has handled over 184 199 queries, at an average of more than 1 295 queries per week, over the 3 years it has been in operation. It is a free and confidential national service provided by a team of experts from various disciplines offering technical, psychosocial and legal advice through a range of contact options including calling 017, instant messaging (WhatsApp and Telegram), email, a web form, and, since 2023, face-to-face consultations at the INCIBE premises. There are also other ongoing initiatives, such as the 'Secure Your Business and the 'Confía' programmes to empower companies and the public, the 'Cyber-resilience Improvement Indicators' initiative to prevent cyberattacks, the 'programme to foster ISMS (Information Security Management Systems) Certifications' with grants for SMEs, the 'Cibercooperantes' programme to increase awareness and the '**INCIBE Emprende'** programme adapted to start-ups and entrepreneurs with cybersecurity-related projects and ideas.

The Computer Security Incident Response Team, as provided for in the NIS and the NIS2 Directives**,** is another service provided by INCIBE. It offers round-the-clock response to cybersecurity incidents that may affect the operations of the public and of private law organisations, including those involved in critical and strategic infrastructure, essential services and the provision of digital services.

In addition, **INCIBE serves as a common vulnerabilities and exposures (CVE) numbering authority (CNA)**. In this role, INCIBE assesses cybersecurity vulnerability reports and designates vulneralibity identifiers for the purposes of the internationally used CVE system. INCIBE serves as a root CNA that is responsible for the recruitment and onboarding of new numbering authorities in Spain. These activities help to make the cybersecurity ecosystem more resilient to vulnerabilities.

Finally, regarding the security of 5G networks, Spain is implementing **the 5G cybersecurity toolbox** by assessing the risk profile of equipment providers. Further steps are expected to be taken to ensure that the digital infrastructure and communication network is resilient and secure.

Best practice: Digital Kit programme

This programme covers the adoption of digitalisation solutions funded by direct aid to SMEs, small businesses, micro-businesses, and self-employed people. The solutions are provided on the basis of the grant decision issuing a 'digital voucher'. Beneficiaries must select from various digital solution categories provided by expert businesses, also known as digitalising agents, in order to provide services from the catalogue (e-commerce, digitalisation of SMEs' internal processes, their relations with the public administration, and e-invoicing).

So far, this programme has received more applications than any other aid programme for businesses in recent history in Spain. To date, 320 159 grants have been awarded for a value of EUR 1 429 million (80% of the current budget of the calls), and the application period has been extended until December 2024.

3 Protecting and empowering EU people and society

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

Spain is taking positive steps towards empowering people and promoting continuous opportunities for all individuals in the digital economy. To bridge gaps, digital technologies must be accessible to all, and that is what Spain is achieving through all the activities related to its National Digital Skills Plan. Spain is ambitious on digital skills, as testified by its current performance. However, the country still has an issue with ICT specialists, which is likely to last until the measures implemented start to take effect. Developments in **Digital Public Services in Spain shows are positive.**

According to the 2024 Eurobarometer, 84% of Spanish people think that accessing public services online will be important for their daily life in 2030. Concerning human support to help access and use digital technologies and services, 83% consider it would improve their daily use of digital technologies, and **92% think public authorities should consider it important to ensure that people receive proper human support** to help them adapt to the changes in their lives brought about by digital technologies and services.

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	66.0	59.8
DESI 2024	66.2	55.6
AVERAGE ANNUAL GROWTH %	1.6	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

Spain brings a very strong contribution to the EU's Digital Decade target on basic digital skills and shows a positive dynamic. In 2023, 66.2% of the Spanish population had at least basic digital skills. That is above the EU average of 55.6%, although Spain is not one of EU's front-runners. Average annual growth is 1.6% while the EU average is 1.5%. Other digital skills indicators such as internet use (94.5%), above-basic digital skills (38.7%), and basic digital skills in content creation (73.8%) point to a similar performance in those areas.

Although it is still behind the EU's front-runners, Spain's current rate of progress, indicates that it is in a **good position to achieve its national target of 85%**, which is above the EU target, by 2030. The roadmap contains eight measures for achieving basic digital skills, accounting for a total public investment of EUR 1 953 million.

While the level of digital skills in all sociodemographic groups in Spain exceeds the European Union average, the digital divide means that there are still significant differences between groups. The differences relate

more to age, occupation, and level of education, than to place of residence and gender (the 66% of the population with basic digital skills was made up half-and-half of men and women).

Since the launch of its national digital skills plan in 2021, Spain has been implementing several measures to improve the basic digital skills of the population. In February 2023, RTVE (the Spanish radio television public broadcaster) introduced the '**Generation D Campaign'** with programmes to explain the digital transformation of various aspects of life to viewers and to help them adapt to the changes. It also launched a channel on its website that has so far received more than 100 000 visits. In addition, the **Pact for Generation D**, a Spanish government initiative bringing together the public and private sectors to train people in digital skills, raise awareness in society and provide a common space to promote digital skills initiatives, has already gathered more than 200 members and more than 900 learning initiatives.

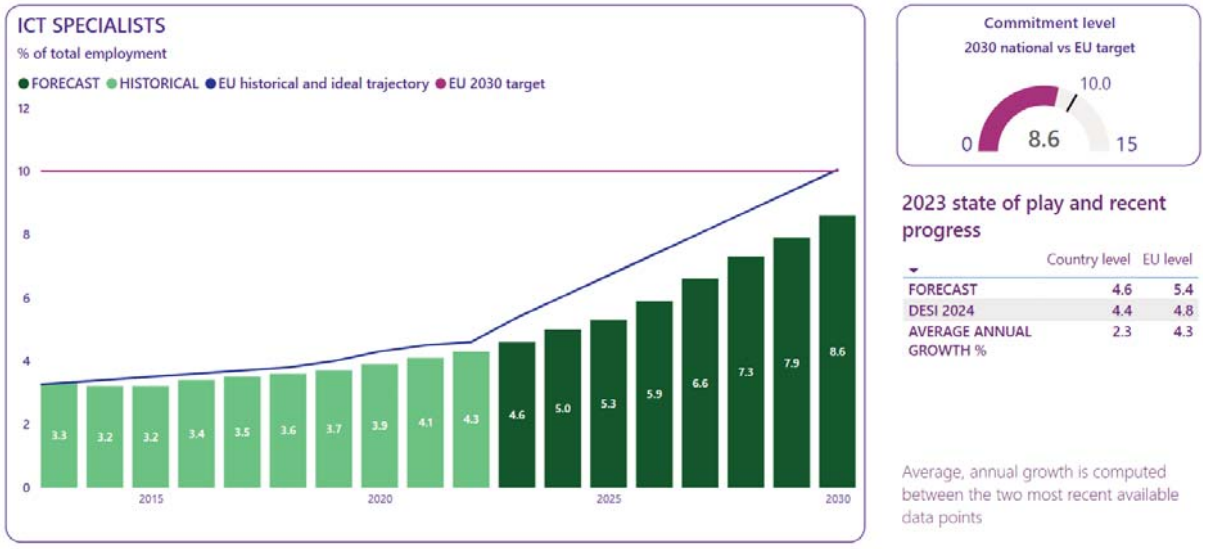
In February 2023, the launch of the '**Digital Rural Challenge Plan**' was announced with an investment of EUR 90 million aimed at training over 380 000 people in rural areas in digital skills by 2025.

In order to improve the basic digital skills of children, the **Digital Skills for Children Program (CODI)** launched a tender for the design and development of a platform and methodology for teaching, both virtually and face to face, with tailored content for each age group. In December, a direct grant of EUR 97 million was allocated to 12 third-sector entities to train 418 761 girls and boys in digital skills. Other programmes, such as 'School Code 4.0', 'Educa en Digital' and 'Escuelas Conectadas', are also showing positive results.

Moreover, from June to September 2023, Spain participated in the '**European digital skills certificate' pilot**, a digital skills enhancement project carried out in collaboration with a community of 71 public and private entities and members of the Generation D Pact.

In addition, there are other measures, such as the acquisition of digital content for the provision of advanced digital skills for the active population and the 'State Network of Digital Training Centres' programme. The latter distributes funds to the autonomous communities and helps the local entities to create of a nationwide network of digital training centres and to implement specific classroom and training initiatives associated with public digital training.

3.1.1.b ICT specialists



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

Spain has untapped potential to contribute to the EU's digital decade target for ICT specialists, while showing positive dynamic. 4.4% of all Spanish employees are ICT specialists; this is slightly below the EU average (4.8%) and shows a limited dynamic (2.3% annual progress).

The target figure for ICT specialists in the Spanish roadmap is lower than the EU target. The national target is 1.75 million, which would represent 8.6% of total employment in 2022, while the European target is 20 million ICT specialists, which, if achieved, would represent 9.8% of total employment in the EU. However, the roadmap includes six measures targeting this objective, accounting for a total public investment of EUR 259 million. This appears to be in line with the recommendation Spain received in the 2023 State of the Digital Decade report, encouraging it to accelerate its efforts in digital skills, notably in the upskilling and reskilling of the labour force, in particular in advanced and emerging technologies, to address the lack of ICT specialists. **Spain could set its sights higher as the country has untapped potential to contribute to the ICT specialist target.**

The measures implemented by Spain focus mainly on increasing the number of ICT graduates, given the high number of unfilled vacancies in the sector. These measures are therefore expected to start showing results from 2026 onwards, when the number of ICT graduates will increase, and the growing demand for ICT specialists should be met. The measures will also positively impact the advanced digitisation of companies, especially SMEs, which often face major challenges in recruiting ICT specialists, hindering their digitisation. In particular, a higher level of ICT specialists in the labour market could have a very positive effect on the digitalisation of the Spanish enterprises, as the percentage of Spanish enterprises that recruited or tried to recruit ICT specialists in 2022 (62.3%), was well above the EU average (32.8%).

The **Plan FP Digital** has resulted in a thoroughgoing reform of vocational training, widening the range of qualifications available to ICT specialists to increase the number of professionals who choose this career. The new training courses are being designed in cooperation with technology companies in the sector through the technology hub set up by the Ministry of Education and Vocational Training. This will ensure that the training is closely related to the real-life demands of the profession. Efforts are also being made through public-private collaboration to increase the number of ICT specialists by improving the training opportunities available to workers and SMEs via the 'Digitalízate Plus' platform. Additionally, various initiatives are in place to develop and attract talent in specific areas, such as the audiovisual sector (through the 'Haz Project'), AI (through the Chair on AI) or cybersecurity (through Talento Hacker). Promoting science, technology, engineering and mathematics (STEM) vocations among women and developing female talent is a common feature of all these measures, which aim to achieve **gender balance among ICT specialists**. In 2022, 5.2% of all Spanish graduates were ICT graduates (4.8% were male and 0.7% were female, while the EU average for female ICT graduates is 1%); this is above the EU average (4.5%) and represents an increase by 0.4 percentage points compared to last year.

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

3.1.2.a e-ID

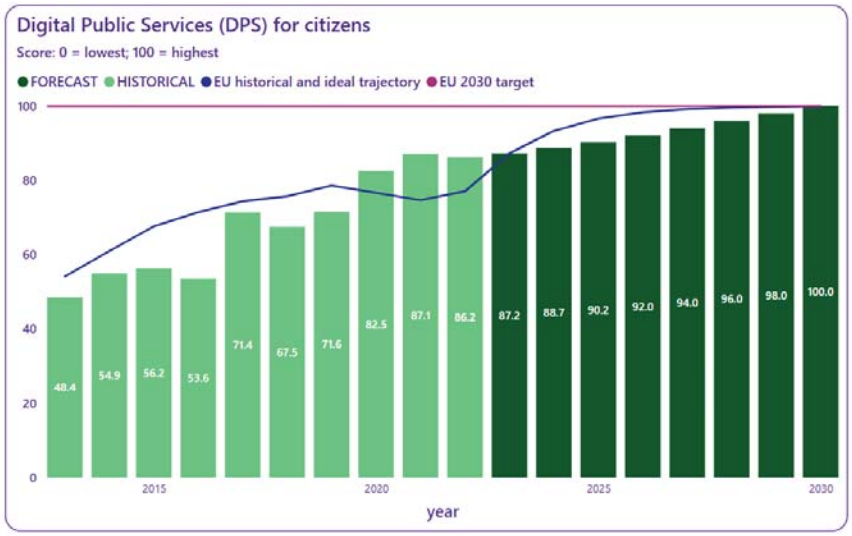
Spain has one national e-ID scheme, the Spanish ID card (DNIe), which has been notified under the Regulation (EU) No 910/2014 on electronic identification ('the eIDAS Regulation') with assurance level 'high'. 54.4% of Spanish people used e-ID for private purposes during the last 12 months, while 50.3% used it for accessing public services. Both figures exceed the EU average (41.1% and 35.7%, respectively), reflecting the efforts made by the Spanish authorities to implement electronic means of identification.

Spain participates in three European consortia piloting the cross-border use of the EU Digital Identity Wallet: Multi-Country Digital Credential for Europe (DC4EU), EU Digital Wallet Consortium (EWC) and PilOTs for EuropeaN digiTal Identity wALlet (POTENTIAL). Spanish stakeholders, both public and private,

are represented in the consortia now that the grant agreement is about to be prepared. In addition, Spain is coordinating the DC4EU consortium, which aims to apply the EU's eIDAS trust framework to the education and social security fields. DC4EU will investigate the issuing of educational credentials and professional qualifications in the education sector and the issuing of the Portable Document A1 and the European Health Insurance Card in the social security sector. In addition, it will support large-scale cross-border piloting of the European Digital Identity Wallet in compliance with the EU Toolbox process. DC4EU will develop four use cases to test interoperability and scalability in the national domain and multiple cross-border contexts to provide feedback to the European Commission and Member States for iterative updates. DC4EU involves 80 institutions from 22 countries backed by 43 public organisations and 49 private entities, including wallet issuing organisations, credential issuers and involving various qualified trust service providers and authentic sources. This will allow comprehensive testing of the wallet using qualified electronic attestations of attributes (QEEAs) and credentials.

The Spanish roadmap includes one measure for achieving the Digital Decade objective of 100% of people in the EU having access to secure electronic identification (e-ID) means recognised throughout the EU, enabling them to have full control over identity transactions and shared personal data. It refers to the establishment of a **National Digital ID-Wallet by Spain**, which aims to foster an inclusive digital landscape, granting everyone a secure handle on their digital identities and interactions with public services. The project is part of the Spain's 2026 digital strategy and the 2021-2025 Digitalisation Plan for Public Administration and involves a mobile application enabling Spanish citizens to verify their identity and other associated attributes. The goal is to provide a harmonised electronic identification method allowing authentication and identity related data to be shared with both public and private entities, emphasising that people have control over their data. It aims to improve overall usability, accessibility and security of public services while fostering a people-centric approach to managing personal information. It is also designed to allow for the future updates of the eIDAS Regulation (EU) and the introduction of the European Digital Identity Wallet (EUDI Wallet).

3.1.2.b Digitalisation of public services for citizens and businesses



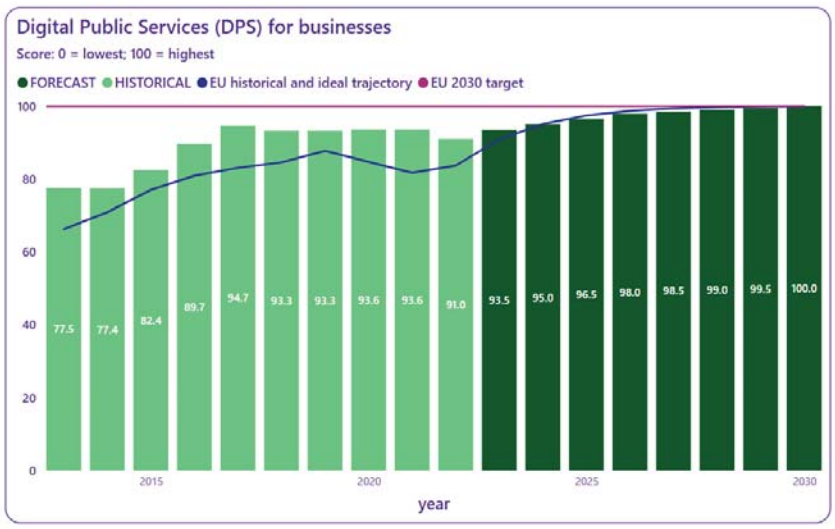
2023 state of play and recent progress

	Country level	EU level
FORECAST	87.2	87.2
DESI 2024	84.2	79.4
AVERAGE ANNUAL GROWTH %	-2.3	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



2023 state of play and recent progress

	Country level	EU level
FORECAST	93.5	90.9
DESI 2024	91.0	85.4
AVERAGE ANNUAL GROWTH %	0.0	2.0

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

Note 1: Data break-in-series in 2020

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

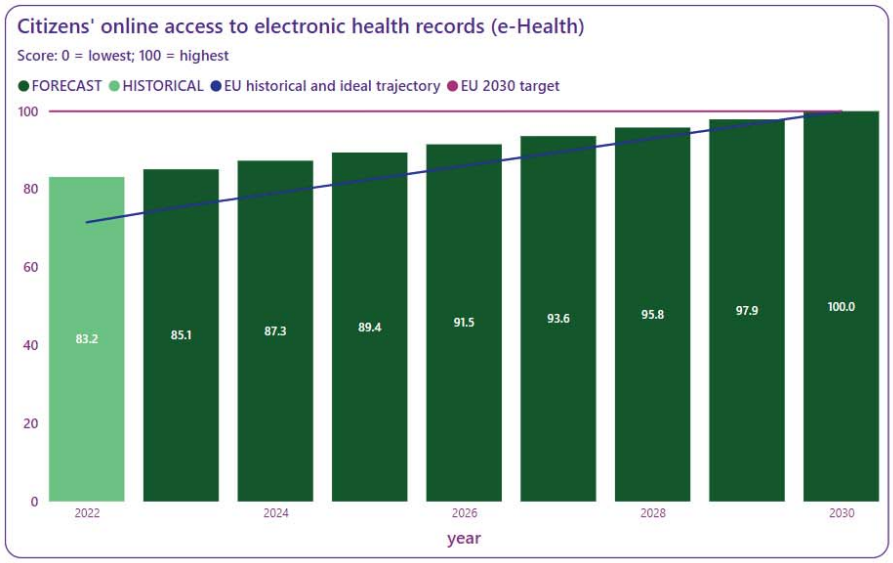
Spain brings a positive contribution to the EU's digital decade targets on public services for both citizens (84) and businesses (91), ranking well above the EU average (79 and 85).

The Spanish roadmap sets a score of 100 for both indicators, which matches the EU expectations. However, Spain would need to see a return to a positive dynamic to reach its targets by 2030.

In other indicators such as e-Government users (83.03%), user support (87) and transparency of service delivery, design and personal data (71.4), Spain is generally above the EU average (75%, 86.4 and 70, respectively). In mobile friendliness, Spain (94.8) is slightly below the EU average (95.3).

The roadmap contains six measures, with a total allocated budget of EUR 244 million, to enhance public services online. These measures are: (i) the 'My Citizen Folder' app to simplify the relationship between the administration and the public by making it accessible, proactive and personalised from any device; (ii) the 'GovTechLab' to utilise technology, notably AI, to enhance the inclusivity and efficiency of public services, simplifying public communication and fostering innovative solutions through a dedicated lab; (iii) the 'App Factory' for the development of quality mobile apps for the main public services on offer, creating a community of open-source developers around the administration that helps to make a Marketplace of Administration mobile application publicly available; (iv) the 'Intelligent Automation Service' (RPA) that uses intelligent automation technologies to improve the quality management and processing services and processes of the public administration; (v) 'SOC' to expand and strengthen prevention and reaction capabilities for security incidents and increase the capacity for surveillance and detection of cyberthreats in a centralised manner; and (vi) the 'New digital services and platforms to improve the active and passive labour market service' which aims to develop innovative and digital services that result in more efficient and effective management of employment services.

3.1.2.c e-Health



2023 state of play and recent progress

	Country level	EU level
FORECAST	85.1	75.5
DESI 2024	84.6	79.1
AVERAGE ANNUAL GROWTH %	1.7	10.6

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

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

Spain brings a positive contribution to the EU's digital decade target on the access to e-Health records. The country's overall eHealth maturity scores is 84.6, well above the EU average (79.1). This compares to a maturity score of 83 in 2022.

National territories (i.e., regions) have their own regional access services in Spain. It is estimated that 80 to 100% of the national population is technically able to access the online access services for eHealth records through both native mobile applications and online portals, logging in using an eID compliant with eIDAS Regulation.

Health data is available across all the 18 health regions of Spain. The country scores 81 on categories of health data, compared to a European average of 74. Data about medical devices/implants, procedures/operations, and medical images are unavailable in more than half the regions. However, the rest of the data investigated in this framework is available in a timely manner. The country's lowest-scoring sub-indicator in this thematic layer is electronic results and reports, with a maturity score of 64.

The main gap in Spain's eHealth maturity is that private healthcare providers do not supply data to the online access service for electronic health records.

Spain is aiming for a score of 100 in e-Health by 2030, in line with the EU target. The roadmap contains two measures, accounting for EUR 29 million of public investment, consisting in improving governance, quality and standardisation of health data and incorporating clinical data into EU interoperability models.

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

Spain is promoting a human-centric and inclusive digital transformation process, in line with the principles, values and rights set out in the Charter of Digital Rights, which was adopted in 2021.

Spain focuses on solidarity and inclusion in the digital environment and puts people at the centre with measures such as the promotion of the Charter of Digital Rights and the creation of a Digital Rights Observatory in 2023, and with the New Economy of Language PERTE project. Spain also has the National Plan for Language Technologies, which aims to further explore of new strategic markets for language

teaching and the promotion of the learning industry. In May, a grant of EUR 2.5 million was approved for the International Spanish Centre of the University of Salamanca - CIEUSAL)[79].

To **ensure privacy and safety online**, the Spanish Data Protection Authority published multiple guidelines in 2023. To **protect consumers online**, the Ministry of Social Rights, Consumer Affairs and 2030 Agenda funded the research 'Untangling the loot boxes: opening and purchasing as risk factors for video game and online gambling problems' that will study the relationship between the purchase and opening of this type of random rewards and its link with pathologies associated with online gambling. In addition, in March 2023 the Council of Ministers approved a royal decree that reinforces the protection of the most vulnerable players online and forces operators to create safer gaming environments.

The Code on the Use of Influencers in Advertising is an ethical code that regulates advertising carried out by influencers on social networks and other digital platforms and offers an extrajudicial dispute resolution service. It is promoted by Autocontrol, an independent advertising self-regulatory organisation, and the Spanish Association of Advertisers (AEA). It acquired new members including advertisers, agencies, and representatives of influencers.

Concerning the **protection of users from illegal content and hate speech**, in 2023 the Global Privacy Assembly awarded a 'Dispute resolution and enforcement' prize to the priority channel of the Spanish Data Protection Agency (AEPD). The channel allows complaints to be submitted quickly and free of charge to the AEPD in order to request the removal of online, e.g., sexual or violent, content published without consent and posing grave risks to the rights, freedoms and physical and mental health of the people affected. In July 2023, the Spanish government approved the (2023-2027) Spanish strategic framework for citizenship and inclusion and against racism and xenophobia[80], which includes a specific line of action with measures targeting the prevention, monitoring, notification and reporting of racist and xenophobic incidents and other related forms of intolerance through media, internet and social networks.

According to the 2024 Eurobarometer**, Spanish people identified** the insufficient protection of children online as one of the online issues with the biggest impact on their personal lives. In addition, **61% of Spanish people consider that the principle of ensuring safe digital environments and content for children and young people is not being well implemented: an increase of 21 percentage points compared to last year's result**. **This reflects an increase in public awareness**, as the Spanish authorities have taken numerous measures to protect children online. In January 2023, a final provision of Organic Law 1/2023 amended the Spanish Penal Code to strengthen the penalties applicable to the creation of a false profile on social networks with a view to impersonating someone when the victim is a child or a person with disabilities.

Several campaigns were launched during 2023 including: (i) the family digital plan, with information and recommendations regarding the healthy use of digital services and electronic devices; (ii) the awareness campaign 'Change the plan', to promote the digital health of children and to reduce the physical, mental, sexual and social risks posed by the intensive and uncontrolled use of screens by children and adolescents; and (iii) the 'Generation XXX' campaign to raise awareness of the risks and dangers of access to pornography by children, which has become widespread.

[79] https://planderecuperacion.gob.es/noticias/consejo-ministros-acuerda-transferencia-dos-millones-y-medio-centro-internacional-espanol-universidad-salamanca-CIEUSAL-prtr

[80] https://www.inclusion.gob.es/oberaxe/ficheros/documentos/SummaryStrategic-Frameworkfor-Citizenship-and-Inclusionagainst-Racism-and-Xenophobia2023-2027.pdf

In November 2023, Spain, alongside Australia, Belgium, Denmark, Estonia, France, Germany, the Netherlands and the United Kingdom, signed the call for global initiatives to reinforce the protection of children online and joined the Children Online Protection Lab. In December 2023, the Spanish Data Protection Authority published the '**10 principles of age verification and protection of children from inappropriate content**' and presented three systems developed as a proof of concept to demonstrate the feasibility of the practical application of the principles.

The Spanish National Markets and Competition Commission (CNMC), which is the national regulatory authority for telecommunications, is also responsible for ensuring that video-sharing platforms implement systems to protect children from access to harmful content. In particular, Article 93(3) of the Audiovisual Law empowers the CNMC to assess the suitability of the systems that verify the age of users requesting access to a platform. In December 2023, the CNMC launched a 'public consultation on age verification systems', which aims to set out the essential requirements that age verification systems must meet in order to fulfil the objective of protecting children.

Furthermore, Spain is committed to safeguarding people from the **risks associated with advanced technologies**, providing adequate regulatory frameworks and promoting the ethical and humane use of such technologies. The 2024 Eurobarometer shows that 79% of Spanish people think that public authorities should prioritise shaping the development of Artificial Intelligence and other digital technologies to ensure that they respect our rights and values. Spain has recently created the first European AI Supervision Agency (AESIA) and is developing, together with the European Commission, the AI regulatory sandbox. This initiative aims to bring competent authorities closer to AI developers in order to jointly define best practices that will serve as the foundation for implementing the future AI Act. This Spanish-led pilot is expected to generate good practice guidelines and guides that promote and raise awareness among companies, especially SMEs and start-ups, facilitating the implementation of ethical AI practices.

Best practice: promotion of the Charter of Digital Rights and the creation of a Digital Rights Observatory

In May 2023 a general invitation was published for entities to help promote the implementation of the Charter of Digital Rights and the creation of a space for the Digital Rights Observatory. This invitation aims to select up to six entities to sign cooperation agreements in order to promote implementation of the charter and a further entity to create the Digital Rights Observatory. This observatory aims to develop an open, inclusive and collaborative space from which to promote knowledge, debate and awareness raising of digital rights among the public and both the public and private sectors, at national and international level.

4 Leveraging digital transformation for a smart greening

Spanish enterprises pay fairly close attention to matters related to the impact of ICT equipment, while Spanish people consider digital technology important to support the green transition. 53.9% of enterprises in Spain consider the environmental impact of ICT services or ICT equipment before selecting them and taking steps to reduce the amount of paper or energy consumed by the equipment. This is slightly below the EU average of 48.7%. Spanish people's propensity to recycle old digital devices is in line with the rest of the EU. About 12.4% of the population recycles mobile phones, 8.2% laptops and tablets and 6.7 % desktop computers (10.4%, 9.7% and 12.8%, respectively, at EU level). The level of desktop recycling is particularly low. In addition, Spanish people think that digital technology is relevant to tackling climate change and supporting the green transition. According to the '2024 Digital Decade' Eurobarometer survey, **72% of respondents in Spain consider digital technologies important to help fight climate change** (slightly below the EU average of 74%), while 85% of Spanish respondents think that ensuring that digital technologies serve the green transition should be an important action for public authorities (above the EU average of 81%).

Spain is harnessing digital technologies to enhance the green transition in key areas while implementing innovative programmes to reduce the environmental impact of energy-intensive digital technologies. A wide range of measures are being implemented in several sectors, such as agri-food, mobility, energy, circular economy, and water use and management. In primary industry, the green transition is being promoted within the (2021-2023) second action plan framework of the digitalisation strategy for the **agri-food and forestry sector** and rural areas[81]. Several measures, backed by a substantial budget of EUR 64 million, aim to foster an economically, socially and environmentally sustainable agri-food sector and to strengthen the active population in rural areas. The initiatives include support for 4.0 technology and precision agriculture, the promotion of data usage to increase efficiency and monitor environmental impact, support for sustainable technological entrepreneurship in the sector, and the establishment of an observatory to digitise the agri-food sector. The third action plan implementing measures up to 2026 will be unveiled during 2024, ensuring that these lines of action are extended.

In mobility, Spain has promoted several initiatives, including the **PERTE electric car project**, to create the necessary ecosystem for the development and manufacture of electric and grid-connected vehicles, with the ultimate aim of positioning Spain as a European e-mobility hub. In total more than EUR 24 000 million is expected to be invested in developing the project, EUR 19 700 million of which will be private funding. In addition, the digital transformation of the **transport system** is being undertaken to increase economic and environmental efficiency. To support the energy transition, Spain is focusing on the digitisation of electricity grids. Between 2021 and 2023 up to 525 million euro was invested to promote decarbonisation of the economy. This has provided incentives for electrification by allowing more renewable energies to be integrated into the system and improving management of energy flows, without penalising electricity price signals.

In environmental management and the circular economy, EUR 100 million has been awarded to develop digitalisation tools that efficiently manage the information needed in transition territories. The tools seek to secure an accessible material supply chain, reduce waste generation and facilitate the processing of data files. In water use and management, the PERTE project for digitalisation of the water cycle has been launched, with an investment of more than EUR 3 485 million. The project promotes the use of new information technologies throughout the water cycle, which will improve its management, increase

[81] https://www.mapa.gob.es/es/ministerio/planes-estrategias/estrategia-digitalizacion-sector-agroalimentario/.

efficiency, reduce losses in the supply networks and help to meet the environmental objectives of the hydrological planning and international regulations.

In the **telecoms sector**, during 2023 Telefónica has developed its strategy to replace all copper lines with fibre cables. On 19 April 2024, to mark the celebration of its centenary, Telefónica switched off its copper network and stations.

To develop environmentally friendly technology guided by sustainability criteria, **the National Green Algorithms Plan (PNAV)**[82] has been launched, with an investment of EUR 257 million from the European Next Generation EU funds. The programme focuses on three key aspects: (i) the defining of energy consumption measurement standards in the development and training of artificial intelligence algorithms; (ii) the creation of a quality seal for companies involved in sustainable AI or applying AI to address environmental issues; and (iii) the development of technological challenges (hackathons) where AI developers compete to solve problems with a pronounced environmental focus. In November, a contract was awarded to provide consulting, software development and support services for the programme.

Overall, Spain is committed to ensuring that all the measures included in the Digital Spain agenda adhere to the principle of not causing significant harm to the environment. This, combined with the associated climate/environmental labelling, will help to ensure that digitisation continues to be sustainable.

[82] https://espanadigital.gob.es/lineas-de-actuacion/programa-nacional-de-algoritmos-verdes

Annex I – National roadmap analysis

Spanish National Digital Decade Strategic Roadmap

The Spanish roadmap was formally submitted in late January 2024 following a public consultation launched in October 2023. Its main document is 82 pages long. In addition, there are three annexes relating to the trajectories and measures for achieving the digital targets and objectives, respectively. To date, the Spanish authorities have not publicly presented or published the roadmap.

Digital Decade target/objective	Budget (EUR million)	Number of measures
Connectivity Gigabit	1 486.3	5
Connectivity 5G	3 027.4	6
Semiconductors	12 697.0	5
Edge nodes	211.0	3
Quantum computing	22.0	1
SME take-up	3 916.0	7
Cloud/AI/Big data uptake	990.0	6
Cloud-only uptake	-	-
AI-only uptake	-	-
Big data uptake	-	-
Unicorns	8 895.0	11
Basic digital skills	1 952.9	8
ICT Specialists	263.0	6
e-ID	16.7	1
Key Public Services	243.4	6
e-Health	29.0	2
Objectives	-	-
Total	**33 749.7**	**67**

The national strategic roadmap includes national target values for all targets where possible, except for edge nodes. Most of the national target values provided are comparable to the EU targets, except in digital skills. While the country shows a good level of commitment by setting higher basic digital skills targets, the targets for ICT specialists are below the EU target level.

Moreover, the roadmap submitted by Spain describes policies, measures and actions supporting each of the targets and groups of objectives. Most measures in the roadmap help empower the population by developing their digital skills, the digital transformation of businesses and public services, and by developing digital infrastructure and ecosystems. However, hardly any of the measures promote synergies between the digital and green transitions. The time frame for most measures corresponds to that for implementing the structural funds and Recovery and Resilience Facility (RRF) programme, and most of the budget set out in the roadmap comes from those sources of funding. The measures set out in the national strategic roadmap address the main challenges faced by Spain. Those challenges are identified in the roadmap and covered under the DDPP and country-specific recommendations. The measures also go further than previous efforts by both helping to achieve the targets and supporting the wider objectives of the programme. At the same

time, the policies, measures and actions set out in the national strategic roadmap build on the existing Digital Spain strategy launched in 2020 and updated in 2022 by maintaining a high level of ambition, as would be expected from a country whose contribution will be essential to achieving the EU Digital Decade targets and objectives by 2030.

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

MCP and EDICs

Spain is a member and the host of the European Digital Infrastructure Consortium of the Local Digital Twins towards the **CitiVERSE – EDIC** and has recently joined the **Alliance for Language Technologies EDIC (ALT-EDIC)**, which addresses the scarcity of European language data needed for AI solutions (both already set up). Spain is also developing the Statutes and other relevant documents of the possible future **Genome EDIC** and the **EDIC for mobility and logistics data**, within their informal working groups. In addition, the country is engaging in discussions on the setups of the possible future **Cancer Image Europe (EUCAIM)** and the **Agri-Food EDICs**, within their informal Working Groups.

Concerning the Important Projects of Common European Interest (IPCEIs), Spain takes part in the IPCEI on **Next Generation Cloud Infrastructure and Services (IPCEI-CIS)** and the IPCEI on **Microelectronics and Communication Technologies (IPCEI-ME/CT).**

In addition, Spain takes part in the **European High Performance Computing Joint Undertaking (EuroHPC)** with the supercomputer MareNostrum 5 based in Barcelona.

EU funding for digital policies in Spain

The Spanish Recovery and Resilience Plan (RRP) allocates 26% of its budget to measures linked to the digital area. The modified plan, updated in October 2023, has a stronger focus on the digital transition incorporating 18 new measures on digital. It devotes EUR 40.4 billion to measures that support digital objectives (up from EUR 19.7 billion in the original plan), having **EUR 39.4 billion directly linked to the Digital Decade objectives and targets**[83]. The plan allocates EUR 3.6 billion to the digital transformation of the public administration, EUR 3.6 billion to digital skills training, EUR 10.2 billion to promote the digitalisation of industry and SMEs, investments in artificial intelligence, digitalisation of tourism and culture systems, and EUR 15.4 billion to support fixed and 5G connectivity, data infrastructure and the related ecosystem. As of May 2024, implementation of the Spanish RRP is advancing as evidenced by payment requests that successfully led to the disbursement of EUR 38.4 billion. The Commission is currently analysing the request for the fourth instalment. Additionally, under the cohesion policy, EUR 5.7 billion (16% of the country's total cohesion policy funding) is allocated to the country's digital transformation.

[83] 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

Sweden

1 Executive summary

Sweden 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, Sweden made notable progress in 5G coverage, including in the 3.4-3.8 GHz bands, and in promoting unicorns. However, **challenges persist** in the area of e-health and the country needs to continue the work on e-ID.

Sweden seeks to be a global leader in digitalisation and continues to build on the increasing economic importance of its ICT sector. Its main strength is its digitally skilled workforce, combined with well-developed infrastructure in most of the country. Eurostat data show that the ICT sector accounted for 6.5% of the economy in 2019 and 7.1% in 2020. Venture capital investments as a share of GDP grew from 7% in 2020 and 8% in 2021 to 9% in 2022. Sweden continues to perform well and is one of the top digital skills performers in the EU. Sweden has made significant steps in rolling out 5G – increasing from 21% to 90% household coverage compared to the previous year. Fibre deployment continues with public support. Despite the funding available, notably under the Recovery and Resilience plan, it will be difficult to ensure that all households have access to a FTTP network by 2030.

According to the Digital Decade Eurobarometer[84], 88% of Sweden's population (well above the EU average of 73%) consider that the digitalisation of daily public and private services is making their lives easier.

Sweden does not at present participate in any European Digital Infrastructure Consortium (EDIC) but may join in the future. In this context, Sweden has expressed interest in the established Alliance for Language Technologies (ALT EDIC) project[85].

Sweden's Recovery and Resilience plan allocates 21% (EUR 674 million)[86] of its funding to digital, most of it to support the deployment of VHCNs in rural areas. Under cohesion policy, an additional EUR 0.2 billion (13% of the country's total cohesion policy funding) is allocated to the country's digital transformation[87].

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

[85] Information last updated on 31 May 2024.

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

[87] 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]	Sweden			EU		Digital Decade target by 2030	
	DESI 2023	DESI 2024 (year 2023)	Annual progress	DESI 2024 (year 2023)	Annual progress	SE	EU
Fixed Very High Capacity Network (VHCN) coverage	81.6%	88.5%	8.4%	78.8%	7.4%	98.5%	100%
Fibre to the Premises (FTTP) coverage	81.5%	83.9%	2.9%	64.0%	13.5%	98.5%	-
Overall 5G coverage	20.5%	90.3%	341.3%	89.3%	9.8%	100%	100%
Semiconductors		NA					
Edge Nodes		34		1186		x	10000
SMEs with at least a basic level of digital intensity	86.1%	79.9%	-3.7%	57.7%	2.6%	95%	90%
Cloud	69.2%	66.0%	[2]	38.9%	7.0%	94%	75%
Artificial Intelligence	9.9%	10.4%	2.5%	8.0%	2.6%	39%	75%
Data analytics	NA	35.0%	NA	33.2%	NA	56%	75%
AI or Cloud or Data analytics	NA	73.1%	NA	54.6%	NA		75%
Unicorns		36		263		64	500
At least basic digital skills	66.6%	66.4%	-0.1%	55.6%	1.5%	89%	80%
ICT specialists	8.6%	8.7%	1.2%	4.8%	4.3%	12%	~10%
eID scheme notification		Yes					
Digital public services for citizens	88.2	93.3	5.8%	79.4	3.1%	90	100
Digital public services for businesses	87.9	96.0	9.2%	85.4	2.0%	90.5	100
Access to e-Health records	70.3	77.9	10.9%	79.1	10.6%	78.5	100

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

National Digital Decade Strategic Roadmap

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

The roadmap is overall consistent with the efforts needed across all the dimensions of digitalisation. It provides a good overview of the areas where Sweden can contribute to the Digital Decade programme and where Sweden needs to step up its efforts. The roadmap sets targets and trajectories for most of the KPIs, but some, such as the KPI on access to e-Health records, are not expected to achieve EU targets for 2030. Trajectories are based on information available before 1 June 2023. Measures are especially focused on digital skills and digital infrastructures, with fewer measures focusing on the digitalisation of public services. Some aspects require more efforts, such as the greening of digitalisation.

Recommendations for the roadmap

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

- **TARGETS**: (i) Complete the roadmap with the missing target for edge nodes; (ii) When there is more than one trajectory for a target, identify the most likely one.
- **MEASURES:** (i) Give a fuller account of how the measures that are broader in scope, such as

Strategic Innovation Programmes, Impact Innovation and Business Sweden, support the Digital Decade objectives and targets; (ii) Provide more information on the implementation of digital rights and principles (and Digital Decade general objectives), including on contributing measures.

- **CONSULTATION**: Explain in greater detail how the stakeholder comments were addressed during the consultation process.

Digital rights and principles

The Special Eurobarometer 'Digital Decade 2024' offers key insights into Swedish perceptions of digital rights. Despite a 5-point decline from last year, 50% of Swedes still believe the EU effectively protects their digital rights, which is above the EU average of 45%. Concerns are growing, particularly with 74% expressing worry about children's online safety—a 21-point increase and the highest in the EU. Additionally, 59% are concerned about control over digital legacy, 19 points above the EU average. On a positive note, 80% trust in the freedom of assembly online, 21 points above the EU average, and 65% appreciate the level of digital skills in the country. 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[88].

A competitive, sovereign and resilient EU based on technological leadership

Sweden is active in deploying connectivity infrastructure. A substantial share of households already have access to VHCNs and 5G networks; however, the cost of connecting a household to FTTP is rapidly increasing and the most remote households will be the costliest to cover. 5G in the 3.4-3.8 GHz band, an essential band for enabling advanced applications requiring large spectrum bandwidth, covers 64.5% of Swedish households in 2023, above the EU average (50.6%).

Sweden has a business environment conducive to innovation with good access to finance, as evidenced by the high number of unicorn companies. Enterprises in Sweden have a high take-up of cloud technologies; however, the take up of AI and data analytics is slower . Sweden argued in the roadmap that the insufficient number of ICT specialists, in particular, restricts the take-up of AI. Sweden is developing a STEM-strategy. By increasing the number of engineers, Sweden can better meet the demand on skills.

Sweden continues to strengthen the National Cybersecurity Centre to further enhance cybersecurity. Sweden is also preparing national information and cybersecurity strategy to be presented in 2024. This will be complemented at a later stage by a national strategy on international cyber and digital issues.

Recommendations – Sweden should:

- **CONNECTIVITY INFRASTRUCTURE**: (i) Continue efforts to achieve full Gigabit coverage, starting with the implementation of the national broadband strategy which sets targets for 2025. Meeting the national targets will be a step towards meeting the Digital Decade targets by 2030; (ii) Ensure sufficient access of new players to spectrum for innovative business-to-business (B2B) and business-to-consumer (B2C) applications and encourage operators to speed up the deployment of 5G stand-alone core networks.
- **AI/CLOUD/DATA ANALYTICS:** (i) Maintain attention to encourage the use of AI and big data

[88] 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.

analytics by enterprises in Sweden; and (ii) Liaise with the Cloud IPCEI Exploitation office and/or the coordinators and the Member States participating in the IPCEI-CIS.
- **CYBERSECURITY:** Continue the implementation of the 5G Cybersecurity Toolbox to ensure secure and resilient 5G networks.

Protecting and empowering EU people and society

The level of digital skills of the population and the share of ICT specialists among the workforce ensure that Sweden will make a strong contribution to the EU targets. Sweden relies heavily on developing and using digital solutions which require a high level of digital skills. Sweden scores well above the EU average in both basic digital skills and ICT specialists; in the former area, however, there is a disparity between rural and non-rural areas regarding the former. Sweden is increasingly taking measures to meet the demand for basic digital skills as well as the demand from industry for more ICT specialists and increased digital skills in the general workforce.

Access for all to an e-ID is also essential in order to use digital solutions provided by both public services and enterprises. Sweden has started a number of actions that aim to ensure that everyone has access to an e-ID.

Recommendations – Sweden should:

- **BASIC DIGITAL SKILLS:** Continue efforts to ensure that the population can improve basic skills, in particular, in rural areas.
- **ICT SPECIALISTS:** (i) Finalise the discussions on a national strategy focussing on science, technology, engineering and mathematics (STEM); (ii) Take action to ensure that more ICT specialists are women.
- **e-ID:** Continue efforts to ensure that everyone has access to an e-ID.
- **e-HEALTH:** Increase efforts to ensure that everyone can access their health records online by 2030, in line with the requirements under the upcoming European Health Data Space regulation. In particular (i) make the data type of medical devices/implants, available to citizens in all regions through the online access services, (ii) Ensure that all data types are made available in a timely manner and (iii) implement technical functionality with the necessary legal basis for legal guardians and authorised persons to access electronic health data on behalf of others.

Leveraging digital transformation for a smart greening

Sweden underlines the potential of digitalisation to green the economy. Replacing old copper and weak mobile connectivity with broadband is important for the society as a well as for the green transition. Surveys show the importance Swedes attach to the use of digital tools to support greening. Sweden is carrying out several projects to better understand the impact of digitalisation on greening; however, it proposes relatively few concrete actions in this area

Recommendations – Sweden should:

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

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

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

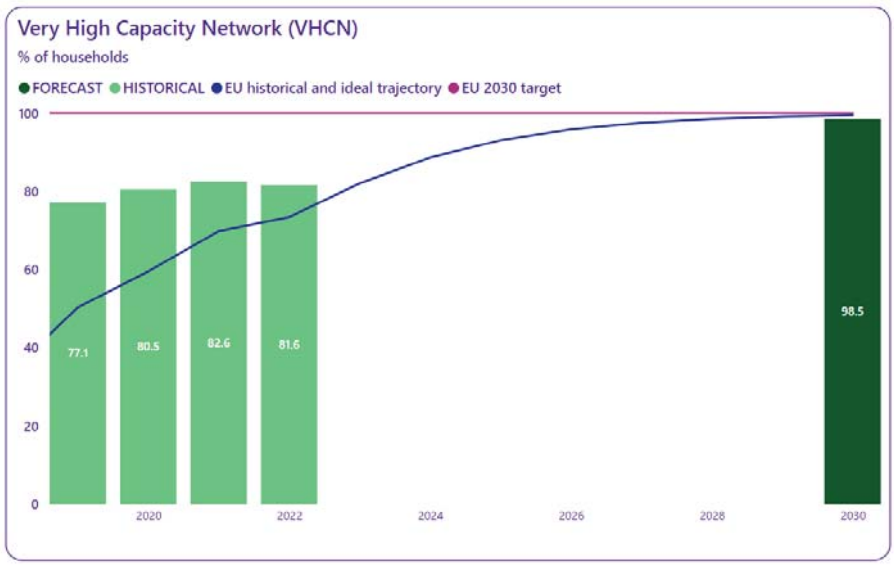
Sweden continues to invest resources from the Recovery and Resilience Facility and other funds in connectivity infrastructure to support digitalisation. Sweden has made significant progress in recent years, in particular as regards 5G coverage. In 2016, Sweden set national coverage targets for both mobile and fixed infrastructure to be reached by 2023 and 2025 respectively. Sweden is close to reaching these national targets, which are in line with and support those of the Digital Decade. However, the most remote areas will be challenging to cover with Gigabit networks. SMEs in Sweden are above the EU average in their use of advanced digital tools.

Through Vinnova, its agency for innovation systems, Sweden participates actively in the Chips Joint Undertaking, which was launched at the end of 2023. In the same year, the European High Performance Computing (EuroHPC) Joint Undertaking selected Sweden for a high performance computing resource, with Linköping University as host. The Arrhenius supercomputer will be both climate- and cost-effective, as Sweden's greenhouse gas emissions per kilowatt hour are among the lowest in Europe. Through the Smart Networks and Services Joint Undertaking, Sweden participates in the Hexa-X II flagship project for 6G.

2.1 Building technological leadership: digital infrastructure and technologies

Sweden is very active in deploying connectivity infrastructure. A large proportion of households already have access to fibre and 5G networks; however, the cost of connecting a household to a Very High-Capacity Network (VHCN) is rapidly increasing, and the most remote households will be the costliest to cover.

2.1.a Connectivity infrastructure (Gigabit)



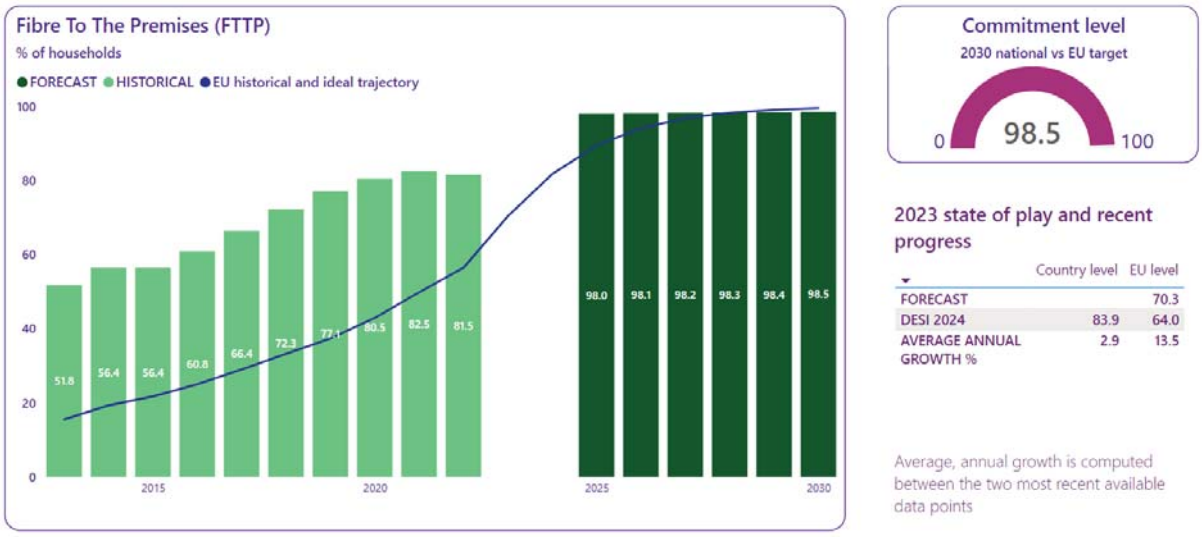
2023 state of play and recent progress

	Country level	EU level
FORECAST		82.0
DESI 2024	88.5	78.8
AVERAGE ANNUAL GROWTH %	8.4	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

Sweden brings a positive contribution to the EU's digital decade VHCN target and is showing a positive dynamic. VHCNs cover 88.5% of households, above the EU average of 78.8% and up from 81.6% coverage last year. Sweden indicated in its roadmap that by 2030 98.5% of households will be covered by a VHCN, just short of the target of 100% coverage.



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

Sweden brings a very strong contribution to the EU's Digital Decade (Fibre to the Premises) FTTP target while demonstrating a limited dynamic. FTTP coverage is above the EU average of 64%. As for VHCN coverage, Sweden expects to reach 99% household coverage by 2030, but not the target of 100%.

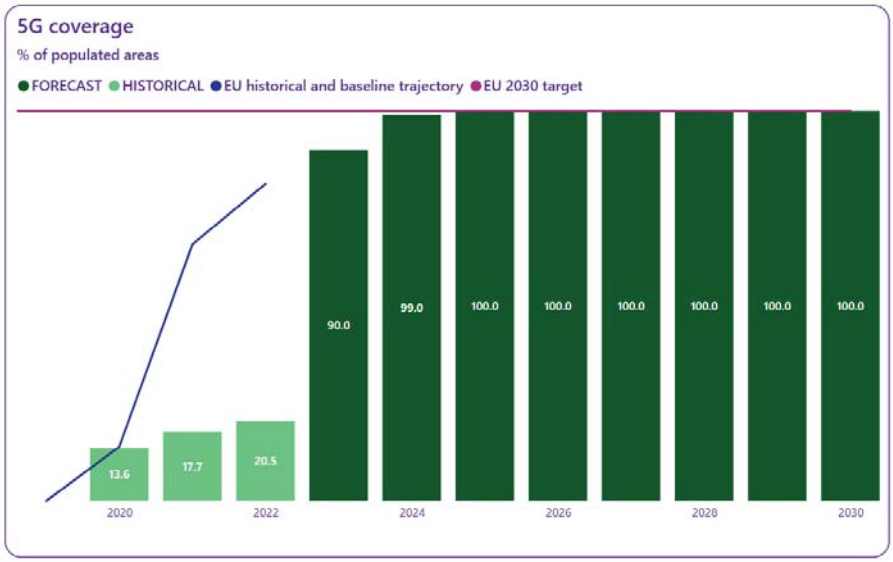
In 2016 Sweden presented a national broadband strategy which set targets similar to those of the Digital Decade. It stipulates that 98% of all households and businesses must have the possibility to access at least 1 Gigabit per second by no later than 2025. Of the remaining 2%, 1.9% and 0.1% must have the possibility to access at least 100 megabits per second and 30 megabits per second respectively. The Swedish Post and Telecom Authority (PTS) reports that the first and third targets were reached in 2023, but not the second.

PTS hosts the Swedish Broadband Forum, which is part of the government's broadband strategy to promote deployment of broadband throughout Sweden. The Swedish Broadband Forum is a meeting place and an arena for dialogue and collaboration between private and public operators in the Swedish broadband market.

For the last 4 years PTS has coordinated and been responsible for the State aid programme for broadband infrastructure investments (Gigabit connectivity). During 2023, state support of just over EUR 1.22 billion was approved. This will enable almost 16 500 buildings to connect to high-speed broadband. The roadmap showed, however, that the State aid support per building had increased over time, and the remaining buildings will be increasingly costly to connect to the VHCN. The stakeholders confirmed this trend. Consequently, the very last buildings to connect to VHCNs will be much more expensive to connect.

During the past 2 years, under the Connecting Europe Facility (CEF), a total of seven Swedish projects have been granted EU funding of approximately EUR 30 million to further develop existing high-capacity infrastructure and to establish new infrastructure to strengthen European connectivity. PTS coordinates this.

2.1.b Connectivity Infrastructure (5G)



2023 state of play and recent progress

	Country level	EU level
FORECAST	90.0	
DESI 2024	90.3	89.3
AVERAGE ANNUAL GROWTH %	341.3	9.8

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

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

Sweden has untapped potential to contribute to the EU's Digital Decade 5G target while showing a very strong dynamic. Given the spectacular recent progression, Sweden is on track to reach a 100% coverage target by 2030. Stakeholders confirmed this during the fact-finding missions, but also indicated that the necessary equipment is not always easily available. 32.2% of the population have 5G SIM cards. That is above the EU average of 24.6%.

Sweden has made substantial progress in 5G coverage since last year, with an increase from 20.5% to 90.3% in 2023, due to operators' upgrade of the infrastructure after allocation of the 2.1 and 2.6 GHz bands and the 900 MHz band. This is above the EU average of 89.3%. In 2023, 5G in the 3.4-3.8 GHz band, an essential band for enabling advanced applications requiring large spectrum bandwidth, covered 65.5% of Swedish households, above the EU average (50.6%). Sweden's 2016 national broadband strategy states that by 2023 stable, good quality mobile services should be accessible in areas people typically live.

In the 2023 Digital Decade report, the Commission recommended that Sweden make swift progress in allocating bands important for the deployment of 5G. The Commission asked, in particular, Sweden assign the remaining spectrum in the 2.1 and 2.6 GHz bands and 900 MHz band without further delay. Since then, Sweden has assigned the national block licenses in the 900 MHz, 2.1 GHz and 2.6 GHz bands, before the previous licenses expired. The licences were assigned only to operators covering certain geographic areas, in particular important transport links. The stated purpose was to enable continued digitalisation and technology development and to contribute to the mobility coverage by deploying new masts along railways and in non-covered areas where people normally live. Sweden expects the assignment of licences in these three important frequency bands to lead to a good spread of spectrum holdings. This will promote competition and provide the right conditions for long term investments in upgrading mobile networks in Sweden to 5G and increasing network capacity.

2.1.c Semiconductors

In the roadmap, Sweden emphasised the importance of its research on semiconductors. In October 2023, the Swedish Agency for Economic and Regional Growth published the report 'The implementation of the European Chips Act in Sweden'. The report provides a basis for the implementation of that Act in Sweden and a background of the Swedish semiconductor ecosystem. It concluded that Sweden's workforce has relevant knowledge and competence, in particular with regards to power electronics and quantum chips.

The universities of KTH, Linköping university, Lund university and Chalmers university advanced research within the field of wide bandgap semiconductors for power electronics. Swedish companies have the expertise within material sciences connected to semiconductor manufacturing of, among other things, wide bandgap semiconductors, for example regarding silicon carbide and gallium nitride wafers. Sweden will be able to maintain its leading role in mobile communication, the electrification of heavy trucks and the provision of electricity, provided that enough is invested into the research in these areas.

A new Swedish hub of semiconductor chip design was opened in 2023. The Swedish Foundation for Strategic Research (SSF) is funding a multidisciplinary research centre during a 6-year period. The investment aims to build a research and education node for semiconductor system design to strengthen Swedish academia and industry in the field. This centre is called ClassIC (Chalmers-Lund Advanced Semiconductor System Design Centre).

In addition, a number of private-sector initiatives were launched in 2023, such as building and upgrading existing semiconductor production facilities, and increasing cooperation on semiconductors with international partners.

2.1.d Edge nodes

With an estimation of 34 edge nodes, up from 14 in 2022, Sweden shows good progress and is expected to meet reaching the EU target. With support from Vinnova, the Royal Institute of Technology (KTH) established a competence centre, TECoSA (Trustworthy Edge Computing Systems and Applications), together with several large and small companies to increase knowledge in edge computing. Furthermore, the Research Institutes of Sweden (RISE) manage a test bed at Luleå University of Technology that allows projects to be tested within edge computing systems.

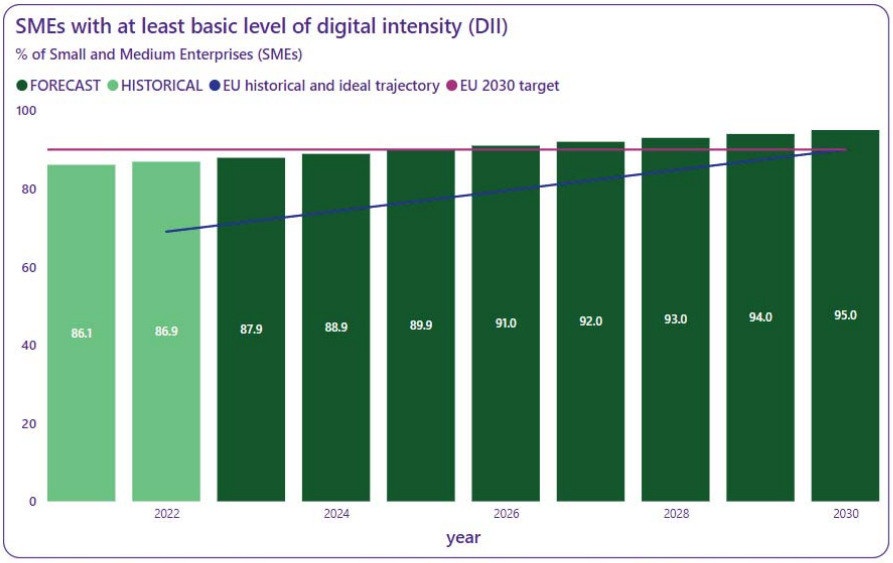
2.1.e Quantum technologies

Sweden reports in its roadmap that it expects to meet the EU target on quantum computing through the Wallenberg Centre for Quantum Technology (WACQT) project. The project started in 2018 and will end in 2030. It is a EUR 88.3 million (SEK 1 billion) national research programme, coordinated by Chalmers University of Technology. The ultimate objective of the programme is to develop a high-end 100-qubit superconducting quantum computer with leveraging a state-of-the-art clean room specialised in the manufacture of superconductive qubits and their enabling electronics (microwave circuits, etc.). Moreover, at the end of June 2023, Chalmers University of Technology and eight European parties signed a hosting agreement for the acquisition and operation of a EuroHPC quantum computer by the LUMI-Q consortium. The purpose is to link WACQT and other Nordic ecosystems for quantum computing to a broad EU user community and accelerate research and development in quantum technologies in the coming years. WACQT aims to develop and secure expertise in the main quantum areas: computing, simulation, communications, and sensing. In the context of the European Quantum Communication Infrastructure (EuroQCI) initiative, Sweden is also setting up a quantum communication infrastructure network, with support from the Digital Europe programme.

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

Sweden has a number of measures in place to continue supporting the development and deployment of AI, data analytics and cloud computing. Sweden has a high number of unicorn companies relative the size of its economy.

2.2.a SMEs with at least basic digital intensity



2023 state of play and recent progress

	Country level	EU level
FORECAST	87.9	71.6
DESI 2024	79.9	57.7
AVERAGE ANNUAL GROWTH %	-3.7	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

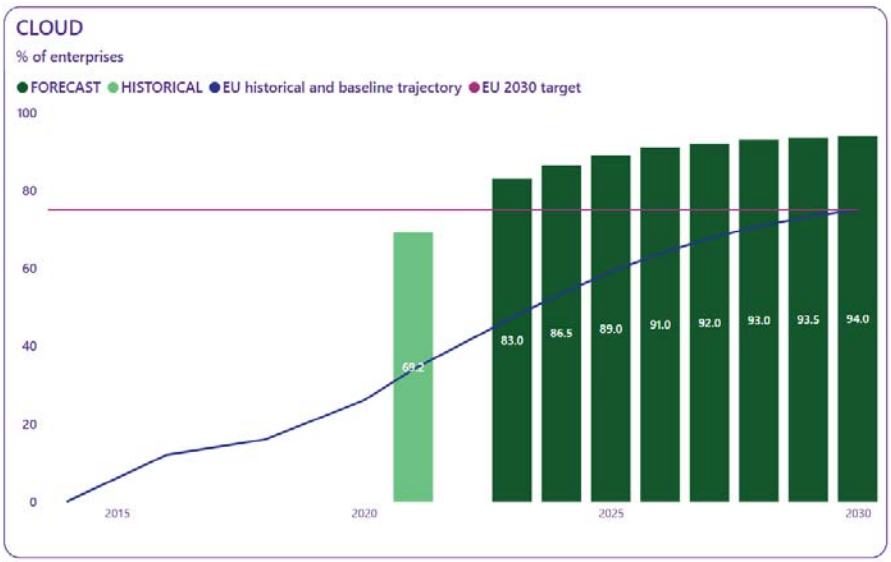
Sweden brings a very strong contribution to the EU's Digital Decade target on SMEs with at least basic digital intensity while demonstrating a very limited dynamic. Sweden performs well as regards the use of digital tools by SMEs, as 79.9% of which had reached a basic level of digital intensity in 2023, above the EU average of 57.7%. Sweden expects to reach the target of 90% before 2026, well in advance of 2030, forecasting that 95% of SMEs will have at least a basic level of digital intensity by the end of the decade. Sweden is carrying out several projects to reach that level.

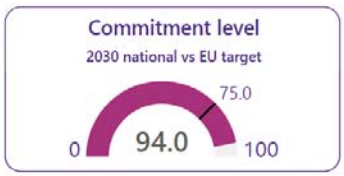
Between 2022 and 2024, the Swedish Agency for Economic and Regional Growth granted funding for 21 projects to help microbusinesses and small businesses in rural areas become more aware of their needs and better understand their digitisation challenges. Some of the projects build knowledge about digital challenges and needs. Others are pilot projects applying digital models, tools or methods to increase the digital maturity of the companies. The funding comes from the EU's rural development programme. The total amount granted was EUR 1,9 million (SEK 21,6 million). In addition to these 21 projects, around 1 300 micro companies located in rural areas can participate in coaching and advising to further contribute to higher digital maturity in these companies.

In 2023 Linköping Science Park launched the 'Digital Competence for Business Competitiveness' to strengthen SMEs in the tech and manufacturing industries. The EU is co-financing the project. Over the next 3 years, the project will give approximately 1 600 people working in tech companies or in the manufacturing industry in the Östergötland region the opportunity to train in areas such as cybersecurity and AI. Some of the training courses on offer are free, meaning that the companies give only employees' time. Competency mapping is conducted for each participating company to ensure that the skills developed correspond to the company's needs. These analyses will be essential to determine which training courses are relevant to and valuable for the employees of each company. Commissioned training courses covering areas such digital basics, automation and AI will also be designed and implemented.

2.2.b Take-up by enterprises of AI or Cloud or Data Analytics

- **Cloud**





2023 state of play and recent progress

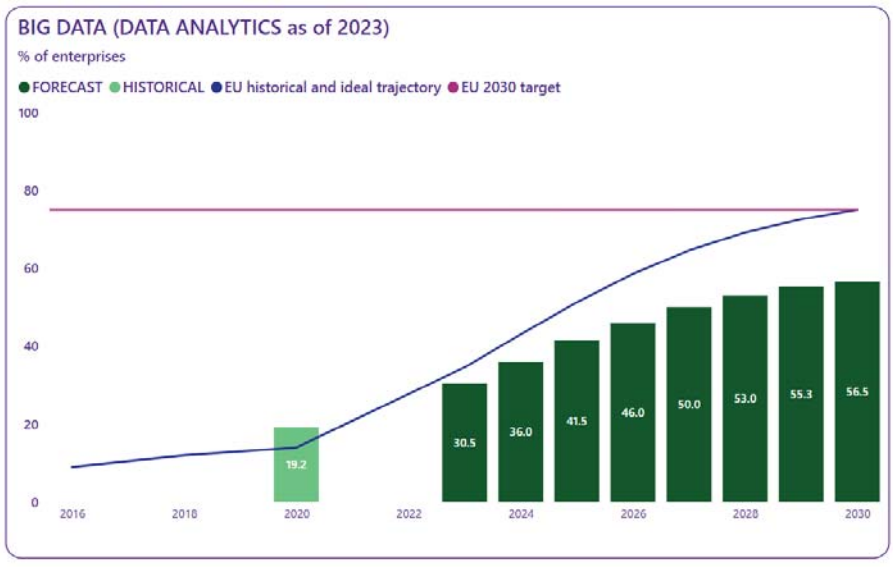
	Country level	EU level
FORECAST	83.0	47.3
DESI 2024	66.0	38.9
AVERAGE ANNUAL GROWTH %	-2.3	7.0

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

Sweden brings a very strong contribution to the EU's Digital Decade target on the use of cloud by enterprises. 66% of enterprises in Sweden use cloud solutions which is well above the EU average of 38.9%. Sweden is already close to 75%. The slight decrease observed cannot be interpreted due to the implementation of the "statistical unit enterprise" (SU ENT), which means that data are not comparable with previous years.

- **Data Analytics (Big Data)**[89]



2023 state of play and recent progress

	Country level	EU level
FORECAST	30.5	34.6
DESI 2024	35.0	33.2
AVERAGE ANNUAL GROWTH %		

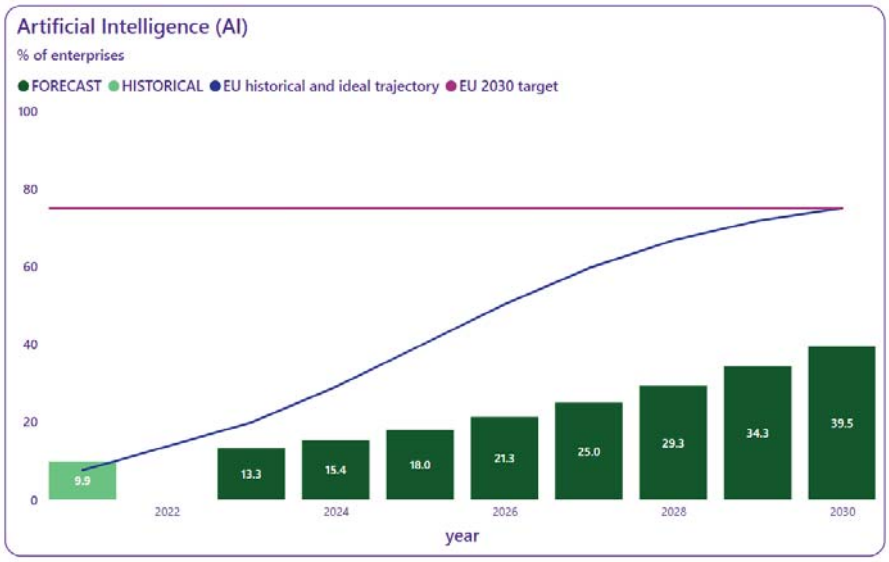
Annual growth cannot be computed in this case because Big Data was replaced by Data Analytics in 2023. The two indicators are not comparable.

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

[89] As of 2023, Eurostat has changed the big data into data analytics indicator, thus making comparison previous years impossible.

Sweden brings a positive contribution to the EU's digital decade target on the use of data analytics by enterprises. 35% of enterprises in Sweden perform data analytics. While this is above the 2023 EU average of 33.2%, Sweden is not expected to reach 75% by 2030. Sweden's roadmap acknowledges that there is room for improvement regarding this indicator.

- **Artificial Intelligence**



2023 state of play and recent progress

	Country level	EU level
FORECAST	13.3	19.9
DESI 2024	10.4	8.0
AVERAGE ANNUAL GROWTH %	2.5	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

Sweden brings a positive contribution to the EU's digital decade target on the use of AI by enterprises while demonstrating a limited dynamic. In Sweden 10.4% of enterprises use an AI technology which, is the above the EU average of 8%.

In December 2023 Sweden set up an AI Commission that will identify priorities to ensure that Sweden can exploit the opportunities AI can bring. The AI Commission will consider what must be done within higher education to broaden AI competence in society and identify what Sweden could do to promote competitive and safe AI within the EU and globally. It will also suggest how Sweden could attract venture capital and facilitate innovation to strengthen competitiveness and how public administration can become more efficient by using AI. Lastly, it will also analyse how the use of AI can affect and foster Sweden's security and counteract undue influence on democracy. The AI Commission will present its work by July 2025 at the latest, but will also be able to provide findings and suggestions during the course of its work.

AI Sweden continues to implement its 'AI Strategy for Sweden', which aims to develop Sweden's capabilities to benefit from AI. AI Sweden is funded by Vinnova and brings together partners from the public and private sectors and elsewhere. One important development in 2023 was that AI Sweden, together with its partners, developed a large-scale generative language model for the Nordic languages. GPT-SW3 is the first large generative language model for Swedish.

The Centre for Applied AI implements the AI agenda for Sweden prepared by representatives from the public and private sectors and universities. The centre is part of RISE and provides support to public and private actors on AI matters.

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

Combining the adoption of these three technologies together (AI, cloud computing and data analytics), Sweden's take-up rate is 73.1%, which is above the EU average of 54.6%. Sweden brings a very strong

contribution to the EU's digital target on the take-up by enterprises of AI or data analytics or cloud computing. Enterprises in Sweden preform well in using cloud computing services but less well as regards AI and data analytics.

The country has established four European Digital Innovation Hubs (EDIHs) receiving funding from the European Commission's Digital Europe programme and five hubs with the status of Seals of Excellence (SoE) in Norrköping, Borås, Gothenburg, Lund, Umeå, Stockholm, Hudiksvall, Västerås and Karlskrona covering a large variety of sectors such as aeronautics, automotive, healthcare, manufacturing and processing, smart city, etc. Some of the SoE in Sweden are co-financed by the European Regional Development Fund (ERDF). The EDIH Network comprises 228 EDIHs. Of those, 151 receive funding from the European Commission's Digital Europe programme, while 77 are funded by national or regional resources. The network's core mission is to build up the digital capacities of companies and public-sector organisations.

Examples of a Swedish hubs that are part of the EDIHs Network:

Through Chalmers University of Technology, Sweden participates in the European Digital Information Hub on Additive Manufacturing (AM-EDIH). Additive manufacturing, also known as 3D printing, is growing fast. AM-EDIH focuses on digital aspects of additive manufacturing. It organises seminars and training activities. It can provide expert support in product design with digital aids, and targeted efforts for product development.

Digital Impact North (SoE) is a Digital Innovation Hub set up to make northern Sweden one of Europe's leading regions in IT, Artificial Intelligence, and digitisation, known for delivering and attracting through cross-border collaboration. Since autumn 2023, Digital Impact North has been part of the European Digital Innovation Hub (EDIH) Network. Digital Impact North aims to contribute to a region that generates knowledge, innovations, technology solutions and growth companies at the highest international level. It also seeks to attract talent, businesses, financiers, and investors despite increasingly tough global competitive conditions. The region aspires to have a globally competitive IT sector, an innovative and expanding business environment, strong research, leading educational programmes and a growing number of stakeholders determined to make a difference in a world undergoing rapid and intense change.

Swedish Incubators and Science Parks (SISP) organises business incubators and science parks which provide platforms for cooperation. Vinnova supports a number of incubators through the national incubator programme. The initiative promotes innovation and can improve the conditions for knowledge-based, growth-oriented companies.

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

Sweden brings a very strong contribution to the EU's Digital Decade target on unicorns and is showing a very strong dynamic. In 2023, 36 of the 263 unicorns in the EU as a whole were from Sweden. Sweden informs that the number of unicorns has increased to 41 since then. Sweden points out that it will make a significant contribution towards the EU target substantially, it may not double its current number of unicorns by 2030. In addition, access to capital, which is an important factor in creating unicorn companies, varies with the business cycle. Sweden argues that it has already reached its target, given the number of unicorns relative to the size of its economy.

Sweden continues to foster unicorns. In June 2023, it hosted a conference on policy measures to promote the growth of deep-tech start-ups. The objective of the conference on deep-tech entrepreneurship was to provide a forum for knowledge exchange within the framework of the European innovation agenda and the action plan on intellectual property. The conference brought together private-sector stakeholders (deep-tech start-ups, corporates, venture capitalists), national and regional governments and EU institutions and

stakeholders to discuss the challenges and possible solutions. A report containing the recommendations from the policies discussed at the conference is under preparation.

The European Regional Development Fund (ERDF) is investing EUR 863 million in Sweden in various thematic areas in the 2021–2027 programming period. The investments will go primarily to research & innovation, digitisation & broadband, environment & climate, competence supply, transport & travel as well as to business & business. Within the framework of the current programming period, the Swedish Agency for Economic and Regional Growth has so far granted 15 projects a total of SEK 82 million (EUR 7.24 million) for residents, companies, research organisations and public authorities to take advantage of digitisation. In February 2024 the agency launched 7 calls with the aim of securing the benefits of digitisation in different ways, but also of developing digital accessibility. The projects will last for 3 years.

Best practice: Advanced digitalisation

In 2023 the government gave Vinnova the task of strengthening the 'Advanced digitalisation' innovation and research programme. The initiatives under the programme aim to develop and apply new digital technology, strengthen Swedish competitiveness, and enable sustainable adjustment. 'Advanced digitalisation' is a joint partnership between public and private actors who co-finance it. The public support budget is EUR 210 million and will run between from 2023 to 2027. The total budget of the programme, with the contribution of participating companies, is EUR 420 million. So far, 400 organisations have participated in 180 projects. 'Advanced digitalisation' offers activities in the fields of:

- enabling technologies
- electrification
- digital infrastructure and communication
- learning and skills.

2.3 Strengthening cybersecurity and resilience

Sweden underlines in its reply to the fact-finding questionnaire the importance of action and cooperation at EU level as cybercrime is cross-border in nature. According to the 2024 Eurobarometer, 93% of Swedes consider improved cybersecurity, better protection of online data and safety of digital technologies important. In 2023 the government and private-sector bodies in Sweden implemented several actions to strengthen cybersecurity and resilience. Sweden aims to present an information and cybersecurity strategy in 2024.

In 2023, the e-evidence package and the Second Additional Protocol to the Budapest Convention on Cybercrime were adopted. Sweden started to implement the package and the protocol in the same year. Also in that year, the Swedish Presidency of the Council of the EU set up a high-level expert group on access to data for law enforcement purposes. The objective is to provide a platform for stakeholders from all relevant sectors to jointly identify actions and present recommendations to facilitate and enhance EU-action to improve access to data, electronic evidence, and information for judicial and law enforcement purposes.

The National Cybersecurity Centre (NCSC) reports to the government, and other recipients in society, both on a regular basis and on request. This reporting was further developed in 2023 to better meet the needs of the recipient to further raise awareness. A higher degree of efficient cooperation both inside the NCSC and with public and private external partners has been instrumental in enabling the NCSC to perform this task:

– incident coordination within the NCSC, involving several agencies;

– cybersecurity training and exercises; and

– developing the cooperation with some of the most important sectors, such as energy, financial and telecommunications.

Cybersecurity relies heavily on the robustness and strength of everyday basic security in information systems at all levels and in all sectors of society. The NIS2 Directive was implemented applying the experience from the previous NIS Directive to more sectors of society and involving a larger number of actors.

During 2023, the Swedish government announced that a 'Cybercampus Sweden' would be established to strengthen cybersecurity competence, research, and innovation. 'Cybercampus Sweden' is a national initiative by KTH Royal Institute of Technology, RISE, and the Swedish Armed Forces. The Swedish Civil Contingencies Agency (MSB), Karlstad University and representatives from the private sector also participate. The budget for 2024 is EUR 2.1 million; this is expected to increase to about EUR 3.35 million annually each year from 2025 onwards. This initiative is in line with the Commission's call in the Cybersecurity Skills Academy to exploit synergies between civilian, defence and law enforcement initiatives.

The NCC-SE, the Swedish Coordination Centre for Cybersecurity Research and Innovation, promotes cooperation between public and private-sector bodies to develop solutions to address cyber incidents. It also provides information about available EU funding. The NCC-SE and RISE further developed 'Cybernode' in 2023. 'Cybernode' is a platform to strengthen Swedish competitiveness and exports in cybersecurity and to help make Sweden more secure.

3 Protecting and empowering EU people and society

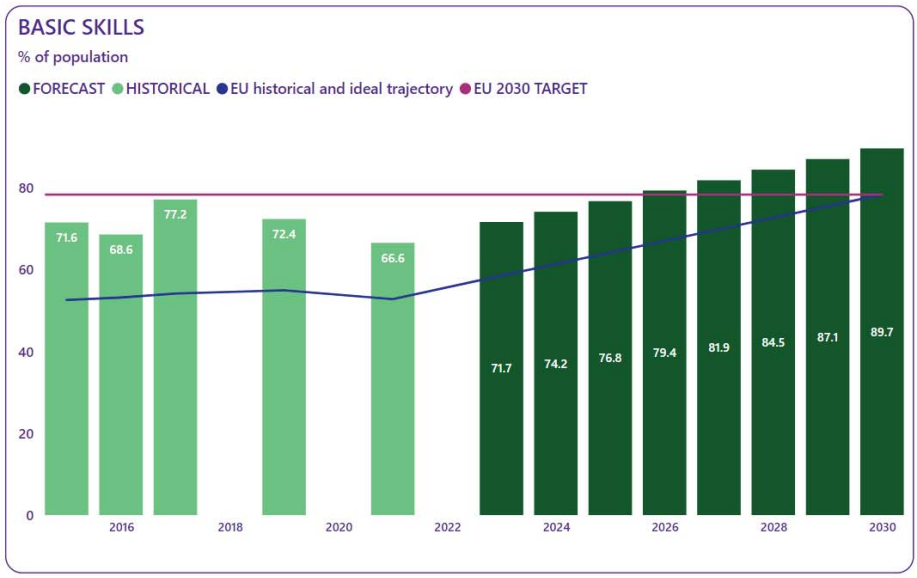
3.1 Empowering people and bringing the digital transformation closer to their needs

A digitally competent workforce is a priority for Sweden. Sweden relies heavily on developing and using digital solutions. This requires a high level of digital skills in the population. Sweden scores well above the EU average as regards both basic digital skills and ICT specialists. But Swedish industry is still asking for an increase in digital skills for both ICT specialists and other parts of the workforce.

Sweden is continuing to act to raise the digital skills of its workforce and, in particular, to meet the ever-increasing demand for ICT specialists.

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	71.7	59.8
DESI 2024	66.4	55.6
AVERAGE ANNUAL GROWTH %	-0.1	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

Sweden brings a very strong contribution to the EU's Digital Decade target on basic digital skills while demonstrating a limited dynamic. In 2023, 66.4% of people between the ages 16 and 74 had at least basic digital skills. Sweden expects to reach the EU target of 80% before 2030. It also has a good gender balance as regards basic digital skills. There is, however, a clear difference in such skills between rural and non-rural areas. Data from Eurostat shows that 71.8% of Swedes living in cities – compared to 52.9% of those living in rural areas – possess at least basic digital skills.

Swedish industry is also asking for an increase in the level of digital skills in the general workforce to allow employees to better integrate new digital solutions.

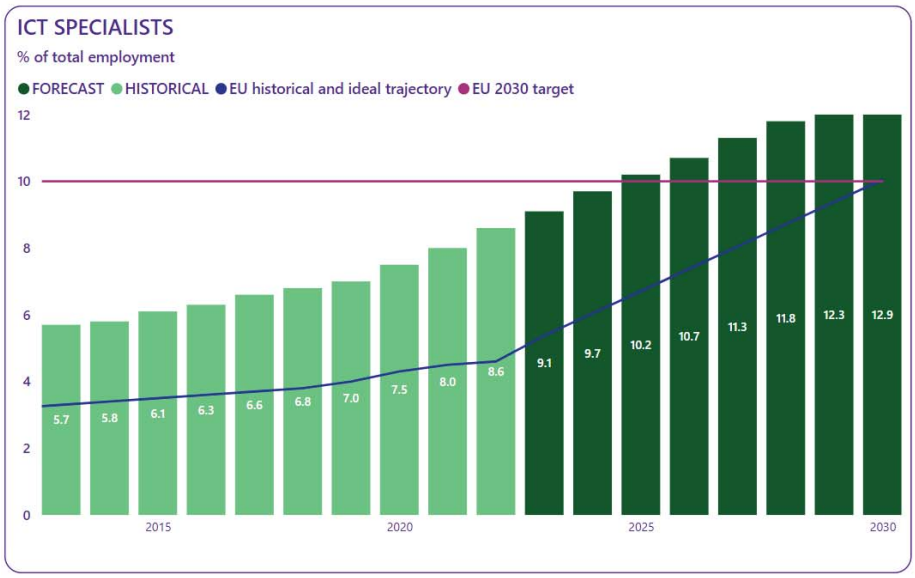
Sweden is continuing to implement measures to further enhance the basic digital skills of its population. One project is 'Digidel', which has formalised cooperation with a number of regional authorities. Digidel has set up a number of support centres (Digidel Centres) to help people raise their basic digital skills. The Digidel Centres are often located in public libraries.

Digitalidag, a platform for collaboration on raising the level of basic digital skills, is a joint initiative between the public and sectors and civil society. Among the authorities and companies involved are PTS, the Agency

for Digital Government (Digg), the National Government Service Centre (Statens Servicecenter), major telecommunications operators, major banks and payment providers, major medication suppliers, religious communities, organisations representing older people and organisations representing minorities.

In October 2023 TechSverige, a trade organisation for enterprises in the tech sector, launched the 'Digital Skills and Jobs Platform'. This platform, which is part of a broader EU initiative, aims to enhance digital competence and inclusion in Sweden and across Europe. It serves as a central hub for exchanging information and details of activities, efforts, and educational opportunities to strengthen digital skills. The platform also allows updates to be provided on the latest activities, training courses and funding opportunities in this field, promoting collaboration and knowledge sharing between members of the public, non-profit organisations, businesses, and policymakers.

3.1.1.b ICT specialists



2023 state of play and recent progress

	Country level	EU level
FORECAST	9.1	5.4
DESI 2024	8.7	4.8
AVERAGE ANNUAL GROWTH %	1.2	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

Sweden brings a very strong contribution to the EU's Digital Decade target of ICT specialists while demonstrating a limited dynamic. 8.7% of people employed are ICT specialists. The positive trend is expected to continue, and Sweden remains well above the EU average of 4.8%. 6.8% of graduates are ICT graduates, which is above the EU average of 4.5%.

Despite this performance, stakeholders confirmed during the fact-finding missions that demand for ICT specialists in Sweden remains strong. The lack of available ICT specialists is hampering the growth of several enterprises. The industry estimates that the number of ICT specialists will have to increase by 18 000 every year until 2028. Most in demand in the digital sector are software and system developers. The other sectors mainly require more IT support staff. 8.5% of online job ads in Sweden were for ICT specialists, which is the same as the EU average.

Sweden is also preparing a national strategy focusing on science, technology, engineering, and mathematics (STEM). The strategy will have a wide scope and cover all levels from pre-school to university. Particular emphasis will be placed on increasing the proportion of women among STEM educated specialists. The purpose is to increase the number of students who start and complete STEM training. The government expects to present the strategy at the end of 2024.

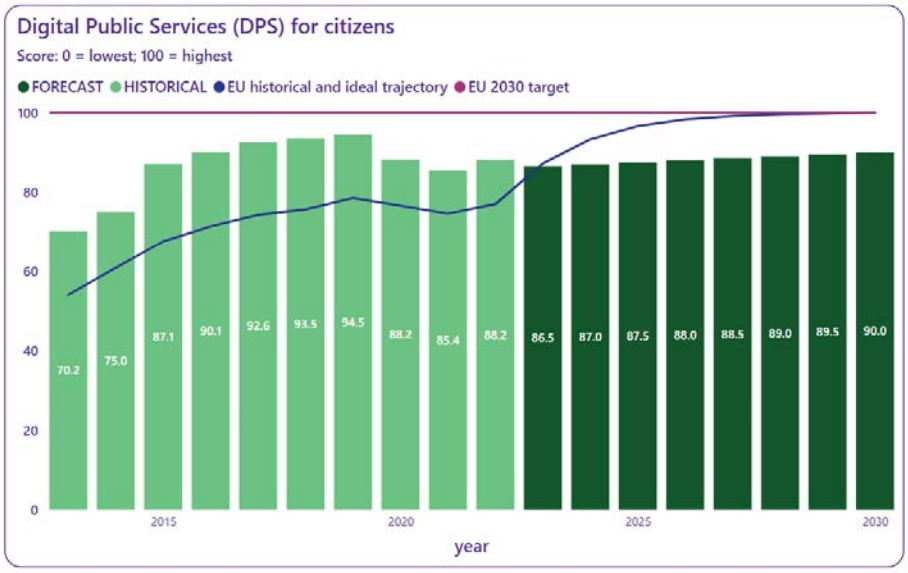
3.1.2 Key digital public services and solutions – trusted, user-friendly, and accessible to all

3.1.2.a e-ID

Sweden has seen rapid growth in the use of e-IDs. Surveys show that 93% of Swedes used an e-ID to access online services for private purpose in the last 12 months. Sweden has notified an e-ID scheme at a high and substantial level of assurance under the eIDAS Regulation.

Sweden has initiated several measures to increase the accessibility of e-ID schemes, as not all have access to one. The Swedish Government Official Report "A secure and accessible e-identification" was submitted in October 2023 with a proposal on how to ensure that all have access to a secure and accessible e-identification. The government has also decided to invest EUR 6.72 million in 2024-2025 to develop a government e-ID.

3.1.2.b Digitalisation of public services and businesses



2023 state of play and recent progress

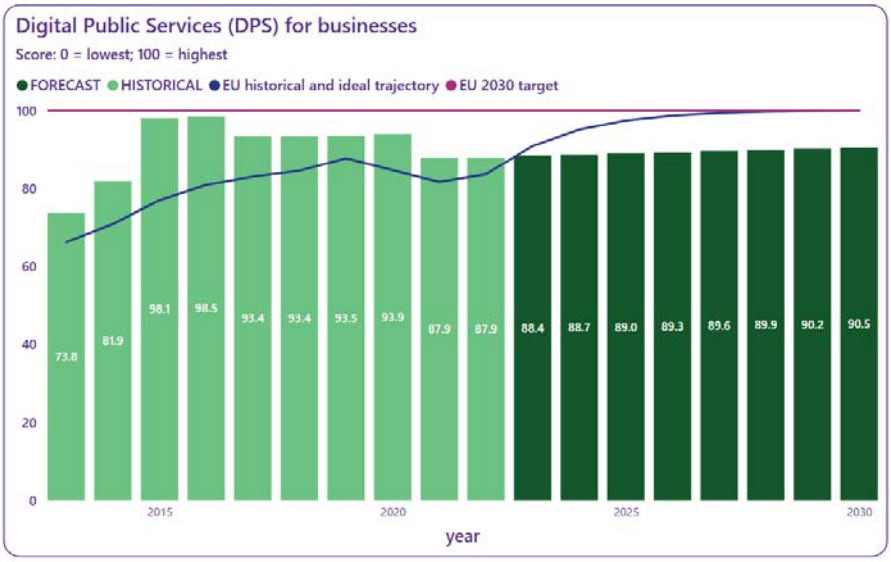
	Country level	EU level
FORECAST	86.5	87.2
DESI 2024	93.3	79.4
AVERAGE ANNUAL GROWTH %	5.8	3.1

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

Sweden brings a very strong contribution to the EU's Digital Decade targets on the digitalisation of public services to citizens and demonstrating positive dynamic. According to the 2024 Eurobarometer, 94% of Swedes believe that by 2030 digital technologies will be important for accessing public services online. This is above the EU average of 84%.



2023 state of play and recent progress

	Country level	EU level
FORECAST	88.4	90.9
DESI 2024	96.0	85.4
AVERAGE ANNUAL GROWTH %	9.2	2.0

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

Note 1: Data break-in-series in 2020

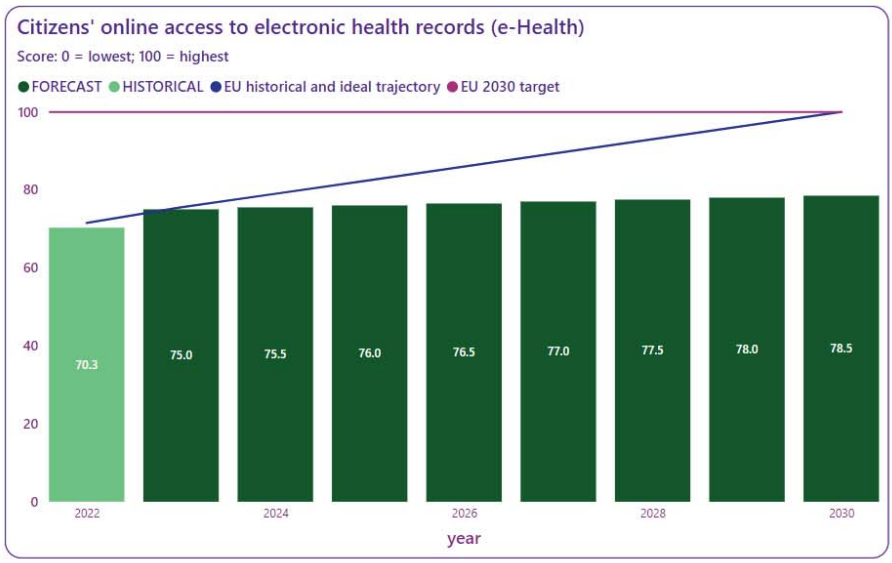
Note 2: The source of national forecast values is the 2023 country roadmap

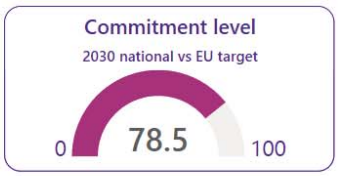
Sweden brings a very strong contribution to the EU's Digital Decade targets on the digitalisation of public services to businesses and demonstrating a very strong dynamic.

In December 2023, an official report on data sharing was submitted to the government. The report includes an assessment of the existing governance and regulation of interoperability in the sharing of data within the public administration and from the public administration to external bodies. The government is currently analysing the conclusions in the report.

Sweden is also carrying out a project to enable enterprises to use digital services in their contacts with the local authorities. The project is planned to end in 2026.

3.1.2.c e-Health





2023 state of play and recent progress

	Country level	EU level
FORECAST	75.0	75.5
DESI 2024	77.9	79.1
AVERAGE ANNUAL GROWTH %	10.9	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

Sweden has untapped potential to contribute to the EU's Digital Decade target on e-Health while showing positive dynamic. Sweden, with a score of 77.9, lags behind the EU average of 79.1 in online access to

electronic health journals; this gap is forecasted to continue to widen. Sweden consequently risks failing to meet the EU target of 100 by 2030.

National territories (i.e., regions) have their own regional access services in Sweden. 80-100% of the national population is technically able to access the online access services for eHealth records through both native mobile application(s) and online portal(s), logging in using an e-ID compliant with eIDAS Regulation. In 2023, Sweden provided data for each of its 21 health regions. In Sweden, all regions connect to one national portal, and users choose the region to which they belong from the landing page. Data about medical devices/implants are unavailable in more than half the regions. Data about allergies, procedures/operations, and medical images are generally available across the regions but not always in a timely manner. Sweden scores 91 on categories of health data, compared to a European average of 74. The country's lowest-scoring sub-indicator in this thematic layer is Summary data, with a maturity score of 80. Furthermore, 7 out of 11 applicable categories of healthcare providers supply relevant data. Sweden expanded the supply of relevant health data, reporting that public mental health facilities and private primary and secondary/tertiary hospitals are connected to the online access service. Regarding access opportunities for certain categories of people, Sweden scores 50 compared to a European average of 77 and does follow the Web Content Accessibility Guidelines. The main gap in Sweden's eHealth maturity is the lack of legal provisions and implemented functionality to grant legal guardians and authorised persons access to electronic health records on behalf of others.

According to the 2024 Eurobarometer, 84% of Swedes think that digital technologies will be important by 2030 for accessing or receiving healthcare services. The EU average is 79%. Accessing an electronic health journal requires an e-ID which is not yet accessible to all. However, Sweden is taking action to address this. It is considering participating in the potential EDICs on Genomics and on Cancer Image Europe (EUCAIM).

Regions, alongside municipalities, are the primary healthcare providers in Sweden. The regions and municipalities are independent authorities, and their digital tools are not always interoperable. Stakeholders have asked for increased data interoperability between the regions' digital tools. Sweden is taking a number of steps to streamline digital infrastructure in healthcare in this respect. In December 2023, the government appointed a national coordinator to support the implementation of a national digital infrastructure, which will be important to promote patients' rights and safety. The aim is also to reduce the administrative burden on healthcare staff. The coordinator's final report is to be presented by 2026.

Health Data Sweden (HDS), a European Digital Innovation Hub (EDIH) with a focus on health data was launched in June 2023. Its objective is to improve the use of health data and to help make healthcare more efficient. Health Data Sweden provides free services to SMEs and also to the public sector. Health Data Sweden supports the digital transformation of SMEs and the public sector as regards the use of health data and AI and enhances cybersecurity and high-performance computing. It works with an ecosystem consisting of 18 parties in a national network to carry out cutting-edge research in health data.

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

According to the 2024 Eurobarometer, 88% of Swedes consider that by 2030 digital technologies will be important for engaging in democratic life. This is well above the EU average of 74%. In the 2024 Eurobarometer 92% of Swedes emphasised the importance of public action shaping the development of AI and other digital technologies so as to ensure that they respect our rights and values. The EU average is 78%.

Sweden continues to step up its efforts to protect and empower children and young people in the digital environment. The Swedish Media Council (which since January 2024 has been called the Swedish Agency for the Media) continued to receive Commission funding to run the Safer Internet Centre (SIC) Sweden in

2023-2024 together with child protection organisations Bris and ECPAT Sweden. SIC Sweden is operated by three organisations performing three different activities. Firstly, the Swedish Agency for the Media is responsible for an awareness centre that produces and disseminates information on issues related to the safety of children and young people online. Secondly, Barnens rätt i samhället (Bris), a children's rights organisation, offers support to children on issues such as online vulnerability via its helpline, chat and email. Lastly, ECPAT Sweden operates a hotline to report suspected sexual abuse and exploitation of children. ECPAT Sweden reviews the reports it receives and passes them on to the police and partners in other countries.

4 Leveraging digital transformation for a smart greening

In its replies to the fact-finding questionnaire, Sweden underlines the possibilities digitalisation offers for greening. Replacing old copper cables and remedying weak mobile connectivity with broadband is important for society as a whole, but also for the green transition. According to the Digital Decade Eurobarometer, 91% of Swedes believe that the authorities should attach importance to digital tools for the green transition. The EU average is 81%. The Swedish authorities are currently focusing on how to better understand the impact of digitalisation on greening the economy.

Digg prepared a report that provides an overview of areas relevant for analysing the net effects of digitalisation on the environment and climate. Close attention is paid to real examples of cloud computing and data centres, so as to understand their overall roles in the transition to a more sustainable, and ultimately circular, economy. The report underlines the importance of the energy mix for data hall emissions. It also highlights possible solutions to reduce the climate impact, such as, for example, placing data halls in colder climates or using water cooling rather than air conditioning. However, for each solution there are other new potential problems that need to be highlighted. Energy consumption in the operation of electronic devices and data centres is not the only aspect of digitisation's climate and environmental effects identified in the report. e-Waste, for example, is a growing problem that is central to the circular economy's increasing focus on lifetime management and the tracking of material content, which includes more environmentally friendly extraction of raw materials, transport, better recycling precision and the possibility of increased reuse through secondary uses. In conclusion, the report addresses future regulation and follow-up via European sustainability reporting standards, as well as the possibility of using coding policy to achieve greener, more resource-efficient coding.

The Swedish Energy Agency presented a first study analysing the energy use of digital infrastructure and digital systems, in particular data centres. This analysis also included an assessment of energy consumption in cryptocurrency mining. The purpose of this study is to raise the level of knowledge and highlight the link between the digitisation taking place in society and its energy consumption.

Sweden also has a number of ongoing research projects. RISE analyses the impact of materials and technologies used for digitalisation and how to reduce this impact. Vinnova is financing Drive Sweden, a research programme developing a future system that will be secure, sustainable, and accessible to all. Around 200 different actors from industry, civil society and universities are participating in the programme.

Swedish operators have launched several initiatives to reduce energy consumption, using 100% renewable electricity in their networks and have set targets for net zero. Some operators have committed to 100% circularity of network equipment in their own operations by 2025. Network modernisation is important because the amount of data in the network is expected to increase in the future. Network modernisation also provides additional opportunities to optimise the network and to put it on low power, and thus reduce energy consumption, at times when needs for the network are lower.

The electronics industry in Sweden has taken steps to provide information on how to reuse electronics. The purpose is to promote a sustainable circular environment so as to help implement the relevant digital rights and principles.

Annex I – National roadmap analysis

Sweden's National Digital Decade Strategic Roadmap

The government adopted the roadmap on 4 October 2023, and it has been published on the government's website. Several organisations have been consulted on the roadmap. Workshops with experts on digital skills and on the digital transition of business were organised to provide input on the roadmap.

The roadmap provides an overview of the current situation, stressing that the population is digitally mature and that Sweden generally performs well compared to other countries. It also highlights Sweden's ambition to be a global leader in the field of digitalisation. A council supports the government in developing digitalisation policies.

The roadmap sets out 40 measures supporting Sweden's contribution to the Digital Decade and presents 7 targets and 8 trajectories. Sweden explains in the roadmap that the trajectories indicate that it will support the EU's Digital Decade targets by 2030. However, Sweden is not expected to reach certain targets such as on complete Gigabit network deployment.

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

Digital Decade Target/objective	Budget (EUR Million)	Number of measures
Connectivity Gigabit	864.0	8
Connectivity 5G	0.0	1
Semiconductors	-	-
Edge nodes	3.0	1
Quantum computing	142.5	1
SME take up	-	-
Cloud/AI/Big Data uptake	956.6	6
Cloud only uptake	-	-
AI only uptake	-	-
Big data uptake	-	-
Unicorns	0.0	3
Basic Digital Skills	84.0	7
ICT Specialists	1 375.2	4
eID	-	-
Key Public Services	38.5	8
e-Health	0.4	1
Objectives	-	-
Total	**3 464.2**	**40**

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

MCP and EDICs

Sweden participates in the Multi-Country Projects on: LUMI, European Quantum Communication Infrastructure (EuroQCI) and the Digital Europe Programme.

Sweden has expressed interest in the established Alliance for Language Technologies (ALT EDIC) and Networked Local Digital Twins towards CitiVERSE (LDT CitiVERSE EDIC), as well as the prospective EDICs on the Cybersecurity Skills Academy, Mobility and Logistics Data, Agri-food and Genomics.

EU funding for digital policies in Sweden

Sweden allocates 21.2% of its total Recovery and Resilience Plan budget (EUR 674 million) to digital. Out of this amount, EUR 650 million are expected to contribute directly to achieve the Digital Decade targets, according to a mapping study by the Joint Research Centre[90]. Most of the budget devoted to digital supports the deployment of VHCN in sparsely populated parts of the country.

According to the same mapping study, out of the Cohesion Policy funds received by Sweden, an additional EUR 208 million contribute directly to the Digital Decade targets.

[90] 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))